Chapter 3

Affected Environment
And Environmental Consequences

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CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter discusses the existing conditions of the resources and the anticipated effects of each of the alternatives.

For each resource addressed in this chapter, past, present, and reasonably foreseeable future activities were analyzed along with proposed activities to determine cumulative effects. Past, present, and reasonably foreseeable future activities are displayed in tabular form in Appendix A.

"Affected environment" is a term that refers to the existing biological, physical, and social conditions of an area that are subject to change, directly, indirectly, or cumulatively as a result of a proposed human action. Information on affected environment is found in each resource section under the heading "Existing Condition". For several primary resource areas, geographic areas within the project area are discussed separately, both to facilitate analysis and to facilitate review for readers who have a particular interest in a certain area of the Forest. Divisions into geographic areas vary according to resource area. Several resource areas used subwatersheds to display effects specific to a specific geographic area. This approach is particularly appropriate for watershed cumulative effects and forested vegetation.

In the discussions contained in Chapter 3, the use of the term "pre-fire" refers to the period before the July-August 2002 Toolbox Fire Complex.

Several resource sections make references to resource reports that are in the planning record. These resource reports provide more detailed information than is presented in Chapter 3.

There is less than complete knowledge about some of the relationships and conditions of wildlife, fish, forest, jobs, and communities. The ecology, inventory, and management of large forested areas are a complex science that continues to develop. The biology of wildlife species prompts questions about population dynamics and habitat relationships. The interactions of resource supply, the economy, and communities is the subject matter of an inexact science. However, the basic data and central relationships are sufficiently well established in the respective sciences for the responsible official to make a reasoned choice between the alternatives, and to adequately assess and disclose the possible adverse environmental consequences.

FIRE AND FUELS

- Introduction
- Key Issue
- Purpose and Need
- Regulatory Framework
- Analysis Method
- Area of Analysis
- Existing Condition / Direct and Indirect Effects
- Summary of Cumulative Effects
- Consistency with Forest Plan and Other Laws

Introduction

Fuels management is a process of managing the hazard in relation to the size and severity of a potential fire event. The objective of fuels management is to reduce the fire hazard to a level where cost effective resource protection is possible should a wildfire ignite. Of the three components affecting wildland fire behavior (fuels, weather, and topography), only fuels can be manipulated.

Key Issue: Recovery using a limited-intervention approach vs. Recovery using a full range of active management practices, including commercial salvage.

Issue Statement: This issue embodies divergent public input on which overall approach to recovery best accomplishes actual recovery and restoration. Some commenters believe that recovery and restoration would be better achieved through an approach that did not include the proposal to commercially salvage fire damaged trees. Others believe recovery and restoration would be better achieved through an approach that allows for commercial harvest of salvage-eligible fire damaged trees.

Measurement Indicator: Fuel loading (tons per acre), its influence on future fire behavior and ability for initial attack to successfully suppress at the pre-stand replacement stag (Fuel Model, Resistance to Control - flame length and rate of spread).

Purpose and Need

The purpose and need of this project includes six elements, two of which relate directly to fire and fuels:

- Reduce future surface fuel loading in order to influence subsequent fire behavior and effects. Reduce the risk of adverse effects on vegetation and soils that can result from long residence heat caused by heavy down fuels.
- Develop a long-term sustainable forest that is maintainable by re-introduction of fire.

Regulatory Framework

National Fire Plan

The National Fire Plan provides national direction for hazardous fuel reduction, restoration, rehabilitation, monitoring, applied research, and technology transfer. In August 2000 President Clinton asked Secretaries Babbitt and Glickman to

recommend how best to respond to the recent fire events, reduce the impacts of wild land fires on rural communities, and ensure sufficient firefighting resources in the future. The Forest Service responded in October 2000, with the report "Managing Impacts of Wildfires on Communities and Environment" (USDA, 2000a), known as "The National Fire Plan." In the report, the Chief of the Forest Service directed operating principles including: firefighting readiness, prevention through education, rehabilitation, hazardous fuel reduction, restoration, collaborative stewardship, monitoring, jobs, and applied research and technology transfer. The Fremont National Forest's Toolbox Fire Recovery Project is responsive to the rehabilitation, hazardous fuel reduction, and restoration elements of the National Fire Plan, which states:

- Rehabilitation – Focus rehabilitation efforts on restoring watershed function.
- Hazardous Fuel Reduction – Assign highest priority for hazardous fuels reduction to: communities at risk, readily accessible municipal watersheds, threatened and endangered species habitat, and other important local features where conditions favor uncharacteristically intense fires.
- Restoration – Restore healthy, diverse, and resilient ecological systems to minimize uncharacteristically intense fires on a priority watershed basis. Methods include removal of excess vegetation and dead fuels through thinning, prescribed fire, and other treatments.

Fremont Forest Plan and Fire Management Plan

The Fremont National Forest Land and Resource Management Plan (LRMP) includes Forest-wide fire management direction that is consistent with other resource goals (Chapter 4 of LRMP). The South Central Oregon Fire Management Partnership (SCOFMP) Mobilization Guide (2002) is an annually updated operational guide. For all fires, the priority is protection of human life and Property and Natural/Cultural Resources (USDI, Standards for Fire, 2002 p.1-6). Firefighter safety is paramount while providing resource protection and fire use necessary to protect, maintain, and enhance resource values and attain land management goals and objectives (Chapter 4 of LRMP). In support of this objective, the Fire Management Team is committed to:

- Recognizing employees, as our most valuable asset, and ensuring that "the protection of human life is the single, overriding priority" (USDI, Standards for Fire, 2002 p.1-2).
- "A fire protection and fire use program that is cost efficient and responsive to land and resource management goals and objectives" (FRF Plan p.118).
- Providing leadership in prescribed fire to accomplish land management objectives by fully integrating fire management principles and techniques into the development of interdisciplinary proposals based upon the acceptable range of results and desired conditions.

Direction provided in the Forest Plan (1989) ensures that fire programs are cost effective, compatible with the role of fire in ecosystems, and responsive to resource management objectives.

FS Manuals/Handbooks

Specific guidelines for Wildland Fire Use and prescribed fire applications are found in Forest Service Manual 5100 (Fire Management) and a number of Forest Service Handbooks resulting from FSM 5100 direction. Forest Service Handbook 5109.19 (Fire Management Analysis and Planning) gives specific direction on planning practices related to Fire and Fuels management.

In 1995, the Federal Wild land Fire Policy and Program Review was initiated (USDI/USDA et al. 1995). Some of the principles of this review include: 1) firefighter and public safety are the first priority; 2) wild land fire is an essential ecological process and natural change agent; and 3) fire management plans must be based on the best available science. This policy contains direction to allow Wild land Fire Use and prescribed fire to restore fire's natural role in appropriate areas where approved plans are in place.

Additional details on Regulatory Framework can be found in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

Analysis Methods and Background Information

The first step in analysis requires identifying measurable criteria that can be used to determine effectiveness of different alternatives in achieving the objectives. In this section, objectives pertaining to fire and fuels are addressed.

- To assess current fuel loads, plots were established and fuel loads were measured.
- To assess anticipated fuel loads, plots were established and all trees were counted. Silvicultural databases and surveys were used to supplement this information.
- To assess resistance to control, BEHAVE models were run to asses flame lengths, and rates of spread (BEHAVE is a widely distributed and accepted fire behavior predictive model, developed by the USDA Forest Service)
- To assess fire fighter safety, resistance to control was considered along with influences such as natural barriers, fuel load and available road system.

In order to understand the common measurements used in discussing fire and fuels, a discussion of the terms "mortality" (or level of mortality), "intensity" and severity" is useful. These terms, particularly severity and intensity have often been are used in different ways in different arenas. They are even sometimes used interchangeably; they are often confused. For example, the Toolbox Complex BAER Report (for the entire Toolbox Complex) indicated that 74,673 acres burned with low severity, 11,311 acres with moderate severity and 810 acres with high severity. However the maps that accompanied that report instead displayed "burn intensity" and showed a very small area of high intensity (corresponding to the 810 acres of "high severity"). In all case, the terms used in the BAER are related to the effect of the fire on the soils, specifically the water absorbency/repellency of the soils. They are not an indicator of levels of vegetative mortally. In a similar light, DeBano's definition of severity pertains to the amount of surface or soil organic matter consumed (DeBano et al. 1998 p. 11).

Mortality, Intensity and Severity

Burn intensity describes the nature of a fire in terms of its rate of energy release. These are physical descriptions of the fires, rather than ecological effects. Debano uses the term "intensity" to refer to the rate of heat produced by a wild land fire. "Fire intensity is a term that is used to describe the rate at which a fire produces thermal energy. Fire intensity is influenced by the amount of fuel available for burning, local weather conditions before and at the time of the fire, and the topography of the burning site. The limiting factor in fire intensity is the amount of energy stored in the fuel. As a consequence, the greater the fuel loading, the more intensely a fire is likely to burn" (DeBano et al. 1998 p. 56-57.).

In this "Fire and Fuels" section, *fire intensity is often used in reference to fire line intensity*. Fire line intensity, also called Byram's intensity, is the product of the available heat of combustion per unit area of ground surface and the rate of spread of the fire. The equation for fire line intensity is: $I = .007HWR$, where I= intensity (kW/m), H= Heat yield (cal/g), W= fuel loading (Mg/ha), R=rate of spread (m/min), (DeBano et al. 1998 p.57) This equation is somewhat altered from Rothermel's 1991 equation which is where: $I = Rwh$, Btu/ft·s, as I= intensity, R=rate of spread (ft/s); w=available fuel, lb/ft^2; and h=heat of combustion, Btu/lb (Rothermel 1991p.6). Thus, it is reasonable to assume that if available fuel is reduced, there is a reduction in fire line intensity. Fire line intensity has been related empirically to flame length, which is easily measured in the field (DeBano et al. 1998 p.56-57).

Silver Lake Ranger District and North Zone specialists in several disciplines worked to develop, update and ground-verify vegetative mortality maps of the burned areas. Any reference to "severity" of burn in any background documentation in the Toolbox Fire Recovery analysis file that is drawn from these maps should not be considered to be the same use of the term "severity" in the Toolbox Complex BAER Report. The mortality mapping is broken down as follows: 0-25% is low mortality, 26-50% is moderate mortality, 51-85% is high mortality, and 86-100% is very high mortality.

In this "Fire and Fuels" section, the term "mortality" is frequently used to provide agreement with the base mapping described above. The mortality information from these base maps was used to perform the fire and fuels analysis reported in this section.

The term "fire effects" refers to the physical, chemical, and biological impacts of fire on the environment and ecosystem resources. Fires affect soil, water, vegetation, air, and cultural resources found in natural ecosystems (DeBano et al. 1998 p.61-63).

Fuel Loads - Background

One objective in burned areas is to reduce fuels so that they more closely approximate historic dead and down woody fuel loads. At lower and middle elevations, this is an important ecological concept because fuel loads can significantly contribute to the effects of a fire disturbance but often exist in levels above pre-European settlement (Brown, R. 2000 p.14; Everett, et al. 2000 p. 220). It is generally accepted that fire suppression and past large-tree harvesting operations have contributed to excess tree densities and fuel loads in ecosystems that developed with relatively short fire intervals (Brown,

R. 2000 p.7). In many places in the western United States organic matter is produced at a higher rate than it can be cycled by decay. The accumulation of this woody material may increase the likelihood of severe stand replacing wildfires (DeBano et al. 1998 p. 140). "Fuel buildups continue and become more continuous in distribution. As a consequence, subsequent occurrence of high-severity fire results in generally greater changes in plant compositions and structure than would occur if the communities had been subjected to more frequent low-intensity fires"(DeBano et al. 1998 p. 201).

If lower and mid-elevation ecosystems are to experience a disturbance regime similar to that which they are adapted, the fuels must first be reduced to keep fire effects within an historic range. One goal of this project is to manage future fuel loads and fuel continuity to be within a manageable range for both fire control and ecosystem processes. In lower elevation dry ponderosa pine forests, it has taken several decades of fire suppression to create the conditions existing today, and one treatment is not going to immediately return this forest to a condition to which it would function under the historical low-severity fire regime (Brown, R. 2000 p.13). The goal, then, is not to completely return these forests to a historic fuel load with one treatment, but to prescribe treatments that would start to move them toward a historic level, which would allow a more natural fire regime to function.

Ponderosa pine forests have undergone substantial structural changes since earlier this century due to fire suppression and logging. Hall (2003) suggests that the historical condition contained very little woody fuel averaging about 3 to 6 tons/acre. Heavy fuel loads and ladder fuels make these stands more susceptible to large, uncharacteristic crown fires. This may result in an increased risk of fire intensity and severity that could exceed the lethal limits of thick barked species (USDA, 2000 p.13; USDA, 2001 p.2). " Certain forest types (low elevation ponderosa pine, for example) may be susceptible to burning in ways that have not been seen in centuries." (Beschta et al., 1995, 5). The type of fire behavior that can be exhibited by this changed stand condition can make conditions less safe for firefighting operations.

Fuel Loads - Analysis Methods

After the 2002 fires, calculated fuel loads show the existing woody surface fuel loads on some sites approaching 10 tons/acre. After 15 years, estimations and models predict that fuel loads could exceed 40 tons/acre on some sites. These estimates were only calculated using woody material less than nine inches in diameter. Fuel loads varied considerably across landscapes. Fred Hall, in a report specific to the expected vegetative responses in the Toolbox Fire Complex, indicates that total down fuel loading could reach up to 100 tons per acres in some areas of high and very high mortality (Hall, 2003). Fire managers are not willing to assume the inherent risk of escape in managing such fires. Therefore, to introduce prescribed fire as a disturbance on the Fremont NF, it is necessary to first remove some of the fuels to allow for these fires to be safe and ecologically beneficial.

In order to first determine if a fuel hazard was present, fuels plots were laid out across the landscape of the burned areas. The data collection method consisted of a fixed plot and used the planer intercept star method. Calculations were based using Brown's Handbook for Determining Downed Woody Material (USDA 1974). Next, the future fuel load in areas burned in the 2002 fires was estimated. Methods used to estimate future fuel loads in these areas are based on silvicultural stand data, primarily the tree counts and size classes from this estimate of slash and other residual weights were estimated (USDA 1977). Other calculations were made using (Bell-Dilworth 1988 p.108) converting volumes into weights. Estimates determined that one hundred trees would produce about ten tons per acre of additional fuel loading in about fifteen years. Up to two hundred trees would produce about twenty tons per acre in about fifteen years and up to three hundred trees would produce about thirty tons per acre additional loading. Any additional trees per acre over three hundred was classified as extreme producing over thirty tons per acre. These calculations seem to be consistent with the findings of Hall (2003).

The following tables were used to determine fuel loads related to salvage activity for all action alternatives in all areas. Assumptions used in making fuel load calculations include: though the trees are dead, green weights were used because they have not yet dried; bark is calculated in to the equation due to a high amount of variance with the thickness due to bark being burned during the fire; and breakage and slash production are uniform throughout the areas. Tree heights are averaged for the whole area.

Table 3.1 Residual weights of Ponderosa Pine trees by diameter and representative height

Diameter Breast Height (DBH)	Height	Wood Weight* cu/ft vol. x lbs/cu/ft	Residual slash weight to 4 inch top*	Tree Weight
5	30	20	50	70
6	40	55	60	115
7	40	85	75	160
8	40	120	95	215
9	50	200	115	315
10	50	245	140	385
11	50	300	180	480
12	60	430	215	645
13	60	510	250	760
14	70	700	295	995
15	70	800	360	1160
16	70	900	420	1320
17	80	1170	465	1635
18	80	1300	525	1825
19	80	1445	610	2055
20	90	1815	680	2495
21	90	1995	755	2750

*Rounded to nearest 5 pounds

A 20-inch ponderosa pine tree would produce about 780 pounds of slash. Assuming that 75 percent of the foliage weight was burned off, the resulting slash weight produced would be about 680 pounds per tree. Assuming that 10 percent would remain on site after harvest that would result in 68 pounds of slash remaining per tree. For trees larger than 21 inches the resulting residual slash would be greater, as only the top would be removed to the landing. This would result on about 730 pounds per tree remaining on site. Calculations of additional tons of fuel per acre used the photos from General Technical Report PNW-105 "Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest" (USDA, Forest Service, 1980, 189). From these it was determined that a net increase of about 1.4 tons per acre consisting of branch wood, a few tops, and breakage would occur in a typical ground-based salvage unit. Helicopter harvest units used the same calculations, with the additional assumption that slash amounts left behind would include tops (these would typically not be removed to the landing). In helicopter units a net increase of about 34 tons per acre, consisting of branch wood, tops and un-merchantable boles would occur.

Resistance to Control and Firefighter Safety – Background

It is the objective of the Fremont Forest Plan that all wildfires with in the analysis area receive a suppression response (Fremont Forest Plan, p.118). If a fire starts within any area, due to the interagency nature of our fire fighting resources, the firefighters are compelled to respond to and manage that fire. In order to protect values at risk from unwanted fire, it is necessary for firefighters to remove fuel and contain the fire. Firefighters have the right to a safe assignment. The shorter the fire's duration, the less potential exists for adverse weather changes or extreme fire conditions that can narrow a firefighter's margin of safety, and there is potentially less firefighter exposure to environmental hazards. Experience has shown that firefighters can more safely fight a fire if it stays small (low rate of spread; largely determined by small fuels), has lower intensities (determined by fuel structure and accumulation), has relatively little spotting potential (determined by potential firebrand sources, how far they travel, and probability of ignition upon landing), and low resistance to control (suppression force required to control a unit of fire perimeter; determined by amount of dead and down fuels). Fire behavior is the manner in which fire reacts to topography, weather, and fuels (DeBano et al. 1998 p. 11; NWCG, 1998 p. G-7). These three elements comprise the fire environment, the surrounding conditions, influences, and modifying forces that determine fire behavior (NWCG, 1994 p. 8).

When firefighters arrive on the scene of a fire, they immediately assess weather (air temperature, wind, relative humidity, forecasts), fuels (size, type, moisture content, total loading), and topography (slope, aspect, elevation) to determine how to proceed. Modifying any one of these elements has a direct result on fire behavior, which is basically described by flame length and rate of spread. Both flame length and rate of spread are readily observed in the field, the intensity of the fire can be estimated by observed flame length. These two observations can be assessed by firefighters to determine whether

conditions are conducive to spotting and crowning—fire behavior that determines firefighter strategies and tactics during fire suppression operations (Rothermel 1983 p.101). Fire behavior is most often characterized by flame length, rate of spread, and fire line intensity (Rothermel 1983 p.59). "Extreme" fire behavior implies a level of fire behavior characteristics that ordinarily preclude methods of direct control. Flame lengths approaching eight feet and beyond, fire line intensities approaching 500 btu/ft/s, fire blowup, fire flare-up and fire storms are often observed during times of extreme fire behavior. Under these conditions, fires are too intense for direct attack by hand crews, and hand line is ineffective. Bulldozers, engines, and use of retardant may be effective in these situations.

Fuel characteristics affecting fire behavior are vegetative density, species composition, amount of surface fuel, arrangement of fuels and moisture content (Rothermel 1983 p.9). Fuels contribute to the rate of spread of a fire, the intensity/flame length of the fire, how long a fire is held over in an area, and the size of the burned area (Rothermel 1983 p.59). There are three types of fuels that affect fire behavior; fine fuels such as grass or forbs, small woody fuels less than three inches in diameter and large woody fuels greater than three inches in diameter. Fine fuels are the major contributors to fire spread, carrying the ignition and flaming front of a fire (Rothermel 1983 p.1). Small woody fuels influence a fire's rate of spread and fire intensity, and small woody fuels lose their moisture faster, start easier and burn more readily (Agee 1993). Under a frequent fire regime it will be possible to maintain fine fuels at lower levels and various patch sizes than under a less frequent fire regime, but fine fuels will always exist. Large fuels (greater than 3" diameter) do not contribute greatly to fire spread, and are not considered in the BEHAVE fire spread prediction model, though they do remain burning after the fire front has passed (Andrews 1986 p.9) and contribute to fire severity. Large fuels also contribute to mortality of residual overstory trees and soil surface sterilization (Hall 2001 p.8). When heavy fuel accumulations are present they can have a long burnout time and can persist for long periods. As they burn, if there are pole-sized trees and overstory tree branches near the burning fuel accumulation, the needles and branches are dried. With prolonged convective heating, live needles and twigs in the trees can ignite and "torch," throwing embers into the wind, and possibly igniting other nearby tree crowns.

Of the three primary factors that determine fire behavior, only fuels can be subjected to effective management. Fuel reduction can play an important part in increasing firefighter and public safety by modifying fire behavior in the fire environment through a reduction in fire intensity and severity (Pollet and Omi 1999 p.3) (Graham et al. 1999 p.18, 20) and (Van Wagtendonk, 1996)

Intensive forest management that involves the creation of activity fuels (slash) can indeed increase fire behavior parameters such as rate of spread and flame length. However, treatment of slash (e.g. burning, chipping, removal, isolation) will reduce fire behavior and fire intensity. Graham et al. (1999 p.22) reports that thinning from below and intermediate tree harvest can effectively alter fire behavior by reducing crown bulk density and ladder fuels, but will not reduce crown fire potential unless tree densities are substantially reduced. Graham et al. (1999 p.20) also states that all intermediate treatments should be accompanied by surface fuel modification, and the most success is achieved when using prescribed fire for such treatments.

Resistance to Control and Firefighter Safety – Analysis Methods

Resistance to control is the relative difficulty of constructing and holding a control line as affected by resistance to line construction and by fire behavior (NWCG 1998 p. G-16). BEHAVE models were run to make Fuel Model comparisons in regard to flame length and rate of spread to assess resistance t control. Fire fighter safety begins with resistance to control, but factors in influences such as natural barriers, fuel load and available road system. Rates for initial attack hand crews are lower in the fuel models with larger diameter fuels (fuel models 10, 11, 12, 13) than in the other common fuel models found on the Silver Lake District of the Fremont NF (fuel models 1, 2, 5, 6, 8, 9 and 10 in mid to upper elevations). For fuel model descriptions see (Anderson 1982 p.3-16).

All BEHAVE runs used the following assumptions:

- Response time to fire starts was constant.
- Dispatch response was for a single ignition. Not multiple starts.
- The fuel moistures were for an average summer day.
- The slope was average for the whole area.
- The mid-flame wind speed was average for a calm clear summer day.
- All resources arrive at same time and begin line production immediately.
- Line production rates were taken from the Fire line Handbook (NWCG, 1998, A22)

The inherent limitations and assumptions used with in the computer program itself include:

- Fire only spreads through surface fuels.
- Fuel Moisture, wind and slope are assumed to be constant
- The fuel bed is assumed to be a single layer, uniform, and constant.
- Spotting and crowning are not credited for fire spread.
- Atmospheric disturbances (e.g. wind gusts) are not modeled. (Andrews 1986, 9; Albini, 1976,5-6)

Additional details on Analysis Methods can be found in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

Analysis Area

The analysis area includes the Silver Creek and Silver Lake Watersheds, which include the following subwatersheds:

Silver Creek Watershed:

(The following subwatersheds)

- Middle Silver Creek
- West Fork Silver Creek
- Upper Silver Creek
- Thompson Reservoir
- Benny Creek

Silver Lake Watershed:

(The following subwatersheds)

- Upper Duncan Creek
- East Duncan Creek
- Lower Duncan Creek

No portion of the Summer Lake Watershed, to the east of the area, is included in the analysis area. With minor exceptions, the 2002 "Winter Fire" occurred entirely within the Summer Lake Watershed, outside the analysis area. Portions of the Winter Fire that crept up over the edge of Winter Ridge, into the Silver Creek or Silver Lake Watersheds are included in the analysis area. Effects to fire and fuels are identifiable at the scales represented in these areas because fuel assessments can be performed on a unit-by-unit basis as well as at the landscape level.

Reference Conditions for Fire and Fuels/2002 Fire Season

Fire History on the Fremont NF

Wild land fires historically played an important role in ecosystem disturbance and development across the landscape. There is incomplete site-specific literature on the fire history and fire ecology of the immediate fire area, but Miller et al. 2001, completed a report that included the northeast portion of the Toolbox analysis area. That study found significant changes in forest stand structure and fire return intervals since the 1870's. Brown 2000 p.21, and Everett, R. et al. 2000 p.1, also indicate that a change has occurred within the last 100 years, essentially the active fire suppression era, and that fire no longer plays its historical ecological role. Pre-suppression era fire history was characterized by a pattern of frequent low intensity disturbance from fire. This pattern was a primary contributor to a sustainable condition. The pattern has been interrupted for the past 80 to 100 years, primarily by fire suppression. This pattern, both prior to 1900 and after is supported by Miller's findings. Fire return intervals with a short return interval would assume that the fuel loads would be reduced significantly, there would be an significantly less ladder fuels, and more grass component and a more open structure. See the Forested Plant Communities section of Chapter 3 (following the Fire and Fuels section) for further discussion of historic conditions in the area.

Fire Management History

After the extensive fires in 1910, the Forest Service, state, and private landowners began an energetic effort to suppress wild land fires for the preservation of natural resources and protection of property. Fire detection efforts included aerial reconnaissance and the development of stationary lookouts with communications. The Forest Service initiated the "10 A.M." policy, stating that the objective in wild land firefighting is to contain all fires by 10 AM on the day after detection. Rapid advances in suppression capabilities occurred in the following decades as aircraft increased initial attack effectiveness in remote areas and roads were constructed, enabling firefighter access many areas.

Records previous to 1949 are hard to find and very sketchy. Individual years can show great variation in the number of starts and in the number of large fires that occur. Fires that reach over 10 acres are generally fires that have escaped initial attack and become extended attack fires lasting for at least several operational periods.

Table 3.2 Fire Starts within the 8 Subwatershed Analysis Area

	Lightning Fires	Lightning Fire Acres	Person Caused Fires	Person Caused Fire Acres	Fires over 10 acres
53 Year Total	405	4628	187	273	11
Average/ Year	8	87	4	5	.2

Additional details on fire history can be found in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District and in Appendix A (Table A-1 – Fire History and Suppression - All Ownerships).

The 2002 Fire Season

The fire season of 2002 was a dramatic example of wildland fire potential. More than 100,000 acres of public and private land were burned on and near the Fremont National Forest. Fires became large and intense because of the numerous fire starts, fuels arrangement, high tree densities, lack of fire suppression resources, severe drought and wind conditions. When the Fremont National Forest was experiencing its worst fires, the Siskiyou, Winema, Deschutes and Umpqua National Forests were also experiencing large wildfires.

The Toolbox, Silver, and Winter fires all started from the same series of dry lightning storms that came through the Fremont NF starting on July 12th. The Toolbox and the Silver fires started on the Silver Lake District, the Winter fire started on Oregon Department of Forestry protected lands and burned onto Paisley Ranger District and eventually onto small portions of the Silver Lake District. The Winter fire only burned approximately 430 acres within the Toolbox Fire Recovery Project area. The Toolbox Complex was made up of the Toolbox Fire, the Silver Fire and some portions of the Winter Fire that were generally on "top of" Winter Ridge.

Table 3.3 Acres per fire in each Subwatershed

Subwatershed	Total subwatershed Acres	Toolbox Fire Acres	Silver Fire Acres	Winter Fire Acres
Lower Duncan Creek	25024	13930		
East Duncan Creek	11607	11160		
Upper Duncan Creek	22157	17430		300
Thompson Reservoir	41182	440	7770	
Middle Silver Creek	38843	1560	90	
Upper Silver Creek	16283	260	5200	
West Fork Silver Creek	24009		9720	
Benny Creek	26826	12700		130

Some areas within the analysis area, such as the site of the lightning caused 1996 Alder Ridge Fire, did not carry fire during the 2002 fires, even though they were encroached upon by the Silver fire. Portions of the Alder Ridge Fire were salvage logged in 1997. The Alder Ridge Fire area did not burn because of the break in continuity of the fuels and the absence of heavy fuels. Several portions of the analysis area had previous under burning activity. The Chaser Broom Underburn (1996), in the Silver Fire Portion of the project is a good example where high-intensity fire dropped out of the crowns onto the ground because of the absence of ladder fuels and the absence of heavy down fuels interrupted the continuity of fuels.

Fire suppression

Fire suppression activities during the 2002 fire season incorporated the use of almost every type of resource available. Type 1,2, and 3 helicopters dropped water in a multitude of different locations all throughout the fire area. Air tankers delivered 102,025 gallons of retardant. A majority of the retardant was delivered to protect the Indian Mountain communications site. "Burnout" was used in conjunction with direct attack action on the fire. "Backfiring" was used in conjunction with indirect attack methods. Numerous small-scale burnouts were conducted throughout the fire area. Most of which were less than one acre in size, and conducted with minimal resource needs. Several backfiring operations were conducted with most being only partially successful. This is due in part to the timing of the operation and wind changes, drought and other environmental conditions. Line construction was accomplished using hand crews and mechanized equipment. Though not much hand line was constructed overall, the areas that did get work were the steep areas that are more susceptible to erosion. Bulldozers completed 204 miles of line within the analysis area using a variety of different size machines. The majority of the bulldozers were equivalent to Caterpillar D-6 and D-7 size. Due to the nature of the fuels and the weather any spot outside the line had a chance to get large fast. This resulted in dozer lines being started then abandoned just to start again outside the growing spot (see Appendix A – Table A-1 for miles of fireline by subwatershed).

Three or more high-tension power lines are present in several of the subwatersheds. These power lines did arc to the ground several times during the fires, due to the smoke. Because of the risk of injury to fire fighting personnel all work around the lines was very restrictive.

Future fire suppression

There is no change expected for the future of fire suppression throughout the area.

Additional details on Fire Suppression can be found in Appendix A of this document (Table A-1 – Fire History and Suppression - All Ownerships) and in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

Additional Background Information

Fuel Dynamics, Succession and Modeling

In forested areas most of the biomass is contained in tree boles and generally unavailable to burn except where fuels are ideally arranged (Brown and See 1981 p. 1). The amount of biomass accumulation not only determines the speed at which the burned area could recover but also the likelihood, intensity and rate of spread of the next fire (Whelan R. 1995 p.260).

Fires have and will occur at irregular intervals. Historically fires have burned far more acreage at lower intensities than in the last 100 years, which have gradually shown an increase in acreage and in the amount of high intensity burning (Barrett et al. 1997 p.15). Increased settlement in the Silver Lake area has altered the native vegetative patterns and resultant fuel models and fuel continuities in the area. This change in fuel types due to alteration by fire suppression, logging, grazing (sheep and cattle), roads, irrigated fields, etc. has reduced the incidence of fires moving upslope into forested lands and has resulted in a change sometimes dramatic in vegetative communities and fuel loads.

Fuel Modeling

At this early date (Year 1 following the 2002 fires) determining which fuel model(s) any specific location would develop involves a degree of conjecture. Anderson describes a total of thirteen standard fuel models and a reference for estimating fire behavior in terms of flame lengths and rate of spread (Anderson, 1982, 3-16). The following table displays those fuel models that are most likely to be represented within the analysis area:

Table 3.4 Fuel Models

Fuel Model	Fire Behavior Characteristics	Rate of spread (ch/hr)	Flame Length (feet)
1	The fine, very porous, and continuous herbaceous fuels govern fire spread. Fires move rapidly through the cured grass and associated material. Very little shrub or timber is present.	78	4
2	Fire spread is primarily through fine herbaceous fuels. Herbaceous material, dead stem wood from shrubs and timber overstory contribute to fire intensity. Shrub and or trees cover one-third to two-thirds of the area	35	6
5	Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and grasses in the under story. Fires are generally not intense due to lighter fuel loadings and younger shrubs with little dead material	18	4
6	Fires carry through the shrub layer. Moderate winds are usually required to carry fire. Shrubs are older but not tall averaging two and one-half feet. Sagebrush is represented in this model.	32	6
8	Slow burning ground fires with low flame lengths are represented. This model represented by the closed canopy stands of short needle conifers. Fire tends to travel through the needles leaves and occasional twigs because little undergrowth is present.	1.6	1
9	Fires run through the surface litter faster than model 8 and have longer flame heights. This model represents closed stands of ponderosa pine.	7.5	2.6
10	Fires burn in surface and ground fuels with greater fire intensity than models 8 and 9. Large down woody material is in greater quantity. Crowning, spotting and torching is more frequent leading to potential fire control difficulties	7.9	4.8
11	Fires are active in the slash and herbaceous material intermixed with the slash. Spacing, lighter fuel load, shading and age of the fine fuels may contribute to limiting the fire potential	6	3.5
12	Fires spread rapidly, with high intensities capable of generating firebrands can occur. Fire starts generally sustain themselves until a firebreak or change in fuels are encountered	13	8

ch/hr = chains per hour, (1 chain equals 66 feet)

Additional details on Fuel Modeling can be found in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

Fuels Treatment Methods

There are many methods and combinations of methods to treat natural and activity related fuels. The options discussed below, by themselves, or in combination with other treatments are determined to be the viable range of options for the action alternatives in this project. Specific treatments determinations can only be prudently made following harvest activity.

Prescribed burning

"Controlled application of fire to wild land fuels in either their natural or modified state, under specified environmental conditions which allows the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives."(NWCG, 1998, G15).

Under burning

Depending on the management direction these can be modified to be light or cool under burns or hot under burns. On average on the Fremont NF the cost of under burning has consistently been about $100.00 per acre.

Broadcast burning

Intentional burning within well defined boundaries for reduction of fuel hazard, as a resources management treatment, or both."(NWCG, 1998, G-2). Depending on the unit, these usually take the shortest amount of time to accomplish. In units with very high fuel loads this is about the only option that is affordable. The cost of this method is about $300.00 per acre.

Jackpot burning

This is a modified method of broadcast burning, mainly used to dispose of slash concentrations where fuel is not continuous. Once again depending on the unit, the cost of this method can vary, ranging up to about $50.00 per acre.

Landing pile burning

This is simply the burning of piles created at the landings at logging operations. The piles consist of un-merchantable tops and limbs. On average one pile comes from the residue off ten acres of ground. It typically costs about $1.00 per acre.

Machine pile and burning

This method can be accomplished with several different types of equipment primarily tracked equipment. Due to soil compaction concerns this method has not been used for several years on the Silver Lake Ranger District. But with the advances in equipment and more low ground pressure equipment being more available this option may still be viable. At this time costs involved with this method are estimated at about $45.00 to $60.00 per acre. The estimated cost of burning these types of piles is about $20.00 to $30.00 per acre

Grapple pile and burning

This method can be accomplished with several different types of equipment tracked, wheeled and legged equipment with grapples buckets. The advantages of this method are the amount and size of material that can be piled. Technology has developed low ground pressure equipment. The estimated cost for this type of work is about $150.00 per acre. The estimated cost of burning these types of piles is about $20.00 to $30.00 per acre

Buncher pile and burning

A feller buncher is used to cut and pile the non-merchantable material next to a skid trail. Advantages of this system are that there is less ground impact by not having to drive over the same piece of ground several times. One disadvantage is that this could produce a large number of small piles that would not be economical to burn. The cost of doing the piling is a cost associated with the timber sale. The estimated cost of burning these types of piles is about $15.00 to $30.00 per acre.

Hand pile and burning

Hand piling small material is a good option for areas not easily accessible by machinery or in areas with other ecological concerns. Limitations include the expense, time commitment, and size limitations of material. Hand piling usually only accounts for materials up to three inches in diameter. Current contractor prices for hand piling range between $160.00 and $700.00 per acre depending on the difficulty level. The burning is an estimated $20.00 to $30.00 per acre.

Air curtain destructors

These area self-contained, efficient, clean-burning fireboxes used primarily in areas with significant air quality concerns. They use a curtain of high-speed air forced over the top of burning fuels to circulate and re-circulate the smoke emissions. The BLM Lakeview Unit is researching this option of fuels reduction in more smoke sensitive areas. The smallest unit can be towed behind a pickup while the larger units are towed by tractor-trailers (USDA 2002a). Cost estimates are (operating and purchase, lease, rent) $7000.00 per month lease.

Ladder Fuel Reduction Thinning

This is a thinning from below operation, sometimes called fuels "pretreatment". Low elevation dry forests offer the clearest opportunity for thinning as a pretreatment for prescribed fire. This process is accomplished primarily through the use of chainsaws. Cost ranges between $40.00 and $137.00 per acre, depending on difficulty level.

Crushing

This method reduces the fuel bed depth, thereby increasing the exposure of more fuel to the ground, increasing the decomposition by increasing the fuel moisture and decreasing the fire intensity. Cost for this method is about $40.00 per acre. Soil compaction and other soils concerns are lessened because the tractor is driving on top of a slash bed.

Masticate

A low ground pressure excavator with a rotating grinding head ("slash-buster") has proven effective in this area. This method does not remove fuel but grinds larger pieces of slash into smaller pieces and scatters them into a semi-uniform, low depth fuel bed. The cost of this treatment method averages about $125.00 per acre.

Additional details on Fuel Treatment Methods can be found in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

Fire Regimes and Condition Classes

Pre-European settlement found most fires in the low and mid-elevation forested stand to be non-lethal. But due to fire exclusion, timber harvest, historic (early 20th century) livestock grazing and exotic plant introduction, fuel conditions have changed and along with it, fire behavior. The change has produced a more lethal fire regime (USDA 1997 p.13; USDA 2002 p.4). Fire ecologists generally attribute these fuel accumulations to disrupted disturbance regimes resulting from fire exclusion policies, such as the "10 A.M. policy" mentioned earlier (Omi and Martinson, 2002).

There are five natural fire regime groups identified, expressed in terms of fire return interval.

Table 3.5 Fire Regimes

Fire Regime	Fire Return Interval	Severity
I	0-35 years	Low Severity
II	0-35 years	Stand Replacement Severity
III	35-100+ years	Mixed Severity
IV	35-100+ years	Stand Replacement Severity
V	> 200 years	Stand Replacement Severity

Three condition classes have been developed to categorize the current condition within the fire regimes. With each level of increase in condition the risk of fire loss of key components in the system increases.

Condition class 1: The historic disturbance regime is largely intact and functioning as defined by the natural fire regime. The effects of insects and diseases as well as potential intensity and severity of fire are within historic ranges.

Condition class 2: Moderate alterations to the historic disturbance are clearly evident; such as one or more missed fire return intervals. The effects of insects and diseases as well as potential intensity and severity of fire pose an increasing threat to key components that define the system.

Condition class 3: The disturbance regime has been significantly altered and historic disturbance processes and effect may be precluded. The effects of insects, disease or fire may cause significant or complete loss of one or more defining ecosystem components (USDA 2000b p.74-76).

The Toolbox Fire Recovery project and surrounding area is within Fire Regime I and II. Previous to the fires of 2002 the prevalent condition classes represented were class 2 and class 3 (Stubbs 2003).

Additional details on Fire Regime and Condition Class can be found in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

ENVIRONMENTAL CONSEQUENCES

Existing Condition (Variations Noted by Subwatershed)

General Information

Entire Project Area:

- Past fire and fuels projects primarily focused on activity fuels reduction, site prep burns and timber sales and BD related fuel reduction projects (see Appendix A) have contributed to the existing condition. Timber sale projects have generally reduced large fuel loads and large fuel continuity, but did increase fine fuels.

- Past fire suppression has allowed fuels and fuel continuity to increase through time. Miller conducted studies around the area north of Dead Indian Mountain. These studies determined that the historic fire return interval in that area was less than ten years over several hundred years prior to the suppression era. (Miller et al., 2001,5).
- There are small-scattered campsites throughout entire area that pose a potential threat of an escaped campfire

Specific to subwatershed:

There are many common characteristics throughout the fires of the Toolbox Complex; there is also some degree of variation. Reporting by subwatershed (see Map 2) allows the picture of the fires to be more specifically focused.

Table 3.6 Fire History and Existing Conditions by Subwatershed

Item	Subwatershed							
	Benny Creek	East Duncan	Lower Duncan	Middle Silver	Thomp-son	Upper Duncan	Upper Silver	West Fork Silver
Vegetative Mortality from 2002 Fires* (Ac.)	12,800	11,140	13,930	1,640	8,320	17,730	5,460	9,720
Slash piles on adjacent private lands from 2002-03 salvage (pockets of heavy fuel loading) (yes/no)	Yes – Extensive Pvt. Lands w/i Subshed	Yes – Extensive Pvt. Lands w/i Subshed	Yes – Extensive Pvt. Lands w/i Subshed	Limited – Some from juniper thinnings	Limited – Southern area of Silver Fire	Yes – Extensive Pvt. Lands w/i Subshed	No	No
Fire History 1949-2001: Fire Starts per Yr (Ave)	2	<1	<1	<1	2	1.5	> 1	1.5
Total Lightning Caused	74	37	31	22	104	49	39	55
% of Total Starts	70%	82%	82%	63%	67%	65%	58%	71%
Acres	518 Ac	7 Ac	16 Ac	4 Ac	448 Ac	7 Ac	2280 Ac	1597 Ac
Total Person Caused	32	8	7	13	51	26	28	23
% of Total Starts	30%	18%	18%	27%	33%		42%	29%
Acres	14 Ac	2 Ac	28 Ac	10 Ac	3373 Ac	6 Ac	38 Ac	43 Ac
Existing Open Road Density (presence of roads allows faster fire suppression access)	3.27 Mi/Sq. Mi	4.19 Mi/Sq. Mi	3.36 Mi/Sq. Mi	1.86 Mi/Sq. Mi	3.95 Mi/Sq. Mi	3.86 Mi/Sq. Mi	3.54 Mi/Sq. Mi	3.54 Mi/Sq. Mi
Dozer Line/Safety Zones Constructed during July-Aug 2002	31 miles/ None	9 miles/ None	34 miles/ 5 Zones	19 miles/ None	30 miles/ None	29 miles/ None	27 miles/ None	24 Miles/ None
High use campsites that pose a potential threat of an escaped campfire	2 - Puddle Spring & Foster Lake	None	None	1- Farm Well Trailhead & CG	2 – East Bay & Thomp-son	None	3 –Forest Bndry, Auger, Bunyard	1 – Silver Creek Marsh

*Note: 85,000 acres burned in the Toolbox Complex. Small portions occurred in the Bridge Creek, Sycan and Ana River Subwatersheds. These areas were excluded from the area of proposed activity in all fully developed action alternatives.

Table 3.7 Other Notable Existing Conditions by Subwatershed

Subwatershed							
Benny Creek	East Duncan	Lower Duncan	Middle Silver	Thompson	Upper Duncan	Upper Silver	West Fork Silver
Toolbox fire started in the Benny Creek Sub-watershed and expanded primarily to the north and east		On Dead Indian Mountain there are areas of patchy incomplete burn due to the amount of retardant that was used to protect the electronics site. Approx. 75,000 gallons of retardant dropped to protect the site (Smith LIFC)	Only a small portion of the subwatershed burned during the 2002 fire season. The Silver Fire threatened one small restaurant, and several homes	Thompson Reservoir, surrounded by scab and moist grass meadows is in the middle of the subwatershed is. The scab flats are given credit for helping stop the fire along the southeast flank		This subwatershed has been entered on several occasions with prescribed fire and other fuels treatments to reduce the fuel loads	Chaser - Broom Under burn (1996) on the northern fire perimeter caused fire to drop from the crowns and slow significantly. Wide expanses of low sage and scab rock flats also helped to steer the fire and increase the control capabilities.
Lower elevations along the southwest perimeter of the Toolbox Fire are checker boarded with expanses of scab rock flats, which did not burn during the 2002 fires	Lower elevations of this subwatershed have a few scattered areas of scab rock flats, which did not burn	Lower elevations of this subwatershed are checker boarded with large expanses of scab rock flats, which did not burn during the 2002 fire season	The subwatershed is checker-boarded with large expanses of scab rock flats, private property, and sage juniper communities	Lower elevations of this subwatershed are checker boarded with large expanses of scab rock flats, which did not burn during the 2002 fire season.			
Three high-tension power lines, that are relatively free of vegetation, run north and south through the middle portion		One high-tension power line, that is relatively free of vegetation, runs west to east through the subwatershed		High-tension power lines run north and south through east portion of subwatershed A minor powerline runs north and south through the middle	Three high-tension power lines, that are relatively free of vegetation, run north and south through the western portion		

Fuel Loads

Reported fuel loads are based on fuels inventories that were performed following the fires. In general, fire-killed trees occur across the landscape over tens of thousands of acres that burned during the 2002 fire, including large areas with up to 100% tree mortality. Mortality mapping, based on September 2002 conditions, on forested National Forest System lands, within the Toolbox Fire Recovery Project area, indicates the following:

- 0-25% (low mortality) – 6,463 acres
- 26-50% (moderate mortality) – 9,292 acres
- 51-85% (high mortality) – 5, 215 acres
- 86-100% (very high mortality) – 12,216 acres

In high mortality areas, surface fuels were generally completely consumed in the smaller size classes (litter, duff, grass, 0-9" woody material) and large logs (greater than 9") were consumed. This resulted in areas with little to no fine fuel and scattered large woody fuels. Where live needles were completely consumed by fire, there will be a slow accumulation of surface fuels over the next five years, herbaceous vegetation should respond within three to five years (Hall, 2003, 15). In high mortality areas, fire-killed trees will eventually fall over and contribute to a greatly increased total fuel loading within the next 5-12 years. Fuel loadings are expected to reach their maximum in about 10 years (Hall, 2003, 8). In areas with lower levels of mortality, a mosaic of dead and green trees remains. Surface fuels were consumed in different patterns. These a still have fine fuels in place as well as an accumulation of fire-killed needles and branches and large woody fuels. Where fires left dead needles on trees, these needles will fall within 1-3 years and accumulate.

Across the landscape there are different fuel types and combinations of fuel types resulting in a wide variety of fuel models. Fuel Models 1 and 2 (grass and scattered sage) are predominant in the lower elevations. Moving upslope fuel model 6 (sage brush and juniper) appears. Further upslope ponderosa pine stands appear that are characterized by different fuel loads and arrangements that act as fuel models 6, 8, 9, 11 and 12. At the higher elevations are the mixed conifer white fir, ponderosa pine, and lodgepole pine that behave similar to fuel model 10 and 12.

Previously under burned areas, particularly in the West Fork Silver Creek subwatershed have fuel models that are similar to a fuel model 9 and or 2.

Table 3.8 Fuel Loads (Tons per Acre) by Subwatershed

Item	Subwatershed							
	Benny Creek	East Duncan	Lower Duncan	Middle Silver	Thomp-son	Upper Duncan	Upper Silver	West Fork Silver
Prior to 2002 Fires – Based on information gathered throughout the subwatershed	6 - 36	6 - 36	18 -73	3 - 30	6 - 36	6 - 36	1 - 20	1 -20
Post – Fire (Fall 2002) within Fire Perimeter	0 - 10.3	0 – 11.4	0.1 – 7.0	0 – 3.1	0 – 9.9	0 – 18.6	0 – 11.4	0 – 11.4
Current Fuel Model	9	9	9	9	9	9	9	9

Resistance to Control and Firefighter Safety

Resistance to control varies throughout the area based on specific conditions and factors that occur within a given location. In general, areas that experienced high mortality are characterized by continuous areas with standing dead trees (snags). Snags pose a threat to firefighter safety as they can fall at any time and without warning to seriously injure or kill firefighters. Snags are also a source of firebrands and contribute to spotting potential. As a result of surface fuel consumption during the 2002 fires, the resistance to control was lowered in all burned areas. Areas that burned at higher intensities had more surface fuels reduced and therefore offer the least resistance to control in the short term. However, as snags accumulate on the ground within the next five to twelve years (Hall 2003 p.8) resistance to control will begin to rise. A lack of canopy fuels has, in many cases, eliminated the occurrence of crown fires for the next five years.

Areas that burned with low fire intensities may still be capable of carrying high intensity fires in the next five years, as the surface and ladder fuels are still present, although the resistance to control is lower than pre-fire. In these stands, the 2002

fires made more fine fuel available for the next fire by creating a dead component with scorched needles and branches. Moderate and mixed-mortality burned stands can still carry fire in the next five years, and also have a standing dead fuel component that can be hazardous for firefighters for reasons stated above.

Fuel loadings across the landscape are extremely variable. In addition the fuel loads are dynamic due to expected changes relating to trees falling and vegetation becoming reestablished. Resistance to control would vary, largely in part due to the fuel loading, fuel type, location and available access. BEHAVE models were run for these representative models to asses flame lengths and rates of spread. The calculations for helicopter harvest units remained the same with the exception of the slope. The slope calculation changed to 35 percent in conjunction with the slope limitations of ground based equipment as listed in the timber sale contracts. By increasing the slope the rate of spread and flame lengths increased.

Table 3.9 BEHAVE Runs Fuel Model Comparison

	Fuel Model	Rate of Spread Ch/hr Slope 10%	Rate of Spread Ch/hr Slope 35%	Size in 1 hour. Acres	Flame length Ft slope 10%	Flame length Ft slope 35%	Contain-ment time Hours Slope 10%	Contain-ment time Hours slope 35%	Contain-ment size Acres Slope 10%	Contain-ment size Acres Slope 35%
	1	20		28	2.3		2.1		138	
	2	8		4.4	3.2		1		11	
	5	2		.4	1.4		.2		<1	
	6	13		11	4		3.8		103	
	8	1	1	<1	.7	.9	.1	.1	<1	<1
	9	3	4	.5	1.8	2.2	.2	.4	1	2
	10	2		.4	2.8		.2		<1	
	11	3	4	.5	2.4	2.9	.2	.3	1	1
	12	6	9	2.6	5.8*	6.8*	1.1*	2.1*	7*	21
Two Fuel Model										
	8 & 2	4		.9			.3		1	
	8 & 6	6		2			.5*		4*	
	9 & 2	5		1.6			.5		3	
	9 & 6	7		3			.8*		7*	
	10 & 6	6		2.8			.7*		6*	
	11 & 2	5		1.6			.5		3	
	11 & 6	7		3			.7*		6*	
	12 & 2	7		3.2			1.1*		9*	
	12 & 6	9		5.1			1.8*		22*	

* Model indicates that the fire is too intense to direct attack with hand forces, the use of engines, dozers, or retardant may be necessary.

Local experience has determined that bitterbrush by itself behaves as a fuel model 5. However, when accompanied with needle-drape it responds similar to fuel model 6, which as can be seen in the above table exhibits markedly different fire behavior. Needle-drape bitterbrush is very common throughout the Silver Lake District, particularly at lower and middle elevation.

Fire line production rates were taken from the "NWCG Fire line Handbook" for initial attack by engine crews (NWGG, 1998).

Additional details on Fuel Models and BEHAVE runs can be found in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

In lower elevations, due to the proximity of scab rock flats and adequate road systems the ability of fire fighters to safely approach a fire start is satisfactory. The presence of large safety zones and good ingress and egress routes provide protection. The resistance to control may be fairly high but the continuity of the fuels is broken. These characteristics describe the:

- Southern and southwestern portion of the Benny Creek subwatershed
- Areas of mule deer winter range, on the northernmost portion of the East Duncan and Lower Duncan and Upper Duncan Subwatersheds

- Northern portion of the Silver Fire, in the northernmost portion of the Middle Silver subwatershed
- Southern and southeastern portion of the Silver Fire in the Thompson Subwatershed

Mid to upper elevations of ponderosa pine zones have a decreasing number of scab rock flats but an increased number of roads both on federal and on private lands. Ingress and egress into most areas is adequate though not fast, and naturally occurring safety zones are less available. Within higher elevations areas of mixed conifer there are a number of roads but very few or no areas of scab rock flats, and few meadows to provide for adequate safety zones. These characteristics occur in all subwatersheds.

Specific to Subwatershed:

Benny Creek - The area around Puddle Springs had an underburn entry in 1996 that reduced the fuels to a large extent, which helped modify the fire behavior of the Toolbox Fire. The powerline corridors that run north and south through the middle portion of the subwatershed "arced" to the ground during the Toolbox fire. Because of this, little action can be taken with fires along the powerline corridor, especially if large volumes of smoke are being produced.

Middle Silver Creek- The primary driver of fires in this area is wind. Local experience is that the winds usually die down in the evening providing an opportunity to aggressively attack fires at that time. The continuity of the fuels is more broken in the sagebrush-juniper communities due to grazing and other activities by private landowners. The lighter fuels burn out quickly and provide more opportunities for safety zones and initial attack responses. There is a minor powerline that runs east and west through the southern portion of the subwatershed. During the Silver fire the power was turned off during the fire. Smoke production under the powerlines is still a concern and could lead to arcing. There are high-tension power lines that run north and south through the eastern portion of the subwatershed.

Thompson Reservoir/Upper Silver Creek/West Fork Silver Creek - Paved Forest Roads 27 and 28 both travel through these subwatersheds and provide rapid access from either the north or the south.

Upper Silver Creek- The lighter fuel loads, open ground and adequate road systems characteristic of the lower portions of this area give the fire fighters the ability to safely approach a fire start. The area north and west of Thompson Reservoir had a large wildfire in 1996 and has since had commercial removal of salvage material. This removal decreased the fuel loads. The area currently has a component of young shrub species. In a few years this will start to develop a dead component and may become a fire hazard. Several underburns have occurred in the subwatershed, which have markedly reduced the fuel loads.

West Fork Silver Creek - Several under burns have occurred in the subwatershed, primarily in the lower elevation pine areas. These have substantially reduced fuel loadings on a mosaic pattern. The lighter fuel loads, open ground and adequate road systems characteristic of the lower portions of this area give the fire fighters the ability to safely approach a fire start. Through out the lower elevations are very good safety zones.

Additional details on Existing Condition can be found in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

Environmental Consequences

Direct and Indirect Effects (Variations Noted by Subwatershed)

Alternative A

There are no fuels treatments or prescribed fire activities proposed with this alternative.

Fuel Loads

As stated in the Existing Conditions section common to all areas, the areas that experienced high and very high vegetative mortality would have an accumulation of fallen dead trees over the next decade. In the ponderosa pine types, down fuel loading in the two higher mortality classes (51 to 85 percent and 86 to 100 percent) is expected to reach as high as 60 to 100 tons per acre. This accumulation would result in greater fire intensities, greater spotting potential, and greater control problems, compared to alternatives proposing some sort of fuel reduction strategy. As Hall suggests, the herbaceous vegetation would establish itself in 3 to 5 years. Assuming that the trees start to come down in 5 to 12 years and at 10 years the highest fuel loads are expected, and in 10 years the herbaceous vegetation is well established with some fine and flashy fuels being created from the grasses, leaves and small branch wood, the period of highest risk for a large fire would begin in about 10 years. Hall (2003) indicates that the fuel loads that are created by the fires of 2002 would eventually "melt down"

to 10 to 20 tons per acre in 75 years. At the same time a new stand of trees would be well established with a variety of age classes represented. This would produce a stand of trees with ladder fuels from the ground to the top, with 10 to 20 tons of residual old fuel in place and a 75-year-old layer of needles, twigs and recent dead material.

The amount of biomass accumulation not only determines the speed at which the burned area could recover but also the likelihood, intensity and rate of spread of the next fire (Whelan R. 1995 p.260). Fuel characteristics are compactness of the fuel bed, loading, horizontal continuity, vertical arrangement, chemical content, size, shape, and moisture content (NWCG 1994 p.344). Fuel arrangements, size and loads can significantly affect fire behavior and fire line intensity. In the case of a stand-replacing crown fire (e.g. 2002 Toolbox Complex) the un-manipulated fuel succession could follow this scenario:

- Year 0 (post-fire), little forest floor fuel available;
- Year 1-10 increasing fine fuel availability with a large component of the larger fuels having fallen down and become surface fuels;
- Year 10-30: increasing duff buildup with herbaceous and shrub fuels, plus conifer regeneration increasing, and more large fuels from standing dead trees increasing downed woody fuel loads and fuel bed depth;
- Year 30-50: high fuel loads, estimated at 60 to 100 tons per acres, as remaining large fuels fall down from the 2002 fire event, duff and dead and live fuel loads increase especially as conifer regeneration increases both in density and vertical arrangement.
- Year 50-75: Some fuel reduction due to decay and other natural processes, down to 20- 40 tons per acre at age 50 and 10 to 20 tons at age 75. (Hall 2003 p. 18.)

While the 2002 fires burned through the mostly vertical fuel loads, with a result of little area of adverse soil impacts; a fire, if it were to occur after several decades of “no-action”, would occur in a fuel bed with substantially more horizontal component. Fuel loading in the next 30 years could contribute to serious soil impacts. Fire in down fuel would burn hotter and longer close to the ground than the 2002 fire (Hall 2003, 15).

Fuel loads in the sagebrush juniper communities are not expected to increase, though an increase in grasses would be expected in the first few years.

The protection of the land around the communications site on Indian Mountain in the Lower Duncan subwatershed remain of the highest concern in this area. The action alternatives, to varying degrees include salvage units, with proposed additional fuels treatment, surrounding the communications site. Alternative A would leave these fuels untreated and the ability to protect the site would not be improved.

An area of high mortality occurred in the Silver Creek drainage and West Fork Silver Creek drainage. This was due to a high accumulation of dead material. The fuel loads in the stream corridors would be expected to increase at a rate slightly higher than elsewhere, due to the greater amount of standing dead. Within the stream corridors the recovery of grasses and brush is anticipated to be elevated due to the amount of moisture available for growth. This also increases the amount of fuel that could potentially be available to burn.

Due to the presence of good public access on Roads 27 and 28 in the Thompson Reservoir, Upper Silver Creek and West Fork Silver Creek subwatersheds, a moderate amount of lodgepole pine and other material is expected to be removed by fire woodcutters and campers. This would have a local effect, but would not affect fuel loads on a large scale.

No prescribed burning would occur. The beneficial effects discussed under the action alternatives (C, D, G and H) would not occur. The fires of 2002 reduced fine and medium fuels (including duff) across large expanses of burned area. In the near future herbaceous fuels would increase in a variable manner according to the burn mortality, rate of regeneration and growth, and weather.

In the areas that experienced high and very high mortality, the standing dead trees would eventually fall over and accumulate as surface fuels over the next five to twelve years (Hall, 2003, 8). The result of large accumulations of surface fuels is greater fire intensities, greater spotting potential, and greater resistance to control. In areas that experienced low mortality, fuel accumulation from dead and dying trees, branches, and needles would continue to accumulate along with natural mortality. Fuel loads can be expected to approach pre-2002 fuel loads in these areas in the next decade and in the event of subsequent fire starts, high intensity fire behavior would be expected. Ladder fuels still exist in some areas and would contribute to vertical fire spread, putting surviving overstory trees at future risk. As fuel loads increase, the risk

associated with the eventual use of prescribed fire increases due to heavier fuel loads and increased resistance to control. Accumulations of untreated fuels on a landscape would make prescribed use fires even more difficult to implement in the coming decades. If this led to further preclusion of the use of prescribed fire, a further continuation of all fuels build up would occur.

Resistance to Control and Firefighter Safety

In areas that experienced high and very high vegetative mortality there are currently many acres with standing dead trees, or snags. This condition also exists in areas that experienced moderate mortality. Snags pose a threat to firefighter safety as they could fall at any time and without warning to seriously injure or kill firefighters. Snags are also a potential source of firebrands and contribute to spotting potential. There are a variety of scenarios that could occur, depending largely on fuel model. The area is dynamic, therefore different fuel models or combinations of fuel models will exist through time. Resistance to control would vary, largely in part due to the fuel loading, fuel type and the location within the subwatershed.

As an example, some of the areas that were represented by a fuel model 6 (juniper sage) after the fire may be more represented by a fuel model 2 as a grass component becomes established.

Table 3.10 BEHAVE Run Results for Fuel Models 2 and 6

Fuel Model	Rate of Spread Ch/hr	Size in 1 hour. acres	Flame length ft	Containment time hours	Containment size acres
2	8	4.4	3.2	1	11
6	13	11	4	3.8	103

As an example, areas that were previously a fuel model 10 before the fire may have had enough surface fuel removed to represent the current fire behavior as a fuel model 8, but in the next decade with down fall and under growth the area would likely become represented by a fuel model 12.

Table 3.11 BEHAVE Run Results for Fuel Models 8, 10, and 12

Fuel Model	Rate of Spread Ch/hr	Size in 1 hour. Acres	Flame length Ft	Containment time Hours	Containment size Acres
8	1	<1	.7	.1	<1
10	2	.4	2.8	.2	<1
12	6	2.6	5.8*	1.1*	7*

* Model indicates that the fire is too intense to direct attack with hand forces, the use of engines, dozers, or retardant may be necessary.

It is anticipated that for the first 3 to 5 years the threat of fire and safety to fire fighters would not be as critical as in years six through several decades. During the first five years there would not be sufficient time sufficient time for the accumulation of fine fuels necessary to carry a fire, except in scattered patches. Eventually, in a no treatment scenario large contiguous acres would acquire fuel loads that present a very high resistance to control.

The key finding of the BEHAVE analysis is that areas that become Fuel Model 12 would likely be beyond the capabilities of initial attack of hand forces. This condition is particularly significant during events similar to July 12 and 13, 2002 in which multiple fire starts occur over a widespread area as a result of lightening (63 local fire starts in the case of July 12, 2002). In such a scenario it quickly becomes impossible for the typically available local forces, even with the use of engines, to successfully keep 100% of the starts contained. While the no-action alternative would not necessarily affect the chances for a fire start to occur, the un-manipulated fuel succession, described above, that would occur with the no-action alternative would produce persistent elevated fuel loadings that would significantly increase the likelihood that a large, intense wildfire would occur during a multiple fire start scenario. This high-risk condition would be present for several decades at a minimum. The recovery of sustainable forests in the areas that have burned depends first on successfully reforesting those areas, either through natural means or planting, and then producing and maintaining conditions that do not contribute to stand replacement fire. One of the primary maintenance tools in ponderosa pine forests is the application of prescribed fire. Applying fire in the presence of fuel loads that range from 30 to 100 tons per acre is imprudent at best. For these reasons, this alternative presents a low likelihood for developing sustainable forests.

The presence of roads allows better and faster access for fire suppression forces if the need arises. Current open road density on National Forest lands within the subwatershed is 3.27 miles per square mile. All of these would remain open with Alternative A, therefore access would be retained and the ability to respond to fire starts would remain high.

Action Alternatives

The action alternatives propose varying amounts of ground based and helicopter commercial salvage with additional fuels treatment, prescribed fire outside salvage units and fuels treatments within a quarter mile buffer of private lands (both inside and outside of harvest units). All action alternatives include the same design regarding commercial salvage in roadside hazard corridors. The effects of these activities on fuel loads are discussed below.

Fuel Loads – Ground Based Units

All action alternatives propose some degree of commercial salvage. All include a design in which additional fuels treatment would be implemented in areas where predicted fuel loading would exceed a certain threshold. The threshold is 20 tons per acre in Alternatives C, D, G and H and 30 tons per acre in Alternative E. The long-term benefit of this harvesting, common to all alternatives, is the reduction of large woody fuels over a large area. In the event of a subsequent fire start the resultant reduction in intense fire behavior would contribute to increased firefighter and public safety. However, in the period between large wood removal and additional post-harvest fuels treatment, it is expected that there would be an increase of fuel loads above current, post-fire levels, mostly in the fine and medium size classes. These woody fuels, combined with the fine herbaceous fuels pose a short-term fire hazard until the slash from the harvesting operations is treated. In the mid and long term however, removing the large fuels early and treating the slash created from these potential operations would produce lower fuel loadings than would be expected without harvest operations. The weight tables for ponderosa pine and the assumptions described earlier in this section under “Analysis Methods” were used to determine fuel loadings. Units identified for additional fuels treatment are those that are predicted to produce fuel loadings in excess of 20 tons per acre, if left untreated (30 tons per acre in Alternative E). Units that are identified for helicopter would not likely be whole tree yarded due to the associated additional costs.

Fuel loads were calculated for areas of mortality greater than 51 percent. The lower mortality areas (0 to 50 percent) have larger areas of live green trees, and smaller pockets of dead and dying trees. The result is that the lower mortality areas would not have a large increase in fuel loads. Projected fuel load increases related to harvest activity in the areas of less than 50 percent mortality are not considered significant, relative to areas of greater than 50% mortality. The material to be harvested in the low and moderate mortality areas is generally more scattered, or in smaller pockets, and therefore it is expected that simply requiring whole tree yard and yard top attached to last log (for trees over 21 inches) would minimize the potential hazard associated with activity generated increases in fuel loading. The mosaic across the landscape created by the areas of low and moderate mortality would be beneficial in helping to create natural fuel breaks.

For all units, removing trees to the landing would remove a large percentage of the potential fuel loading from a given site. However, even with this reduction, at least 75 percent of the remaining foliage is expected to experience “breakage” during yarding and remain on site. The following discussion includes the assumption that materials down to 9 inches dbh would be removed to the landing. If material removed to the landing includes only that which is greater than 14 inches dbh, an additional 8 to 10 tons per acre would need to be treated with post-activity fuels treatment. A discussion of this scenario can be found following the 9-inch removal scenario.

The current fuel loads are best represented by fuel model 9. The current post-fire fuel loads in each subwatershed was previously reported in the Existing Conditions section. In harvest units where planting would occur, much of the remaining non-commercial material would be felled (or “slashed”) for safety reasons (as per OSHA requirements). The result would be an increase in the small diameter fuel loading. If it is assumed that 300 trees per acre that would be felled in this operation, it would produce on average about 21 tons per acre additional slash to the ground. The table below displays the resultant fuel loading when the commercial harvest “breakage” additions (1.4 tons per acre in ground-based units) and the slashing fuel load of 21 tons per acre is added to the existing post-fire fuel loads.

Table 3.12 Average Fuel Loadings (Tons per Acre) in Ground-Based Harvest Units – Prior to Fuels Treatment

	Subwatershed							
	Benny Creek	East Duncan	Lower Duncan	Middle Silver	Thomp-son	Upper Duncan	Upper Silver	West Fork Silver
Fuel Loading following harvest and preparation for planting (prior to slash treatments)	22.4 – 32.7	22.4 – 33.8	22.5 – 29.4	22.4 – 25.5	22.4 – 32.3	22.4 – 41.0	22.4 – 25.4	22.4 – 33.4
Average Fuel Loading	28	28	26	24	27	31.7	24	28

The alternatives vary primarily by the number of acres of harvest and the resultant acreage of "additional fuels treatment" within harvest units. Units identified for ground-based harvest would have the fuels treated by whole tree yarding of the material up to 21 inches DBH and yard top attached to last log for trees larger than 21 inches, with the exception of top breakage in the unit. Fred Hall, in a report specific to the expected vegetative responses in the Toolbox Fire Complex, indicates that total down fuel loading could reach up to 100 tons per acres in some areas of high and very high mortality (Hall, 2003) without removal of large woody fuels. For all action alternatives except Alternative E, on those units where predicted fuel loadings would exceed 20 tons per acre, additional fuels treatment, beyond whole tree yarding or yard-tops-attached, would occur. This would occur on the amount of acres, by alternative, by subwatershed that is displayed in the table below. For Alternative E, on those units where predicted fuel loadings would exceed 30 tons per acre additional fuels treatment would occur. This "threshold" is 10 tons per acre greater than the other action alternatives, and therefore a substantially smaller proportion of the units would receive additional fuels treatment. Alternative G includes additional fuels treatment within ¼ mile of private land, regardless of predicted fuel loading (see "Fuel Loads- ¼ Mile Buffer Zone" section below). Another difference between units is the amount of helicopter acres that would be salvaged. This aspect is discussed following the consideration of ground-based units.

Table 3.13 Acres of Additional Fuels Treatment in Ground-Based Harvest Units

Alternative	Subwatershed							
	Benny Creek	East Duncan	Lower Duncan	Middle Silver	Thomp-son	Upper Duncan	Upper Silver	West Fork Silver
C	1472	751	846	341	2220	1561	722	1869
D	565	571	434	70	927	1080	420	1340
E	844	568	718	270	1016	1290	273	1525
G	1700	1000	1050	420	2550	1900	800	1934
H	1400	725	740	320	2138	1400	600	1730

The range of slash treatment methods is described earlier in the Fire and Fuels section. The table below summarizes the comparative effects of different slash treatment options that would be applied to the above areas:

Table 3.14 General Effectiveness of Fuels Treatments in Ground-Based Harvest Units

	Jackpot burning	Broadcast burning	Under burn	Hand pile and burn	Masticate	Crush	Buncher pile and burning	Machine pile and burning	Grapple pile and burning	Landing pile burning
Does Method Remove Fuel?	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Does Method Change Fuel Continuity ?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Does Method Change Fuel bed Depth?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimated Fuel Reduction	10%	75%	50%	25%	0%	0%	50%	50%	50%	N/A

Taking into account the variation between expected fuels loading within subwatersheds, and the varying effectiveness of the different fuels treatment methods, calculating the resultant fuel loadings reveals that most methods listed in the above tables would reduce the fuel loading to a level below 20 tons per acre. The exceptions (see table below) are Jackpot burning, hand piling and burning (in typical fuels conditions in some subwatersheds), mastication and crushing. However, mastication and crushing would significantly reduce the fuel bed depth.

Table 3.15 Effectiveness of Varying Fuels Treatment Methods, Specific to Conditions in each Subwatershed

	Would Fuels Treatment Method bring fuel loadings below 20 tons per acre*?								
Subshed	Jackpot burning	Broad-cast burning	Under burn	Hand pile and burn	Masti-cate	Crush	Buncher pile and burning	Machine pile and burning	Grapple pile and burning
Benny	No	Yes	Yes	No	No	No	Yes	Yes	Yes
East Duncan	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Lower Duncan	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Middle Silver	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Thomp-son	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Upper Duncan	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Upper Silver	No	Yes	Yes	Yes t	No	No	Yes	Yes	Yes
West Fork Silver	No	Yes	Yes	No	No	No	Yes	Yes	Yes

* for a typical fuels loading situation in each subwatershed

The overall effect of the harvest, the post harvest slashing and the additional fuel treatment would be to return the area treated to a fire safe condition. The comparative beneficial effects from this treatment, between action alternatives, are propionate to the area treated, which varies by alternative, as, displayed above. Alternative G would treat the most areas and therefore provide the greatest benefit within ground-based units, because it includes additional fuels treatments within ¼ mile of private lands. This ranges down to Alternative D, which would provide the least amount of additional fuels treatments within ground-based units of any of the action alternatives.

The protection of the land around the private property, and the installations at the communications site on Indian Mountain is the highest concern in this subwatershed. Alternative C includes salvage units, with proposed additional fuels treatment, essentially surrounding the commutations site.

An area of concern that warrants individual disclosure of expected effects is the area around the Indian Mountain Communications site. During the July 2002 fires the heavy fuels loadings that essentially surrounded the top of the mountain necessitated a large commitment of resources, including most of the retardant that was used during suppression, to prevent damage to the site. The site contains valuable telecommunications equipment located on National Forest Land through special use permit, that provides important safety and emergency services. Mortality in the area surrounding the site is primarily in the 51% to 85% range, with a lesser amount being characterized as 26% to 50%.

The action alternatives vary in the amount and pattern of fuels treatment that would occur near the site. Alternative D includes salvage units, with proposed additional fuels treatment, to the south and southwest of the commutations site. Alternative D is the only action alternative that does not include a salvage unit (unit 138 - that proposes additional fuels treatment) that is located on the northwest, north and northeast perimeters of the communications site. Without treatment, this area to the north of the site would be expected to produce high fuel loads over the next 10 to 15 years as standing dead trees fall. Alternative E is the only action alternative that does not include a salvage unit (unit 145 - that proposes additional fuels treatment) that is located just to the south of the communications site. Without treatment, this area to the south of the site would be expected to produce high fuel loads over the next 10 to 15 years as standing dead trees fall. Alternatives C, G and H include salvage units, with proposed additional fuels treatment, that essentially surrounding the commutations site. In addition, fuels treatments are proposed (in Alternative G only) outside of salvage units to the northeast of the communications site. Because of this, while each action alternative would provide activities that would decrease fuel loads near the communications site; Alternative G most fully addresses this concern.

Fuel Loads – Ground Based Units (14" dbh and greater scenario)

The assumption for all alternatives is that materials down to 9 inches dbh would be removed to the landing. The resultant fuel loadings and the effect of the various treatments are displayed in the above tables. However***, if material removed to the landing includes only that which is greater than 14 inches dbh,*** an additional 8 to 10 tons per acre would need to be treated with post-activity fuels treatment.

Table 3.16 Average Fuel Loadings (Tons per Acre) in Ground-Based Harvest Units (if only 14" dbh and greater material is brought to the landing) – Prior to Fuels Treatment

	Subwatershed							
	Benny Creek	East Duncan	Lower Duncan	Middle Silver	Thomp-son	Upper Duncan	Upper Silver	West Fork Silver
Average Fuel Loading following harvest and preparation for planting (prior to slash treatment)	37	37	35	33	36	40.7	33	37

Taking into account the variation between expected fuels loading within subwatersheds, and the varying effectiveness of the different fuels treatment methods, calculating the resultant fuel loadings reveals that most methods listed in the above tables would reduce the fuel loading to a level below 20 tons per acre. The exceptions (see table below) are Jackpot burning, hand piling and burning (in typical fuels conditions in some subwatersheds), mastication and crushing. However, mastication and crushing would significantly reduce the fuel bed depth. Another exception is in the Upper Duncan subwatershed where, based on subwatershed averages, only broadcast burning would lower fuel loadings below 20 tons per acre; but several would reduce fuel to 20.4 tons per aces (underburn, hand pile and burn, buncher pile and burn and grapple pile and burn). The overall effect of the harvest, the post harvest slashing and the additional fuel treatment would be to

return the area treated to a fire safe condition, however, on average there would be 29 percent higher fuel loadings following fuels treatment in this scenario.

Table 3.17 Effectiveness of Varying Fuels Treatment Methods, Specific to Conditions in each Subwatershed (if only 14" dbh and greater material is brought to the landing)

Subshed	Would Fuels Treatment Method bring fuel loadings below 20 tons per acre*?								
	Jackpot burning	Broad-cast burning	Under burn	Hand pile and burn	Masti-cate	Crush	Buncher pile and burning	Machine pile and burning	Grapple pile and burning
Benny	No	Yes	Yes	No	No	No	Yes	Yes	Yes
East Duncan	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Lower Duncan	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Middle Silver	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Thomp-son	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Upper Duncan	No	Yes	No	No	No	No	No	No	No
Upper Silver	No	Yes	Yes	No	No	No	Yes	Yes	Yes
West Fork Silver	No	Yes	Yes	No	No	No	Yes	Yes	Yes

* for a typical fuels loading situation in each subwatershed

Funding availability

An assumption has been made that funding will be available to treat all acres identified that need or require fuels treatment in all the action alternatives. Areas proposed for fuels treatment are limited to those areas that would have a direct need in order to promote long term recovery. Included in this assumption is the consideration that funding from other than that associated directly with timber sales, such as brush disposal (BD) funds, would become available. The schedule of events or the timing of events in regards to site prep activities and planting has been considered in these proposals.

Fuel Loads –Helicopter Units

Alternatives C, D, E and G each include helicopter units. Helicopter harvest units used the same basic calculations, with the additional assumption that slash amounts left behind would include tops (these would typically not be removed to the landing). The remaining trees would be slashed to remove the aerial hazard to ground personnel. The result of this would be a large increase in the small diameter fuel loading. On average the number of trees to be slashed would be over 300 trees per acre. Given existing fuels loadings based on subwatershed averages (see "Existing Conditions") and adding the commercial harvest and the slashing fuel would result in fuel loading in helicopter units as displayed in the table below.

Table 3.18 Average Fuel Loadings (Tons per Acre) in Helicopter Harvest Units – Prior to Fuels Treatment

Item	Subwatershed							
	Benny Creek	East Duncan	Lower Duncan	Middle Silver	Thomp-son	Upper Duncan	Upper Silver	West Fork Silver
Average Fuel Loading following harvest and preparation for planting (prior to slash treatments)	46	47	45	N/A	N/A	50	43	46

The alternatives vary primarily by the number of acres of harvest in helicopter units. The following table displays, by alternative and by subwatershed, the amount of area in helicopter units that would receive fuels treatment.

Table 3.19 Acres of Fuels Treatment in Helicopter Harvest Units

Alternative	Subwatershed							
	Benny Creek	East Duncan	Lower Duncan	Middle Silver	Thomp-son	Upper Duncan	Upper Silver	West Fork Silver
C	13	11	307	0	0	75	29	30
D	13	0	297	0	0	49	0	0
E	0	0	307	0	0	0	0	0
G	13	11	307	0	0	75	21	21
H	0	0	0	0	0	0	0	0

The range of slash treatment methods is described earlier in the Fire and Fuels section. The table below summarizes the comparative effects of different slash treatment options that would be applied to the above areas:

Table 3.20 General Effectiveness of Fuels Treatments in Helicopter Harvest Units

	Jackpot burning	Broadcast burning	Under burn	Hand pile and burn	Masticate	Crush	Buncher pile and burning	Machine pile and burning	Grapple pile and burning	Landing pile burning
Does Method Remove Fuel?	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	Yes
Does Method Change Fuel Continuity ?	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	Yes
Does Method Change Fuel bed Depth?	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	Yes
Estimated Fuel Reduction	10%	75%	50%	25%	N/A	N/A	N/A	N/A	N/A	N/A

Taking into account the variation between expected fuels loading within subwatersheds, and the varying effectiveness of the different fuels treatment methods, calculating the resultant fuel loadings reveals that of the available methods on helicopter ground, only broadcast burning would reduce the fuel loading to a level below 20 tons per acre (see table below). The overall effect of the harvest, the post harvest slashing and the additional fuel treatment, if it were broadcast burning, would be to return the area treated to a fire safe condition. The amount of helicopter units is relatively small, even in Alternative C, which has the most (470 acres). Because of this, differences between alternatives, regarding fuel loads may be apparent only a local level. On a landscape scale, particularly in relation to the effect of fuel loads on fire behavior, differences between action alternatives are minimal.

Fuel Loads - Roadside Hazard Treatment

Approximately 1300 acres of commercial salvage would occur in roadside hazard corridors in all action alternatives. These corridors are located as 150-foot wide areas on both sides of the higher maintenance level roads. They are all located in areas with 26% or greater vegetative mortality. In areas of low mortality (25% or less) roadside hazard trees would be

handled on a case-by-case basis. The majority of the fuels treatment is expected to take place using Brush Disposal (BD) collected funds, rather than funding associated with site preparation for reforestation.

Areas of moderate mortality (26 –50 percent) would not likely produce quantities of slash that would greatly add to the fuel loads in the area. The larger trees that could potentially fall on the road are the ones that would be selected for harvest. The smaller trees that do not threaten the road would not be harvested. These fire killed non-harvested trees would eventually fall, adding to the total fuel load, but not at a scale that would create a high concern. Local experience has been that dead trees close to the roads will have a high degree of removal by local firewood cutters, thus a decrease in fuel loads. In areas of greater mortality, use of whole tree yarding (up to 21 inches dbh) or yard-top attached (larger trees) would assist in producing overall fuel loads are within acceptable levels.

Fuel Loads - Prescribed Burning (Common to Alternatives C, D, G and H)

These alternatives all propose prescribed burning, in the same general area though with a variation in the number of acres – see the following table and Maps 9 (Alt. C), 14 (Alt. D), 24 (Alt. G) and 29 (Alt. H).

Table 3.21 Acres of Prescribed Fire by Subwatershed

Alternative	Subwatershed							
	Benny Creek	East Duncan	Lower Duncan	Middle Silver	Thomp-son	Upper Duncan	Upper Silver	West Fork Silver
C	365	1200	230	0	0	1777	0	0
D	365	756	134	0	0	1195	0	0
E	0	0	0	0	0	0	0	0
G	365	1200	230	0	0	1777	0	0
H	365	756	134	0	0	1195	0	0

In the prescribed burn project areas Alternatives C, D, G and H would have similar environmental consequences. Prescribed fire would be applied to the ground with the intention of creating a mosaic of burned and unburned area. The fires of 2002 reduced fine and medium fuels (including duff) across large expanses of burned area. With time, herbaceous fuels would increase as these areas regenerate, but this response would be variable according to the burn severity, rate of regeneration and growth, and weather. These fine fuels would build up as grass, herbaceous, shrub and needle drop from conifers develops. This regeneration of grasses, forbs and shrubs can lead to increased rates of spread or decreased rates of spread depending on the retention of fuel moisture in these types (shrubs tend to retain fuel moisture much longer in the season and can act as heat sink and retard fire growth). This increase in fine fuels is inevitable and is desirable from an ecological standpoint.

The mosaic from the prescribed fire would create a pattern that reduces fuel loads while retaining other important features for wildlife and other resources. The amount of fuel reduction is dependant on the area, the fuel load and the continuity of the fuels. No ladder fuel reduction treatments would be conducted in conjunction with the application of prescribed fire. Prescribed fire would decrease the fuel load in the small diameter fuels. The large diameter fuels including large logs would remain if timing and moisture conditions were satisfactory. It is anticipated that 60 percent of the area would have a fuel reduction of about 50 percent, while the other 40 percent would not have a reduction. The fuel models present are primarily represented by fuel model 8, 10, 11 and 12. Anticipated post fire fuel loading (in the absence of any activities) would be expected to shift large areas to a fuel model 12. The application of prescribed fire would maintain the area in a fuels condition similar to a fuel model 8 or 9. Prescribed fire would break up the continuity of the fuels. The area would move into a condition, which could become more fire resistant and safer for fire suppression operations. The impacts of future fire suppression operations would be lessened due to a condition that would be represented by a more open stand of older trees and a decreased amount of ground fuels. Prescribed fire areas would aid in the speed of fire suppression operations in handling a wildland fire moving onto or off of private lands.

Fuel Loads - Prescribed Burning (Alternative E)

No prescribed burning would occur. The beneficial effects discussed under the Alternatives C, D, G and H would not occur. The fires of 2002 reduced fine and medium fuels (including duff) across large expanses of burned area. In the near future herbaceous fuels would increase in a variable manner. In the areas that experienced high and very high mortality, the standing dead trees would eventually fall over and accumulate as surface fuels over the next five to twelve years (Hall, 2003, 8). The result of large accumulations of surface fuels is greater fire intensities, greater spotting potential, and greater resistance to control. In areas that experienced low mortality, fuel accumulation from dead and dying trees, branches, and

needles would continue to accumulate along with natural mortality. Fuel loads can be expected to approach pre-2002 fuel loads in these areas in the next decade and in the event of subsequent fire starts, high intensity fire behavior would be expected. Ladder fuels still exist in some areas and would contribute to vertical fire spread, putting surviving overstory trees at future risk. As fuel loads increase, the risk associated with the eventual use of prescribed fire increases due to heavier fuel loads and increased resistance to control. Accumulations of untreated fuels on a landscape would make prescribed use fires even more difficult to implement in the coming decades. If this led to further preclusion of the use of prescribed fire, a further continuation of all fuels build up would occur.

Fuel Loads- ¼ Mile Buffer Zone (Alternative G only)

In addition to the fuels treatments contained in all of the action alternatives, Alternative G proposes to treat fuels both inside and outside harvest areas if they are within a ¼ mile buffer zone of private lands, regardless of predicted fuel loads. The purpose of this treatment is to provide fire protection to private as well as public lands. Fuels conditions often vary between public and private lands. Fires that burn on both public and private lands can add to the complexity of suppression efforts. Treatments in this ¼ mile buffer zone would include ladder fuel reduction treatments, prescribed burning, and a variety of other fuels treatments that would allow more control of both prescribed fire and of wildfire. The areas outside of harvest units include only those areas that are in a conifer ecotype. Approximately 5600 acres outside of harvest units are proposed for treatment and about 1130 acres of treatment in harvest units with light fuel loads are proposed for these additional fuels treatments.

The area of buffer zone that overlaps the proposed prescribed burning would not receive ladder fuel reduction treatments, as design elements to achieve retention of wildlife cover. Approximately 10% of the area of in the proposed ¼ mile buffer zone is currently functioning as mule deer cover. None of these cover areas are within Winter Range. In the 10% of the buffer area that is mule deer cover, ladder fuel reductions would not occur in order to achieve retention of wildlife cover. Ladder fuel reduction treatments in all other areas would “slash” (thin) material less than 5 inches in areas with excessive trees. This would be followed by prescribed fire of some sort, such as underburning, hand pile and burn, jackpot burn. Areas outside of harvest units would most likely not need treatments with mechanized equipment; though if the option were used, it would require low ground pressure equipment.

The additional fuel treatments proposed for the ¼ mile buffer would create a zone that would be in a fire-safe condition for several years prior to requiring additional treatment. It would provide a protection zone along the private land boundary. By reducing the fuel loads and some understory ladder fuel component flame lengths and scorch heights would be reduced. In addition, the beneficial effects of reduced competition for nutrients, sunlight and water would be realized for the remaining trees.

Additional details on fuels treatments in the ¼ mile buffer can be found in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

Resistance to Control and Firefighter Safety - Ground Based Units

The fuel conditions described above directly relate to resistance to control, which will be reported in terms of predicted rate of spread and flame length. Fuel characteristics affecting fire behavior are vegetative density, species composition, amount of surface fuel, arrangement of fuels and moisture content (Rothermel 1983 p.9). Fuels contribute to the rate of spread of a fire, the intensity/flame length of the fire, how long a fire is held over in an area, and the size of the burned area (Rothermel 1983 p.59).

The only difference between action alternative is the amount of area with proposed harvest and with additional fuels treatment. Differences between subwatersheds are minimal, except for Upper Duncan Creek, which has somewhat higher existing fuel loadings. A separate table for Upper Duncan Creek follows the table below.

Table 3.22 Fuel Model/Predicted Rate of Spread & Flame lengths - Ground-based Units (All Action Alternatives) - All Subwatersheds Except Upper Duncan Creek

	Before Treat-ment	Jackpot burning	Broadcast burning	Under burn	Hand pile and burn	Masti -cate	Crush	Buncher pile and burning	Machine pile and burning	Grapple pile and burning
Fuel Loading	24 to 28 tons per acre	22 - 25	6-7	12-14	18 - 21	24-28	24-28	12-14	12-14	12-14
Representative Fuel model	11	11	8	9	9-11	11	11	9	9	9
Predicted Rate of Spread in ch/hr	3	3	1	3	3	1	1	3	3	3
Predicted Flame lengths in FT	2.4	2.4	.7	1.8	1.8-2.4	1.5	1.5	1.8	1.8	1.8
		No Change			Minimal Change					

Table 3.23 Upper Duncan Creek - Fuel Model/Predicted Rate of Spread & Flame lengths - Ground-based Units (All Action Alternatives)

	Before Treat-ment	Jackpot burning	Broadcast burning	Under burn	Hand pile and burn	Masti -cate	Crush	Buncher pile and burning	Machine pile and burning	Grapple pile and burning
Fuel Loading	31.7 tons per acre	28.5	7.9	15.8	23.8	31.7	31.7	15.8	15.8	15.8
Representative Fuel model	12	11	8	9	11	12	12	9	9	9
Predicted Rate of Spread in ch/hr	6	3	1	3	3	2	2	3	3	3
Predicted Flame lengths in FT	5.8	2.4	.7	1.8	2.4	2.3	2.3	1.8	1.8	1.8

Mastication and crushing reduces the fuel bed depth. The fuel loading is not affected by crushing or masticating. But by reducing the fuel bed depth the rate of spread and flame lengths are reduced significantly. Line production capabilities in these fuel types would depend on the amount and size of the residual fuel, the larger and the closer the fuel the slower the line production. Mastication and crushing do improve the fire fighters ability to safely approach and work in an area. With either of these two methods, a secondary treatment of burning would be needed to reduce the fuel loads to below 20 tons per acre.

Overall, the salvage harvest activities and fuels treatments would reduce the anticipated fuel loads below the levels that Hall (Hall, 2003) predicted for a no-action scenario. The removal to the landing of material down to 9-inch, with follow-up fuels treatment, would create a condition within the range of control of relatively safe fire fighting operations. For the project area as a whole, remaining areas of untreated lands have a mosaic of vegetative mortality that could potentially be a concern in regards to fuel loads. As Hall suggests (Hall, 2003) the area could have potential fuel loads that exceed 100 tons per acre in some places. Several areas within the subwatershed have large contiguous blocks outside of harvest units that have high or very high vegetative mortality. These areas would be expected to produce high fuel loads. In areas where natural fuel breaks are not present a subsequent wild fire under these conditions would be very difficult to contain.

If only material 14 inched dbh and above is removed to the landing a condition with higher fuel loads and a larger amount of large material in the units would be created. Large logs impeded fire line production, produce more heat near the fire line and are more capable of producing firebrands. It is expected that fire-fighting operations in this situation would still be effective, though more time, effort, and resources would need to be employed.

Road closures, which vary by alternative, affect the ingress and egress possibilities of initial attack forces and decrease the speed of access. The presence of roads allows better and faster access for fire suppression forces if the need arises. Both initial response and reinforcement response times are increased as access decreases. The longer it takes for initial attack forces to arrive on the scene of an incident the higher the probability of the incident growing in size and moving from initial attack into an extended attack situation. Road closures can also limit access to water resources. Current open road density on National Forest lands within the subwatershed is 3.27 miles per square mile. This would be reduced, on National Forest System lands within the project boundary, as follows:

Alternative C – 1.76 miles/square mile

Alternative D – 1.68 miles/square mile

Alternative E – 2.57 miles/square mile

Alternative G – 2.57 miles/square mile

Alternative H – 1.72 miles/square mile

All other factors being equal, the action alternatives with the higher resultant open road density (Alternatives E and G) would retain the highest level of rapid access and better facilitate the ability to respond to fire starts than would Alternatives C, D and H.

The following table summarizes and compares resistance to control, in terms of expected fire behavior (rate of spread and flame length), for all alternatives (including No Action), by subwatershed, by focusing on two common representative fuel treatment methods: mastication and underburning.

Table 3.24 Predicted Rate of Spread (ROS) in Chains per Hour & Flame Length in Feet

** Fuel Model Rate of Spread and Flame length are displayed for two possible fuels treatment methods: Mastication – Underburning

Subshed	Alternative A			Alternative C				Alternative D			
	Typical Fuel Model (after a decade of down fall)	ROS (Chains/Hr)	Flame Length (Feet)	Acres with reduced Fuels w/i Ground - based Units	Fuel Model**	ROS** following treatments (Chains/Hr)	Flame Length** following treatments (Feet)	Acres with reduced Fuels w/i Ground - based Units	Fuel Model**	Rate of Spread** following treatments (Chains/Hr)	Flame Length** following treatments (Feet)
	(0 acres with fuels treatments or Rx Fire)										
Benny	10 or 12	2 - 6	2.8 - 5.8	1472	11 or 9	1 - 3	1.5 – 1.8	565	11 or 9	1 - 3	1.5 – 1.8
E. Duncan	10 or 12	2 - 6	2.8 - 5.8	751	11 or 9	1 - 3	1.5 – 1.8	571	11 or 9	1 - 3	1.5 – 1.8
L. Duncan	10 or 12	2 - 6	2.8 - 5.8	846	11 or 9	1 - 3	1.5 – 1.8	434	11 or 9	1 - 3	1.5 – 1.8
M. Silver	10 or 12	2 - 6	2.8 - 5.8	341	11 or 9	1 - 3	1.5 – 1.8	70	11 or 9	1 - 3	1.5 – 1.8
Thompson	10 or 12	2 - 6	2.8 - 5.8	2220	11 or 9	1 - 3	1.5 – 1.8	927	11 or 9	1 - 3	1.5 – 1.8
U. Duncan	10 or 12	2 - 6	2.8 - 5.8	1561	12 or 9	2 - 3	2.3 – 1.8	1080	12 or 9	2 - 3	2.3 – 1.8
U. Silver	10 or 12	2 - 6	2.8 - 5.8	722	11 or 9	1 - 3	1.5 – 1.8	420	11 or 9	1 - 3	1.5 – 1.8
W. Silver	10 or 12	2 - 6	2.8 - 5.8	1869	11 or 9	1 - 3	1.5 – 1.8	1340	11 or 9	1 - 3	1.5 – 1.8
Total				9815				5407	11 or 9		

* acres of ground-based harvest with full range of available fuels treatment methods (underburning, broadcast burning, jackpot burning, low ground pressure-machine pile and burning, grapple pile and burning, hand pile and burning, air curtain destructors, ladder fuel reduction (thinning - dead trees only), crushing (tomahawk / roller chopper), mastication /"slash buster").

Subshed	Alternative E				Alternative G				Alternative H			
	Acres with reduced Fuels w/i Ground - based Units	Fuel Model **	Rate of Spread** following treatments (Chains/Hr)	Flame Length** following treatments (Feet)	Acres with reduced Fuels w/i Ground - based Units	Fuel Model**	Rate of Spread** following treatments Chains/Hr	Flame Length** following treatments (Feet)	Acres with reduced Fuels w/i Ground - based Units	Fuel Model**	Rate of Spread** following treatments (Chains/Hr)	Flame Length** following treatments (Feet)
Benny	844	11 - 9	1 - 3	1.5 – 1.8	1700	11 or 9	1 - 3	1.5 – 1.8	1400	11 or 9	1 - 3	1.5 – 1.8
E. Duncan	568	11 - 9	1 - 3	1.5 – 1.8	1000	11 or 9	1 - 3	1.5 – 1.8	725	11 or 9	1 - 3	1.5 – 1.8
L. Duncan	718	11 - 9	1 - 3	1.5 – 1.8	1050	11 or 9	1 - 3	1.5 – 1.8	740	11 or 9	1 - 3	1.5 – 1.8
M. Silver	270	11 - 9	1 - 3	1.5 – 1.8	420	11 or 9	1 - 3	1.5 – 1.8	320	11 or 9	1 - 3	1.5 – 1.8
Thompson	1016	11 - 9	1 - 3	1.5 – 1.8	2550	11 or 9	1 - 3	1.5 – 1.8	2138	11 or 9	1 - 3	1.5 – 1.8
U. Duncan	1290	12 - 9	2 - 3	2.3 – 1.8	1900	12 or 9	2 - 3	2.3 – 1.8	1400	12 or 9	2 - 3	2.3 – 1.8
U. Silver	273	11 - 9	1 - 3	1.5 – 1.8	800	11 or 9	1 - 3	1.5 – 1.8	600	11 or 9	1 - 3	1.5 – 1.8
W. Silver	1525	11 - 9	1 - 3	1.5 – 1.8	1934	11 or 9	1 - 3	1.5 – 1.8	1730	11 or 9	1 - 3	1.5 – 1.8
Total	6504	11 - 9			11354				9053			

Resistance to Control –Helicopter Units

Table 3.25 Fuel Model/Predicted ROS & Flame lengths in Helicopter Units (Alternatives C, D, E & and G)

	Before Treatment	Jackpot burning	Broadcast burning	Under burning	Hand pile and burning
Fuel Loading	45 - 50 tons per acre	41 - 45	11 – 12.5	22.5 - 25	34 - 37.5
Representative Fuel model	12	12	9	11	12
Predicted Rate of Spread in ch/hr	9	9	4	4	9
Predicted Flame lengths in Ft	6.8	6.8	2.2	2.9	6.8
		No Change			No Change

The flame length calculations indicate that a fire, both prior to treatment and following treatment (with either jackpot burning or hand pile and burning), would be outside the ability to control with direct attack using hand crew personnel alone. The fuels treatment options listed above for helicopter units would remove a portion of the fine fuels and the resulting fuel load would have a dominant large fuel component. Only broadcast burning would reduce fuels to below 20 tons per acre. It is expected that a re-entry of these areas with follow-up fuels treatment, once a carrier component such as grasses could be built up enough to carry a fire, would be necessary to bring the residual fuel loads below 20 tons per acre.

The amount of helicopter units is relatively small, even in Alternative C, which has the most (470 acres). Because of this, differences between alternatives, regarding resistance to control are not likely to be apparent, except on a very only a local level.

Resistance to Control – Roadside Hazard Units

Approximately 1300 acres of commercial salvage would occur in roadside hazard corridors in all action alternatives. In all areas the increase in fuel loading would not be significant. Firewood cutters would remove an undetermined amount of fire-killed trees, the larger wood would be gone but the tops and small diameter debris would remain. The small diameter material would not create a high degree of difficulty in line construction efforts if a fire were to start in the area. The use of whole tree yarding (up to 21 inches dbh) or yard-top attached (larger trees) would assist in producing overall fuel loads are within acceptable levels. The 150-foot (each side of road) corridor is well within the reach of fire engine pumps and hose lay equipment. In the long term, the reduced likelihood that a large tree would fall across one of these higher maintenance level roads (and impede access) just prior to a response to a wild fire could benefit response time.

Resistance to Control and Firefighter Safety – ¼ Mile Buffer (Alternative G)

By creating a buffer zone of open pine stands with low fuel loads the ability of fire fighters to safely approach and suppress wildfires is greatly enhanced. Ladder fuel reduction reduces the ladder fuels and opens the canopy. The line production rates in slash created by this activity are slow, due to the intermingled nature of the slash and variety of different size material. The lighter the fuel the faster the line production rate. The additional fuel treatments proposed for the ¼ mile buffer would create a zone that would be in a fire-safe condition for several years prior to requiring additional treatment. It would provide a protection zone along the private land boundary. Fuels treatments of this nature have been shown to be effective in modifying wildfire behavior in areas a relatively frequent historic fire regime (Omi and Martinson, 2002).

Many of the areas, including all areas that currently contain mule deer cover (approximately 600 acres within the 5,600 acres of ¼ mile buffer area) would not receive ladder fuel reduction treatment, only an application of prescribed fire. By only prescribed burning in these areas the ladder fuels would be reduced slightly and ground fuels would also be reduced. The areas would be in a condition, which would be safer for fire fighters to approach and work a fire. The reduction of fuels in these areas would further reduce them so additional entries would not be necessary for several years.

Summary of Fuel Loads/Resistance to Control

Alternative G, because it has the largest area of fuels treatments, including the most area of prescribed fire, the most area of additional fuels treatment in ground-based harvest units and the greatest amount of fuels treatment outside of harvest units (1/4 mile buffer areas), and the highest resultant open road density, would have the greatest overall beneficial effect toward producing an overall fuels and firefighter access condition that would decrease the likelihood that a large, intense wildfire would occur during a multiple fire start scenario in this area, in the foreseeable future. Alternative D, though it would have a beneficial effect in this regard in comparison to Alternative A, because it includes the least overall amount of additional fuels treatment in ground-based harvest units (roughly one-half the amount contained in Alternative G) and the lowest resultant open road density, would have the least overall beneficial effect, of the action alternatives, toward producing an overall fuels and firefighter access condition that would decrease the likelihood that a large, intense wildfire would occur during a multiple fire start scenario in this area, in the foreseeable future.

In all alternatives, in areas where no fuels reduction activity would occur and where natural fuel breaks are not present, a subsequent wildfire under conditions characterized by fuel loads of 30 to 100 tons per acre, would be very difficult to contain. The lesser amount of treated area in Alternative D would create larger areas without fuel breaks to stop a potential wild fire. The relative benefits of the other alternatives are portrayed in the tables above, which describe area (acres) of fuels treatment of the various types.

Alternative E does not include prescribed fire. The benefits relating to fire fighter safety and lowered resistance to control would not be realized. Given the lack of prescribed fire outside the units and the moderate level of salvage units with additional fuels treatment (due to the higher "threshold" of a predicted 30 tons per acre before additional fuels treatment is proposed) Alternative E would not result in the same level of improvement in terms of resistance to control that would be realized with the other three alternatives that include in the range of 11,000 to 14,000 cares of ground-based of salvage in (Alternatives C, G and H).

For all alternatives, remaining areas of untreated lands have a mosaic of vegetative mortality that could potentially be a concern in regards to fuel loads. As Hall suggests (Hall, 2003) the area could potentially develop fuel loads that exceed 100 tons per acre in some places.

Due to the presence of good public access on Roads 27 and 28 in the Thompson Reservoir, Upper Silver Creek and West Fork Silver Creek subwatersheds, a moderate amount of lodgepole pine and other material is expected to be removed by fire woodcutters and campers. This would have a local effect, but would not affect fuel loads on a large scale.

Additional details on Direct and Indirect Effects can be found in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

Cumulative Effects common to all Geographic Areas

Most past, present and reasonably foreseeable future projects in the eight subwatersheds of the Silver Creek and Silver Lake Watersheds are discussed in the individual subwatershed sections later in this section. However some projects are more appropriately discussed under an "All Areas" heading. No portion of the Summer Lake Watershed, to the east of the area, is included in the cumulative effects analysis area. Indeed the fire behavior exhibited during 2002 demonstrates that exclusion of this adjacent watershed from the cumulative effects analysis area is appropriate. Where the Winter Fire approached the Silver Lake-Summer Lake Watershed Boundary or the Silver Creek-Summer Lake Watershed boundary (defined by the top of Winter Ridge) it burned relatively small areas over the top of the rim. The exception to this was near Dead Indian Mountain where the Summer Lake Watershed extends all the way to the top of the mountain on its east flank. This portion of the Toolbox Complex Fires, which occurs within the Ana River subwatershed of the Summer Lake Watershed, was excluded form the Toolbox Fire Recovery project area. No project activity for the Toolbox Fire Recovery Project is proposed within the Summer Lake Watershed.

See Appendix A for a complete compilation of past, present and reasonably foreseeable future activities (and wildfire history and 2002 suppression history), regardless of ownership, in the eight subwatershed area.

All Alternatives (Past Projects)

2002 Toolbox Suppression Burnout Operations

Both "Firing" and "Burnout" Operations occurred on the Toolbox Complex. This tactic was used in association with indirect attack. Burning out is almost always done as a part of line construction. The effects of the operation increased fire

acres at the time but most likely reduced total fire acres with containment. These operations reduced fuel loadings in the areas affected and reintroduced fire into a fire dependent ecosystem. See Appendix A, Table A-1.

2002 Toolbox Suppression Snag Felling Operations

Snag felling occurred on the Toolbox Complex in order to provide for safety to fire fighters and to aid in suppression of fire up in the top portions of trees. Felling Snags reduces the numbers of snags per acre and increases the large down and woody fuel component. This has increased the 1000-hour fuel loadings. See Appendix A, Table A-1.

Noxious Weed Treatments 1995-2002

Noxious weed treatments have occurred in all subwatersheds including hand pulling and chemical treatments. These treatments reduced the noxious weeds and increased the amount of native grasses. This increased the fine dead fuel loadings in the affected area for the first year. This didn't change the large fuel loadings or large fuel continuity, but may have increased the rate of fire spread in the fine fuels for the affected area.

Recreation Facility Development 1960-2002

The development of recreation facilities increases the number of visitors to the forest and increases the percentage of human caused fires in the area.

Road System Development over the Past 125 Years

The past Road System Development has served to reduce fuel loadings on a local scale and helped to disrupt fuel continuity on the local and landscape scale by directly removing the fuel creating fuel breaks. Roads have increased accessibility for suppression resources to locate and control wildfires decreasing the acres burned in the area. Adversely, roads have increased the number of visitors and contractors to the forest and have increased the percentage of human caused fires in the area.

Livestock Grazing

Livestock grazing reduces the fine fuel loadings and slows fire spread. Grazing allotments have had little, if any effect on large fuel loadings and large fuel continuity.

Though there has been speculation about the interaction of livestock grazing and tree regeneration (and therefore fuel structures), a definite cause and effect relationship does not appear to have been established. When Skovlin and others studied different cattle grazing methods on ponderosa pine ranges, they found an increase in tree seedling density during a thirteen-year study period. This increase though may have not been related to cattle use since the same response occurred in units grazed only by wildlife species, and there was no significant difference in seedling density between areas with differing cattle-grazing intensities (Skovlin et al. 1976). Others have concluded that that cattle grazing does affect forest structures by reducing understory grasses and sedges, which allows a occurrence of dense understory trees (Belsky and Blumenthal 1997).

Timber Stand Improvement (TSI)

Timber Stand Improvement is the thinning of sub-merchantable trees. Activity has focused on modifying the structure and composition of stands in order to create desired conditions that are resilient to future fires, insects and disease. Short-term effects of thinning include increases in fine fuel loading for the first 3 to 5 years. Longer term, TSI decreases future large woody fuel loadings and disrupts large fuel continuity.

Table 3.26 Silviculture Timber Stand Improvement (TSI)

Subwatershed	Acres
Benny Creek	1,668
East Duncan Creek	1,219
Lower Duncan Creek	543
Middle Silver Creek	935
Thompson Reservoir	5996
Upper Duncan Creek	2106
Upper Silver Creek	3,565
West Fork Silver Creek	4,241
TSI Total	**20,273**

Timber Harvest

Harvest activities have focused on modifying the structure and composition of stands in order to create desired conditions that are resilient to future fires, insects and disease. Timber sales have served to reduce fuel loadings and disrupt continuity of large fuels. Uneven age regeneration, salvage harvests and shelterwood harvests have typically left saplings and brush components that increase the ladder fuel component. Ladder fuels increase the susceptibility of crown fire and stand replacing fire. Fine fuels would be expected to increase to for the first 3 to 5 years. Fine fuels provide less resistance to control, are considered more favorable for fire suppression and fire fighter safety objectives than a heavy load of large fuels. Disruption of fuel continuity of fuels, both live and dead have decreased the probability of independent crown fire and stand replacing fire. Landing piles and machine piles are usually generated in conjunction with harvest. These piles decreased the 10, 100 and 1000-hour fuel concentrations created by harvest within the harvest unit and concentrated them in isolated locations (piles).

Table 3.27 Timber Harvest

Subwatershed	Acres of Harvest by General Type				
	Intermediate Harvest	Harvest Regeneration Even Age	Harvest Regeneration Uneven Age	Harvest Salvage	Grand Total
Benny Creek	705	2474	17	48	3244
East Duncan Creek	241	596	768		1605
Lower Duncan Creek	42	429	124		596
Middle Silver Creek	169	1442	24		1635
Thompson Reservoir	601	4258	537	1971	7366
Upper Duncan Creek	474	2133	664		3270
Upper Silver Creek	545	3531	437	233	4745
West Fork Silver Creek	246	3792	166	77	4281

One of the clearest examples of the effects of past activities (and events) acting as one factor on the behavior of the July 2002 fires was apparent at the site of the lightning caused 1996 Alder Ridge Fire (3,600 acres). In general, this area did not carry fire during the 2002 fires, even though it was encroached upon by intense fire activity. Portions of the Alder Ridge Fire (1500 acres) were salvage logged in 1997. The Alder Ridge Fire area did not burn in 2002 because of the break in continuity of the fuels and the absence of heavy fuels. In addition, the shrub component that has established itself over the burned area is still young and green enough that it doesn't carry a substantial dead or decadent component. In the July 2002 fire an exception to this occurred in the area of Alder Spring (within the 1996 Alder Ridge Fire). The area near the spring burned only lightly during the 1996 Alder Ridge fire to produce a mosaic of dead and green trees. No salvage activity was included in the immediate vicinity of the spring in the 1997 salvage timber sale. The combination of the heavy fuel loadings in this area, both from down dead trees, originally killed in 1997 and the residual green timber stand surrounding the spring, was a factor in the area burning in July 2002. Other potential factors such as time of day and direction of wind also likely influenced July 2002 fire behavior in this area.

Several portions of the analysis area had previous under burning activity. The Chaser Broom Underburn (1996), in the Silver Fire Portion of the project is a good example where high-intensity fire dropped out of the crowns onto the ground because of the absence of ladder fuels and the absence of heavy down fuels interrupted the continuity of fuels.

All Alternatives (Present and Reasonably Foreseeable Future Projects)

Private Lands

On private lands salvage harvest began in the fall of 2002 and continues in 2003. US Timberlands is the primary private landowner within the burned area. Their lands are concentrated in the Toolbox Fire portion of the project area. Removal of merchantable trees has substantially reduced the amount of standing dead trees, but also produced a slash component. This includes an increase of fine fuels within the units and large numbers of landing piles, comprised of larger fuels. US Timberlands has indicated all the landing piles created on their lands will be left for wildlife habitat. As a result, pockets with large fuel loads and associated potential for long spotting distances will be created.

Fire Suppression

Future fire suppression would generally increase fuel loading and fuel continuity on a local and a landscape level. Changes in stand structure would increase the possibility of stand replacing fires (areas outside of the 2002 burn area are still at risk). Continued fire suppression in some areas may lead to disruption of fire's natural role and the function of some forested ecosystems. If this continues, unnatural fuel loads may occur; and an event like the 2002 fires may occur again.

Recreation Facility Development

Future Recreation Facilities will be maintained and developed on the Silver Lake Ranger District and are inclusive of all subwatershed under analyses. The development of recreation facilities increases the number of visitors to the forest and will increase the percentage of human caused fires in the area.

Personal Use Firewood Cutting

Personal use firewood cutting increases the number of visitors to the forest increasing the chance of human caused fires. Firewood cutting decreases the large fuel loadings in the local area. See Appendix A.

Cumulative Effects Specific to Individual Subwatersheds

Discussions below represent potential cumulative effects for activities listed in Appendix A that may affect fire and fuels.

For additional information on the effects of the following activities, see "Summary of Cumulative Effects" under the heading "Cumulative Effects common to all Geographic Areas" earlier in the Fire and Fuels section.

Benny Creek

All Alternatives (Past Projects)

For the following six projects, fuels management objectives, that were achieved, included: alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

Retool South Underburn 950 Acres 2000
This project was located in the western portion of the Benny Creek Subwatershed.

Little Benny Underburn 205 Acres 1993

This project was located in the western portion of the Benny Creek Subwatershed.

Tool Underburn 506 Acres 1994
This project was located in the western portion of the Benny Creek Subwatershed.

Graham Underburn 650 Acres 1994
This project was located in the southwestern portion of the Benny Creek Subwatershed.

After Thought Underburn 100 Acres 1995
This project was located in the western portion of the Benny Creek Subwatershed.

Puddle Underburn 1750 Acres 1999
This project was located in the southern portion of the Benny Creek Subwatershed.

Plantation Mowing 360 Acres 1999
This project was located in the western portion of the Benny Creek Subwatershed. Fuels Management objectives that were achieved, included: reduce the brush height without stimulating growth/regeneration of manzanita in order to lower the potential for large flame lengths in the occurrence of a future wildfire.

BD Boise 64 Piles Burned 2002
This project was located in the western portion of the Benny Creek Subwatershed. .

BD Mc Vat 66 Piles Burned 1994
This project was located in the northern portion of the Benny Creek Subwatershed. .

BD Bungle 4 Landing Piles Burned 1992
This project was located in the northern portion of the Benny Creek Subwatershed.

For the above three projects, fuels management objectives that were achieved, included: reduce fuels accumulated by logging activities.

Wildlife Habitat Projects 2000

Wildlife Habitat Improvement Projects included 130 acres of aspen enhancement. Aspen enhancement thinning increased the fine fuel loading for the first 3 to 5 years, but decreased future large woody fuel loadings and disrupted large fuel continuity. Regenerating aspen seedlings helps break up the fuel profile in the local area.

All Alternatives (Reasonable Foreseeable Projects)

Retool North 550 Acres Underburn 2003-2004

This project is located in the northwestern portion of the Benny Creek Subwatershed. Fuels management objectives will be to alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

Triad Pile Burning 2006

In the Benny Creek subwatershed the Triad harvest activities are expected to include approximately 500 acres of commercial thinning. As a result, an estimated 50 landing piles would be burned. Fuels management objectives will be to reduce fuels accumulated by logging activities.

Fire Suppression/Recreation Facility Development/Personal Use Firewood Cutting

See “Cumulative Effects common to all Geographic Areas”

East Duncan Creek

All Alternatives (Past Projects)

BD Pine Salvage 10 Landing Piles Burned

This project was located in the Northern portion of the East Duncan Creek Sub shed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Farm Underburn 320 Acres 1995

This project was located in the Northern portion of the East Duncan Creek Sub shed. Fuels management objectives, that were achieved, included: reduce fuels accumulated by logging activities and alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

BD Farm 33 Landing Piles Burned 1994

This project was located in the Northern portion of the East Duncan Creek Sub shed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

Wildlife Habitat Projects 2000

Wildlife Habitat Improvement Projects included 90 Acres of Juniper thinning and 4 Acres of Ponderosa Pine thinning. Juniper Thinning increases the fine fuel loadings and the down and woody fuel loadings. Juniper reduction leads to increased native grasses and increases the fine fuel loadings. Ponderosa pine thinning modified the structure and composition of stands creating desired conditions that will be resilient to future fires, insects and disease. Short-term effects were an increased fine fuel loading for the first 3 to 5 years, but a decrease in future large woody fuel loadings and disruption of large fuel continuity.

All Alternatives (Reasonable Foreseeable Projects)

Fire Suppression/Recreation Facility Development/Personal Use Firewood Cutting

See “Cumulative Effects common to all Geographic Areas”

Lower Duncan Creek

All Alternatives (Past Projects)

BD Farm Underburn 32 Acres 1995

This project was located in the Southern portion of the Lower Duncan Creek Sub shed. Fuels management objectives, that were achieved, included: reduce fuels accumulated by logging activities and alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

All Alternatives (Reasonable Foreseeable Projects)

BLM Future Activities

The BLM plans in 2005 to treat up to 10000 acres of juniper in the Lower Duncan Creek Subwatershed. They also plan to commercially salvage about 60 acres from the Toolbox in 2003. Mechanical juniper treatment increases the fine fuel loadings and the heavy fuel loadings. Juniper reduction leads to increased native grasses and increases the fine fuel loadings. Prescribed juniper treatment will reduce the fine fuel loading for the first two years and may increase the heavy fuel loadings with the sporadic falling of trees to the ground level. Salvage Harvest will focus on modifying the structure and composition of stands creating desired conditions that will be resilient to future fires, insects and disease. See Appendix A.

Fire Suppression/Recreation Facility Development/Personal Use Firewood Cutting

See “Cumulative Effects common to all Geographic Areas”

Middle Silver Creek

All Alternatives (Past Projects)

Pretreatment 780 Acres 2001

Pretreatment projects were performed in the southern portion of the Middle Silver Creek Subwatershed. The purpose of this project was pretreatment of selected areas. The stands consisted of a natural regeneration understory and an overstory of ponderosa pine and some white fir. Treatment consisted of removal of small diameter size class trees from stands that were scheduled for under burning.

2916 Winter Range Underburn 208 Acres 1982

This project was located in the southern portion of the Upper Silver Creek Subwatershed. Management objectives, that were achieved, included: induce sprouting and new leader growth on browse species by removing at least 60 % of dead stems and decadent brush and increase availability of high quality browse for wintering mule deer.

Dary Underburn 333 Acres 1987

This project was located in the southern portion of the Upper Silver Creek Subwatershed. Management objectives, that were achieved, included: induce sprouting and new leader growth on browse species by removing at least 60 % of dead stems and decadent brush and increase availability of high quality browse for wintering mule deer.

Northeast Hager Underburn 313 Acres 1988

This project was located in the southern portion of the Middle Silver Creek Subwatershed. Fuels management objectives, that were achieved, included: alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

BD Farm 2 Landing Piles Burned 1994

This project was located in the southern portion of the Middle Silver Creek Subwatershed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Gelding 2 Landing Piles Burned 1996

This project was located in the southern portion of the Middle Silver Creek Subwatershed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

Wildlife Habitat Projects 2000

Wildlife Habitat Improvement Projects included 210 Acres of juniper thinning and 330 Acres of ponderosa pine thinning. Juniper thinning increases the fine fuel loadings and the down and woody fuel loadings. Juniper reduction leads to

increased native grasses and increases the fine fuel loadings. Ponderosa pine thinning modified the structure and composition of stands creating desired conditions that will be resilient to future fires, insects and disease. Short-term effects increased the fine fuel loading for the first 3 to 5 years, but will decrease future large woody fuel loadings and disrupt large fuel continuity.

All Alternatives (Reasonable Foreseeable Projects)

Windmill Underburn 4200 Acres 2004-2005

This project is located in the southern portion of the Middle Silver Creek Subwatershed. Fuels management objectives, that were achieved, included: alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

BLM Future Activities

The BLM plans in 2005 to treat 1000 acres of juniper in the Middle Silver Creek Subwatershed. Mechanical juniper treatment increases the fine fuel loadings and the heavy fuel loadings. Juniper reduction leads to increased native grasses and increases the fine fuel loadings. See Appendix A.

Fire Suppression/Recreation Facility Development/Personal Use Firewood Cutting

See "Cumulative Effects common to all Geographic Areas"

For additional information on the effects of the above activities, see "Summary of Cumulative Effects" under the heading "Cumulative Effects common to all Geographic Areas" earlier in the Fire and Fuels section.

Thompson Reservoir

All Alternatives (Past Projects)

Pretreatment 415 Acres 1999

This project was located in the northeastern portion of the Thompson Reservoir Subwatershed. The purpose of this project was pretreatment of selected areas in preparation for prescribed fire. The stands consisted of a natural regeneration understory and an over story of Ponderosa Pine. Treatment consisted of removal of small diameter size class trees from stands that were scheduled for underburning.

Pretreatment 165 Acres 2000

This project was located in the northeastern portion of the Thompson Reservoir Subwatershed. The purpose of this project was pretreatment of selected areas in preparation for prescribed fire. The stands consisted of a natural regeneration understory and an over story of Ponderosa Pine. Treatment consisted of removal of small diameter size class trees from stands that were scheduled for underburning.

Fuels management objectives, that were achieved for the following five projects, included: alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

Retool North 350 Acres Underburn 2001

This project was located in the northeastern portion of the Thompson Reservoir Subwatershed.

Puddle Spring 1512 Acres Underburn 1987

This project was located in the eastern portion of the Thompson Reservoir Subwatershed.

Dry Lake 271 Acres Underburn 1992

This project was located in the northeastern portion of the Thompson Reservoir Subwatershed.

After Thought 116 Acres Underburn 1995

This project was located in the northeastern portion of the Thompson Reservoir Subwatershed.

Puddle Underburn 1746 Acres Underburn 1999

This project was located in the eastern portion of the Thompson Reservoir Subwatershed.

Plantation Mowing 285 Acres 1999

This project was located in the northeastern portion of the Thompson Reservoir Subwatershed. Fuels management objectives, that were achieved, included: reduce the brush height without stimulating growth/regeneration of manzanita in order to lower the potential for large flame lengths during the occurrence of subsequent wildfire.

BD Bungle Fuels Treatment 1992-1993
This project was located in the eastern portion of the Thompson Reservoir Subwatershed. The projects included 600 acres of underburn and burning 4 landing piles. Fuels management objectives, that were achieved, included: reduce fuels accumulated by logging activities and alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Knothole Fuels Treatment 1993-1996
This project was located in the northwestern portion of the Thompson Reservoir Subwatershed. The projects included 107 Acres of Crushing and burning 9 landing piles. The Fuels management crushing goals were to reduce fuel bed depth with mechanical means in order to lessen future potential flame length and scorch heights to aid in lower mortality ratios in the case of a wildfire. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Parameter 419 Machine Piles Burned 1993
This project was located in western portion of the Thompson Reservoir Subwatershed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Shoe/dad Fuels Treatment 1995-1996
This project was located in the western portion of the Thompson Reservoir Subwatershed. The projects included 40 Acres of Crushing and burning 37 Landing piles. The fuels management crushing goals were to reduce fuel bed depth with mechanical means in order to lessen future potential flame length and scorch heights to aid in lower mortality ratios in the case of a wildfire. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Shorn Ridge 9 Landing Piles Burned 1995
This project was located in the central portion of the Thompson Reservoir Subwatershed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

Wildlife Habitat Projects 2000

Wildlife Habitat Improvement Projects included 40 acres of Aspen enhancement. This thinning increased the fine fuel loading for the first 3 to 5 years, but decreases future large woody fuel loadings and disrupts large fuel continuity. Regenerating aspen seedlings would help break up the fuel profile in the local area.

All Alternatives (Reasonable Foreseeable Projects)

Retool North 550 Acres Underburn 2003-2004
This Project is located in the northeastern portion of the Thompson Reservoir Subwatershed.

Retool South 300 Acres Underburn 2003-2004
This project is located in the central portion of the Thompson Subwatershed.

Fuels management objectives for the above two projects are to alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

Triad Pile Burning 2006

In the Thompson Reservoir subwatershed the Triad harvest activities are expected to include approximately 400 acres of commercial thinning. As a result, an estimated 40 landing piles would be burned. Fuels management objectives will be to reduce fuels accumulated by logging activities.

Fire Suppression/Recreation Facility Development/Personal Use Firewood Cutting

See “Cumulative Effects common to all Geographic Areas”

Upper Duncan Creek

All Alternatives (Past Projects)

Littleguy Underburn 250 Acres 1996

This project was located in the Western portion of the Upper Duncan Creek Subwatershed. Fuels Management objectives, that were achieved, included: alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

BD McVat 150 Piles Burned

This project was located in the Southern portion of the Upper Duncan Creek Subwatershed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Farm Underburn 560 Acres 1995

This project was located in the Northern portion of the Upper Duncan Creek Subwatershed. Fuels management objectives, that were achieved, included: reduce fuels accumulated by logging activities and alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

BD Farm 54 Landing Piles Burned 1994

This project was located in the Northern portion of the Upper Duncan Creek Subwatershed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Lafini 12 Landing Piles Burned 1991

This project was located in the Southern portion of the Upper Duncan Creek Subwatershed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD McCall 3 Landing Piles Burned 1993

This project was located in the Southern portion of the Upper Duncan Creek Subwatershed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

Wildlife Habitat Projects 2000

Wildlife Habitat Improvement Projects included 30 Acres of Juniper thinning and 2 Acres of Ponderosa Pine thinning. Juniper Thinning increases the fine fuel loadings and the down and woody fuel loadings. Juniper reduction leads to increased native grasses and increases the fine fuel loadings. Ponderosa pine thinning modified the structure and composition of stands creating desired conditions that will be resilient to future fires, insects and disease. Short-term effects increased the fine fuel loading for the first 3 to 5 years, but will decrease future large woody fuel loadings and disrupt large fuel continuity.

Upper Silver Creek

All Alternatives (Past Projects)

Pretreatment 850 Acres 1999

Pretreatment projects were performed in the central portion of the Upper Silver Creek Subwatershed. The purpose of this project was pretreatment of selected areas in preparation for prescribed fire. The stands consisted of a natural regeneration understory and an over story of Ponderosa Pine, Lodgepole Pine and some White Fir. Treatment consisted of removal of small diameter size class trees from stands that were scheduled for underburning.

Fuels management objectives, that were achieved for the following eight projects, included: alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

Bunyard (North/South) Underburn 1940 Acres 1986-1995

This project was located in the northern portion of the Upper Silver Creek Subwatershed.

Auger (North/South) Underburn 1640 Acres 1986-1993

This project was located in the southern portion of the Upper Silver Creek Subwatershed.

Horsetail Underburn 72 Acres 1986

This project was located in the southern portion of the Upper Silver Creek Subwatershed.

East Silver Underburn 510 Acres 1993

This project was located in the southern portion of the Upper Silver Creek Subwatershed.

Boundary Underburn 310 Acres 1994

This project was located in the southern portion of the Upper Silver Creek Subwatershed.

South/Southwest Hagar Underburn 4660 Acres 1995-1999

This project was located in the southern portion of the Upper Silver Creek Subwatershed.

East Thompson Underburn 576 Acres 1995

This project was located in the southern portion of the Upper Silver Creek Subwatershed.

CB Underburn 1000 Ares 1996

This project was located in the central portion of the Upper Silver Creek Subwatershed.

BD Ridge 100 Acres Jackpot 2002

This project was located in the southern portion of the Upper Silver Creek Subwatershed. Fuels Management objectives that were achieved, included: reduce the fuel loadings to protect the residual stand from potential wildfire, and to prepare small openings for natural or artificial regeneration.

BD Bama 7 Landing Piles Burned 2002

This project was located in the southern portion Upper Silver Creek Subwatershed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Hogleg Fuels Treatment 1992-1993

This project was located in the northern portion of the Upper Silver Creek Subwatershed. The projects included 52 acres of underburning and burning 1 landing pile. Fuels Management underburn objectives, that were achieved, included: alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Knothole Fuels Treatment 1993-1996

This project was located in the northern portion of the Upper Silver Creek Subwatershed. The projects included burning 20 landing piles and crushing 195 Acres. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities. The Fuels Management crushing objectives, that were achieved, included: reduce fuel bed depth with mechanical means in order to lessen future potential flame length and scorch heights to produce lower mortality ratios in the case of a wildfire.

Wildlife Habitat Projects 2000

Projects included 60 acres of juniper thinning. Juniper thinning increased the fine fuel loadings and the down and woody fuel loadings.

All Alternatives (Reasonable Foreseeable Projects)

BD Feast Pile Burning 2 Piles 2003

This Project is located in the south central portion of the Upper Silver Creek Subwatershed. Fuels management objectives will be to reduce fuels accumulated by logging activities associated with the Feast Timber Sale.

Triad Pile Burning 2006

In the Upper Silver Creek Subwatershed the Triad harvest activities are expected to include approximately 800 acres of commercial thinning. As a result, an estimated 80 landing piles would be burned. Fuels management objectives will be to reduce fuels accumulated by logging activities.

BLM Future Activities

The BLM plans in 2005 to treat 1000 acres of juniper in the Upper Silver Creek Subwatershed. Mechanical juniper treatment increases the fine fuel loadings and the heavy fuel loadings. Juniper reduction leads to increased native grasses and increases the fine fuel loadings. See Appendix A.

Fire Suppression/Recreation Facility Development/Personal Use Firewood Cutting

See "Cumulative Effects common to all Geographic Areas"

West Fork Silver Creek

All Alternatives (Past Projects)

Pretreatment 950 Acres 1999-2000

Pretreatment projects were performed in the central portion of the West Fork Silver Creek Subwatershed. The purpose of this project was pretreatment of selected areas in preparation for prescribed fire. The stands consisted of a natural regeneration understory and an over story of Ponderosa Pine, Lodgepole Pine and some White Fir. Treatment consisted of removal of small diameter size class trees from stands that were scheduled for underburning.

Bunyard Underburn 330 Acres 1987-1988

This project was located in the northern portion of the West Fork Silver Creek Subwatershed.

CB Underburn 3500 Ares 1996

Fuels management objectives, that were achieved for the above two projects, included: alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem. This CB project was located in the northern portion of the West Fork Silver Creek Subwatershed. This area provides a good example of intense wildfire fire (July 2002) dropping out of the crowns onto the ground because of an interruption in the continuity of fuels, characterized by a general absence of ladder fuels and absence of heavy down fuels. The CB area was one of a few larger areas within the July 2002 wildfires that had two, successive prescribed fire introductions over the past 15 years (the late 1980s and then again in 1996).

BD Ridge 100 Acres Jackpot 2002

This project was located in the central portion of the West Fork Silver Creek Subwatershed. Fuels management objectives, that were achieved, included: reduce the fuel loadings to protect the residual stand from potential wildfire, and to prepare small openings for natural or artificial regeneration.

BD Alder Fuels Treatment 1993

This project was located in the central portion of the West Fork Silver Creek Subwatershed. The projects included 17 acres of broadcast burn, 5 acres of Jackpot burn and burning 30 piles and 163 machine piles. Fuels management broadcast burn objectives, that were achieved, included: reduce fuel loadings and to disrupt fuel continuity in the established area. Fuels management jackpot burn objectives, that were achieved, included: reduce the fuel loadings to protect the residual stand from potential wildfire, and to prepare small openings for natural or artificial regeneration. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Hogleg Fuels Treatment 1991-1996

This project was located in the northern portion of the West Fork Silver Creek Subwatershed. The projects included 255 acres of underburn, 227 acres of crushing, 100 acres of pretreatment and burning 14 landing piles and 145 machine piles. Fuels management underburn objectives, that were achieved, included: alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem. Fuels management crushing objectives that were achieved, included: reduce fuel bed depth with mechanical means in order to lessen future potential flame length and scorch heights to aid in lower mortality ratios in the case of a wildfire. Pretreatment consisted of removal of small diameter size class trees from stands that were scheduled for underburning. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

BD Shoe/dad 23 Landing Piles Burned 1995-1996

This project was located in the central portion of the West Fork Silver Creek Subwatershed. Fuels management pile burning objectives, that were achieved, included: reduce fuels accumulated by logging activities.

Wildlife Habitat Projects 2000

Wildlife Habitat Improvement projects included 10 acres of aspen enhancement and 150 Acres of juniper thinning. Aspen enhancement thinning increased the fine fuel loading for the first 3 to 5 years, but decreases future large woody fuel loadings and disrupts large fuel continuity. Regenerating aspen seedlings would help break up the fuel profile in the local area. Juniper thinning increased the fine fuel loadings and the down and woody fuel loadings.

All Alternatives (Reasonable Foreseeable Projects)

West Fork Silver Creek 4000-5000 Acres Underburn, 2004

This project will be located in the southwestern portion of the West Fork Silver Creek Subwatershed. Fuels management objectives are to alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependant ecosystem.

BD Spoon Crushing 62 Acres 2004 -

The project would reduce fuel bed depth with mechanical means in order to lessen future potential flame length and scorch heights to aid in lower mortality ratios in the case of a wildfire.

West Fork Silver Creek Analysis Area Pile Burning 2007

In the West Silver Creek Subwatershed the "West Fork Restoration Project" harvest activities are expected to include approximately 600 acres of commercial thinning. As a result, an estimated 60 landing piles would be burned. Fuels management objectives will be to reduce fuels accumulated by logging activities.

BLM Future Activities

The BLM plans in 2005 to treat 1000 acres of juniper in the West Fork Silver Creek Subwatershed. Mechanical juniper treatment increases the fine fuel loadings and the heavy fuel loadings. Juniper reduction leads to increased native grasses and increases the fine fuel loadings. See Appendix A.

Fire Suppression/Recreation Facility Development/Personal Use Firewood Cutting

See "Cumulative Effects common to all Geographic Areas"

For additional information on the effects of the above activities, see "Summary of Cumulative Effects" under the heading "Cumulative Effects common to all Geographic Areas" earlier in the Fire and Fuels section.

Summary of Cumulative Effects

Past, ongoing and reasonable foreseeable projects would affect the eight subwatersheds in a variety of ways. Prescribed fires, fuel reduction projects and timber sales (following slash treatments) would all serve to reduce fuel loadings and disrupt continuity of large fuels. Fine fuels would be expected to increase to a certain degree, but since they provide less resistance to control, are considered more favorable for fire suppression and fire fighter safety objectives than a heavy load of large fuels.

Pretreatment and harvest (removing green merchantable and sub merchantable trees) have focused and will focus on modifying the structure and composition of stands creating desired conditions that will be resilient to future fires, insects and disease. Short-term effects of pretreatment increases the fine fuel loading for the first 3 to 5 years, but decreases future large woody fuel loadings and disrupts large fuel continuity. Harvest activities have focused and will focus on modifying the structure and composition of stands creating desired conditions that will be resilient to future fires, insects and disease.

Underburn and broadcast burns in conjunction with pretreatment and harvest reduces surface fuels and ladder fuels. Landing piles, machine piles and hand piles decreases the 10, 100 and 1000-hour fuel concentrations created by pretreatment and harvest into isolated locations (piles) with the intent to burn 90% of the hand piles and 100% of machine and landing piles in a location, not landscape fire. Ten percent of the hand piles would remain to accommodate wildlife needs for habitat.

Crushing has and will focus on modifying the structure and composition of fuel bed depth and continuity increasing the fine fuel loadings for the first 3 years, but also increases the surface to volume ratio of fuels increasing the susceptibility to rot. Mowing temporarily decreases ladder fuels, increases dead fine fuel loadings within the first 3 years and reduces water and nutrient competition to trees in the area.

Special prescribed burns (implemented in the past on portions of winter range) decreases the fine fuels in sage and bitterbrush for the first 20 to 25 years returning to a more decadent brush in the areas that the fire affected. It is more typical to have a mosaic burn in this fuel type than a landscape burn. Prescribed burning (medusahead noxious weed treatment, past treatment) in a grass fuel model reduces the fine fuel component in the first three years in the areas the fire affected.

Prescribed burns in natural fuels alter the live and dead fuel components within the burn area to reduce the potential of a high intensity, stand replacing wildfire and re-introduce fire to a fire dependent ecosystem.

Additional information on cumulative effects can be found in Appendix A of this document; and in the Fire and Fuels Specialist Report in the Toolbox Analysis File at the Silver Lake Ranger District.

Consistency with Forest Plan and Other Laws

The Toolbox Fire Recovery Project is responsive to the rehabilitation, hazardous fuel reduction, and restoration elements of the National Fire Plan. The Toolbox Fire Recovery Project is responsive to the objectives outlined in the Fremont Forest Fire Management Plan by integrating firefighter safety, fuels treatment and prescribed fire use into an interdisciplinary project designed to move the burned area towards desired conditions.

Alternatives C, D, G and H each include the use of prescribed fire outside of harvest areas. Alternatives C and G include more prescribed fire that Alternatives D and H. Specifically, C and G include 3572 acres of prescribed fire. This activity, coupled with other proposed activities, would result in Alternative G having the largest area treated for fuels reduction, and C the second largest area of fuels reduction of any of the alternatives. The amount and location of the additional prescribed fire in Alternatives C and G is expected to result in a minor decreases in cover in mule deer summer range (Lower Duncan Creek, Upper Duncan Creek and East Duncan Creek subwatersheds) and transition range in the East Duncan Creek subwatershed. This would require a site-specific Forest Plan Amendment in relation to mule deer cover for these areas. Effects of these treatments on mule deer habitat are discussed in the Wildlife Section of this EIS. Prescribed fire would be applied to the ground with the intention of creating a mosaic of burned and unburned area, breaking up the continuity of the fuels. In response to the Purpose and Need of this project, the areas treated would move toward a condition of increased ecological sustainability, as well as increased fire resistance that would contribute to safer future fire suppression operations. Prescribed fire areas would aid in the speed of fire suppression operations in handling a wildland fire moving onto or off of private lands

FORESTED VEGETATION

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- Key Issue
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Introduction

Forested lands within the Toolbox project area are considered part of the Basin and Range physiographic province. They lie within the rain shadow created by the Cascade mountain range and grow on soils that are predominantly volcanic in nature. Precipitation within the project area averages 12-35 inches annually, with most of that falling as snow. The topography of the area could be characterized as primarily gently sloping lands that feature a few volcanic cinder cones, such as Hager Mountain and Foster Butte. Elevations range between approximately 4,450 feet to 7,200 feet (top of Winter Ridge), rising gradually toward the eastern boundary of the project area, which is generally coincident with Winter Rim. Winter Rim is a large fault-block rim that rises about 3,600 feet above the Summer Lake Valley, which lies to the east of the rim. Several relatively flat stream channels cross the project area. Some segments of these streams flow through small basalt canyons characterized by fairly steep rimrock. Other common landscape features include dry scabrock flats, grass meadows, and small springs, seeps or marshes.

Ponderosa pine, a relatively drought-tolerant tree species, provides the most common forested habitat type found within the project area. At higher elevations, white fir and mixed ponderosa pine/white fir habitat types are also abundant. Lodgepole pine is found on the wetter sites, the sites with pumice soil types, or both, within the project area. Western juniper can also be found on south-facing slopes and other drier sites within the project area. Fire suppression efforts in the last 100 or so years across the Fremont National Forest (including the Silver Lake Ranger District and the Toolbox project area) have resulted in the expansion of all three of these forest types—white fir, lodgepole pine, and western juniper—into areas that previously featured pure, widely-spaced stands of ponderosa pine. The discussion of historic and existing vegetative conditions that comes later in this section provides more detail about the ecological consequences of this expansion.

Key Issue: Recovery using a limited-intervention approach vs. Recovery using a full range of active management practices, including commercial salvage.

Issue Statement: This issue embodies divergent public input on which overall approach to recovery best accomplishes actual recovery and restoration. Some commenters believe that recovery and restoration would be better achieved through an approach that did not include the proposal to commercially salvage fire damaged trees. Others believe recovery and

restoration would be better achieved through an approach that allows for commercial harvest of salvage-eligible fire damaged trees.

Measurement Indicator: Since recovery of sustainable forests in areas that have burned depends on reforesting those areas, either through natural means or planting, one indicator of responsiveness to this issue is the method of reforestation used (planting or natural regeneration), its degree of success, and its contribution to sustainable Late and Old Structure (LOS) conditions (measured in acres).

Purpose and Need

Two components of the purpose and need identified for this proposed project area especially relevant to forested plant communities:

- Develop a long-term sustainable forest that is maintainable by natural fire functions.
- Reduce insect infestation by removing breeding habitat for bark beetles (recent fire killed or beetle killed trees).

The estimated effect of the alternatives on forested plant communities will be examined with a focus on how the alternatives would affect the development of sustainable forests, at both a stand and landscape level.

Regulatory Framework

Guidance for conducting this project analysis is provided by a complex layering of laws and regulations developed over the past century. The National Forest Management Act of 1976 is the basic law that governs vegetation management treatments on National Forest System lands. Several sections in the Act and its accompanying regulations (USDA Forest Service, 1982) specifically address terms and conditions relevant to the vegetation resource. These include sections on timber suitability, and management requirements for vegetative manipulation, including tree regeneration time frames and Regional opening size limits. The Code of Federal Regulations (CFR) is a codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government. The minimum specific management requirements to be met in accomplishing goals and objectives for the National Forest System are set forth in 36 CFR 219.27, which are the implementing regulations for the National Forest Management Act of 1976. Management requirements relevant to silvicultural practices are summarized as follows:

- Section (a) Resource Protection: Management prescriptions shall (3) be consistent with resource values involved, and prevent long lasting hazards and damage from pest organisms, utilizing principles of integrated pest management. Under this approach all aspects of a pest-host system should be weighed to determine situation-specific prescriptions which may use a combination of techniques including, as appropriate, natural controls, harvesting, use of resistant species, maintenance of diversity, removal of damaged trees, and judicious use of pesticides. The basic principle in the choice of strategy is that, in the long-term, it be ecologically acceptable and compatible with the forest ecosystem and the multiple use objectives of the plan; (5) provide for and maintain diversity of plant and animal communities to meet overall multiple-use objectives.
- Section (b) Vegetative Manipulation: Management prescriptions shall (1) contain multiple-use goals that are consistent with Forest Plan goals and standards; (2) assure that lands treated can be adequately restocked based on prior reforestation efforts in the Toolbox project area; and (3) that lands are not chosen for greatest dollar return; (4) potential effects on residual trees and adjacent stands must be considered; (5) avoid permanent impairment of site productivity; (6) provide desired effects on all resources; (7) be practical in terms of transportation and harvest requirements, and costs of preparation and administration.
- Section (c) Silvicultural Practices: Management prescriptions must (1) be suitable; (2) provide allowable sale quantity; (3) provide for restocking; (4) allow cultural treatments; (5) allow for change in harvest levels; (6) provide for even-aged regeneration harvests while protecting other resources; (7) prevent increases of forest pests.
- Section (g) Diversity: Treatment activities designed to maintain the diversity expected in a natural forest might be modified slightly to meet the desired future condition of the area.

The National Forest Management Act of 1976 directed each National Forest to prepare a Forest Plan to guide management activities for lands within its jurisdiction. The Fremont National Forest Land and Resource Management Plan was published in 1989.

In 1994 and again in 1995 the Forest Plans of all Eastside Pacific Northwest Region National Forests were amended by the Regional Forester to provide additional interim standards for managing fish, wildlife and old growth habitats, pending completion of the Interior Columbia Basin Ecosystem Management Plan (Regional Forester's Eastside Forest Plans Amendment 1 Alternative 3, adopted May 20, 1994 and Regional Forester's Forest Plan Amendment #2, adopted August, 1995). The interim standards, which established additional protection requirements for these habitat components, remain in effect today (see Chapter 1 for more details).

In 1995 the Regional Forester also adopted the Inland Native Fish Strategy (INFISH), intended to provide additional interim protection for native fish populations. INFISH focuses on riparian areas and provides governing direction for these areas that supercedes the riparian direction in the other two Regional Amendments. (See Chapter 1 and the Watershed/Fisheries section of Chapter 3 for more detail.)

Current Forest Plan management direction (subject to the above amendments) relevant to the Toolbox project analysis is summarized as follows:

Management Direction

The direction from the Regional Forester's Eastside Forest Plans Amendment 1 Alternative 3, as adopted. 5/94 and the Regional Forester's Forest Plan Amendment #2, 8/95 that pertain to the Toolbox project are found in the Interim Ecosystem and Wildlife Standards. This direction affects all management areas within the project area and applies primarily to the planning and design of timber sales. The Regional Amendment direction is primary when any conflict with Forest Plan direction occurs, *unless* the Forest Plan direction is more restrictive, in which case the more restrictive standard applies. In summary, these amendments direct the forested environment to be managed:

- In a sustainable condition which mimics historical process and function.
- To develop and maintain Late and Old Structure (LOS) forest stands.
- To maintain specific wildlife habitats.
- To maintain specific down wood levels.

Defining Historic Conditions

Natural resource managers increasingly rely on the "range of natural variation," "historic condition," or (in the Pacific Northwest Region) the "historic range of variability" to analyze and develop projects that move lands toward the range of ecological and evolutionary conditions appropriate for an area. This information is used to understand the past conditions and processes and provides context and guidance for managing ecological systems.

The Regional Forester's Amendment directs project analysis for timber sales to "characterize the proposed timber sale and its associated watershed for patterns of stand structure by biophysical environment, and compare to the Historic Range of Variability (HRV)." It states further that HRV "should be based on conditions in the pre-settlement era; however, 1900-s photography may be acceptable. HRV should be developed for large landscapes across which forest types, environmental settings, and disturbance regimes (fire and insects/disease) are relatively uniform. Each component watershed should not be expected to reflect the average conditions for the larger landscape, but the sum of conditions across watersheds within the area for which HRV is developed should reflect ranges of conditions determined in the HRV evaluation."

Interim Ecosystem Standard:

This standard from the Regional Amendment directs that any analysis of a proposal to harvest timber should:

- Characterize the Historic Range of Variability (HRV) for the area.
- Compare current conditions to the HRV.
- Describe the dominant historical disturbance regime.
- Apply direction from one of two habitat management scenarios (A or B, described in the interim wildlife standard), depending on whether the forest type is above or below HRV.

Interim Wildlife Standard:

The interim wildlife standard directs that one of two management scenarios be applied to govern any timber harvest proposal, depending on the HRV within the watershed. Scenario A is to be used whenever one type of LOS is below HRV. Use Scenario B whenever one type of LOS is above HRV.

Scenario A

- No net loss of LOS stages.
  - Some timber sale activities can occur within LOS stages that are within or above HRV in a manner to maintain or enhance LOS within that biophysical environment. It is allowable to manipulate one type of LOS to move stands into the LOS stage that is deficit if this meets historical conditions.
  - Outside of LOS the intent is to maintain and/or enhance LOS components by adhering to the following standards.
    - Maintain all live trees greater than or equal to 21" diameter breast height (dbh).
    - Manipulate vegetative structure that does not meet LOS in a manner that moves it toward these conditions as appropriate to meet HRV.
    - Maintain open park-like stand conditions where this condition occurred historically. Manipulate vegetation in a manner to encourage the development and maintenance of large diameter, open canopy structure.
  - Maintain connectivity and reduce fragmentation of LOS stands, maintain or enhance the current level of connectivity between LOS stands and old growth habitats.
  - Connect within each other by at least two different directions.
  - Connectivity corridor stands - medium or larger trees are common and canopy closures are within top 1/3 of site potential.
  - Goshawks - protect goshawk nest site habitats; 30 acres of suitable nesting habitat and 400 acres Post Fledging Area (PFA). While harvest activities can occur within this area, retain the LOS stands and enhance younger stands towards LOS condition as possible.

Scenario B

- Timber harvest can occur in those areas that are above HRV. (This condition is not encountered for this project analysis and will not be discussed further.)

Summary of Toolbox Project Area HRV Analysis

A more detailed analysis of the Historic Range of Variability within the Toolbox Project Area appears later in the Forested Communities section. In general, the results of the analysis can be summarized as follows:

- The project area, as a whole, is considered below the Historic Range of Variability because it is deficient in stands exhibiting Late and Old Structure (LOS).
- In the Ponderosa pine type, there is an excess of multi-storied stands, and a deficiency of single-storied mature stands.
- In the Lodgepole pine type, there is an excess of conifer type and a deficiency of non-conifer type, such as meadow, grassland, and inclusions of scattered large ponderosa pine.
- The currently classified mixed conifer/white fir type (CW) has become dominated with white fir due to fire exclusion. Compared to HRV for this forest type, there are too many multi-storied stands and too few single-storied mature stands.

The results of the HRV analysis for the Toolbox project area indicate that the interim ecosystem/wildlife standards from Scenario A are to be applied. Thus, in all alternatives considered for the project area, no live trees greater than 21" dbh were proposed for harvest. Regeneration and precommercial thinning prescriptions in all action alternatives were designed

to meet the objectives of Scenario A. Connectivity corridors were established in the more lightly burned areas. More details on the wildlife corridors can be found in the Wildlife section of Chapter 3.

Forest Plan Direction Relevant to Silvicultural Practices within the Toolbox Project Area

Forest wide Standards for Timber Management:

Timber Harvest:

- Long-term site productivity will be considered in all silvicultural prescriptions. Items to be integrated into the prescription will include, but are not limited to, maintenance of small and large woody debris to act as a nutrient reservoir, wildlife habitat and erosion impediments; soil compaction, displacement, erosion potential; and effect of frequency of harvest entries on insect and disease occurrence.

Regeneration:

- Minimum stocking of seedlings, unless amended by site–specific guidelines, will be 100 trees per acres.
- Stocking level control will be done on stands, commensurate with Earned Harvest Effect requirements. Earned Harvest Effect is a concept that considers the effects of future management techniques that will accelerate future growth, as a factor in shaping present or current management harvest designs.
- Integrated pest management strategies will be used to manage pests within the constraints of laws and regulations and to meet Forest management objectives.
- Stands may require protection from biological agents in order to meet stocking and growth.

The relevant direction for silvicultural practices contained in each of the Management Area allocations that occur within the Toolbox Project area can be found in Chapter 1 and in the Forested Vegetation resource report. All silvicultural prescriptions for the vegetation management activities within the project area would be designed to meet the objectives of the specific Management Area(s) involved. Proposed salvage harvest of trees burned by the fire is limited to those trees with 20 percent or less live crown, with the exception of white fir less than 21 inches dbh with 30 percent or greater bole char, regardless of crown condition. A small amount of precommercial thinning in some partially burned plantations would also be included in several alternatives. Management Area direction was used to guide the extent and location of leave areas and to determine appropriate regeneration prescriptions. All precommercial thinning would be designed to meet mule deer cover standards.

Analysis Area

The Toolbox Project Area is comprised of parts of the following watersheds and subsheds:

Silver Creek Watershed (made up of the following subsheds)

- Middle Silver Creek
- West Fork Silver Creek
- Upper Silver Creek
- Thompson Reservoir
- Benny Creek

Silver Lake Watershed (made up of the following subsheds)

- Upper Duncan Creek
- East Duncan Creek
- Lower Duncan Creek

Analysis Methods

The effects analysis for this project is grouped into two general areas, as defined by the purpose and need to develop long-term sustainable forests within the project area, and the key issue of recovery using a limited-intervention approach versus recovery using a full range of active management practices, including commercial salvage:

- *Stand Development* –this topic is directly related to how and when forested communities will be re-established within the project area. It also ties to the degree of long-term sustainability the stands will exhibit once they are established.

- *Forestland Integrity* – this topic addresses the structure, composition, and diversity at the stand and landscape level as compared to the Historic Range of Variability. It is directly related to the question of long-term sustainability of the forests within the project area.

Numerous different sources of data were used to characterize historic and recent (pre- and post-fire) conditions within the project area, and to estimate what conditions would be created by the different alternatives for salvage and recovery activities:

- *The ecoclass layer* in the Geographic Information System (GIS) records was used to map the forested areas and provide an indicator of site productivity.
- *Stand examination data* was used to characterize the forested condition before the 2002 fires. Most of this data is 10-20 years old. It was evaluated to determine that no entries had been made in that time, and was used if no activity (other than the fire) had occurred since the data was collected. The data was used with no growth or mortality assumptions.
- *The Silvicultural Activities Tracking (SAT) layer* in the GIS records was used to categorize and populate rough stand data, based on the past vegetative management activities within stands.
- *The fuels underburning and vegetation management activities layers* in GIS were combined into one layer and used to further evaluate stand conditions.
- *True color aerial photos* were flown in early September 2002 to assess vegetative mortality after the Toolbox and Silver fires. Additional ground verification was done over 10 to 20 percent of the project area.
- *1,121 post-fire plots* were taken in selected areas in October and November of 2002 to further validate vegetative mortality and other post-fire conditions. These plots were done on a 10 by 10 chain grid. They were located in old growth areas, partial-burn areas, areas with white fir, and proposed helicopter yarding areas. These were minimal level plots designed to verify levels of mortality only.
- *Satellite imagery data, known as ISAT data,* was used to determine the degree of canopy closure (an indicator of stand density) present before the 2002 fires in the forested stands within the eight subsheds crossing the project area. This data was compared to the stand density that would have been expected before the advent of regular fire suppression, and used to evaluate whether the present-day forested communities within the project area within or outside the Historic Range of Variability.

The mortality data was classified into one of four mortality levels, as well as areas classified as “null” if no mortality was visible on the photo. All of the data described above was overlaid with other relevant information, such as the location of streams, other waterbodies, and riparian areas; proximity to sensitive cultural resource sites or wildlife areas; the distance from roads; the presence of steep slopes or sensitive soils; and a host of other factors. All these considerations together went into the development of alternatives to the proposed action that have been designed to respond in different ways to the purpose and need for the project, and to the key issues identified during scoping. The detailed silvicultural and other data used to develop the alternatives and to estimate their effects on forested plant communities within the project area is located in the project file.

Condition of Forested Plant Communities Before and After the Fire

Historic Forest Conditions

The forested stands within the Toolbox project area historically have been dominated by ponderosa pine, almost to the exclusion of any other conifer species. These stands were single story large tree stands in an open grown condition with occasional clumps of smaller trees present. Most of the acres that burned were in the ponderosa pine type. Most of these forested stands also contained a shrub component of Basin big sagebrush, bitterbrush, greenleaf manzanita and snowberry. Grasses, when present, were predominantly western needlegrass, Idaho fescue, Ross’ sedge, squirreltail, and long-stolen sedge. Even after a century of fire suppression in these watersheds, ponderosa pine has remained as the major overstory and understory species, although minor amounts of white fir, lodgepole pine and juniper were also present. Overall, the vegetative composition of the Forest Service managed lands within the project area is approximately as follows:

- 25 percent of the area would be considered nonforested, classified instead as a grass, meadow, riparian or shrub type. Some of these acres have become occupied with ponderosa pine, lodgepole pine, and/or juniper since the advent of extensive fire suppression.
- 5 percent of the area is occupied by lodgepole pine.
- 55 percent of the area is occupied by "true" ponderosa pine types. This means that even though there may be some inclusions of white fir as a result of fire suppression, if periodic (8 to 20 year intervals) low-intensity fire is re-established as a disturbance agent in these stands, they will return to pure ponderosa pine.
- 15 percent of the project area is a mixed conifer type (primarily ponderosa pine and white fir), which, if left free of disturbance long enough, would become partly or completely dominated by white fir. These sites include the mixed ponderosa pine/white fir stands along Winter Rim, stands at the extreme southern and western edge of the Silver Fire and a few other small, scattered other locations within the project area.

The following maps display the distribution of the forested vegetation types across the Silver Lake and Silver Creek watersheds. The heavy dark line delineates the project area boundary, the blank white areas are nonforested types, and the gray areas are private lands. Ponderosa pine (CP), lodgepole pine (CL), mixed conifer (CW), and hemlock (CM) are the forested types shown on these maps. Hemlock occurs only as a very small patch **outside** the project area, on the flank of Yamsay Mountain.

Figure 3.1 Forested Vegetation Stand Types Within the Project Area – Silver Portion

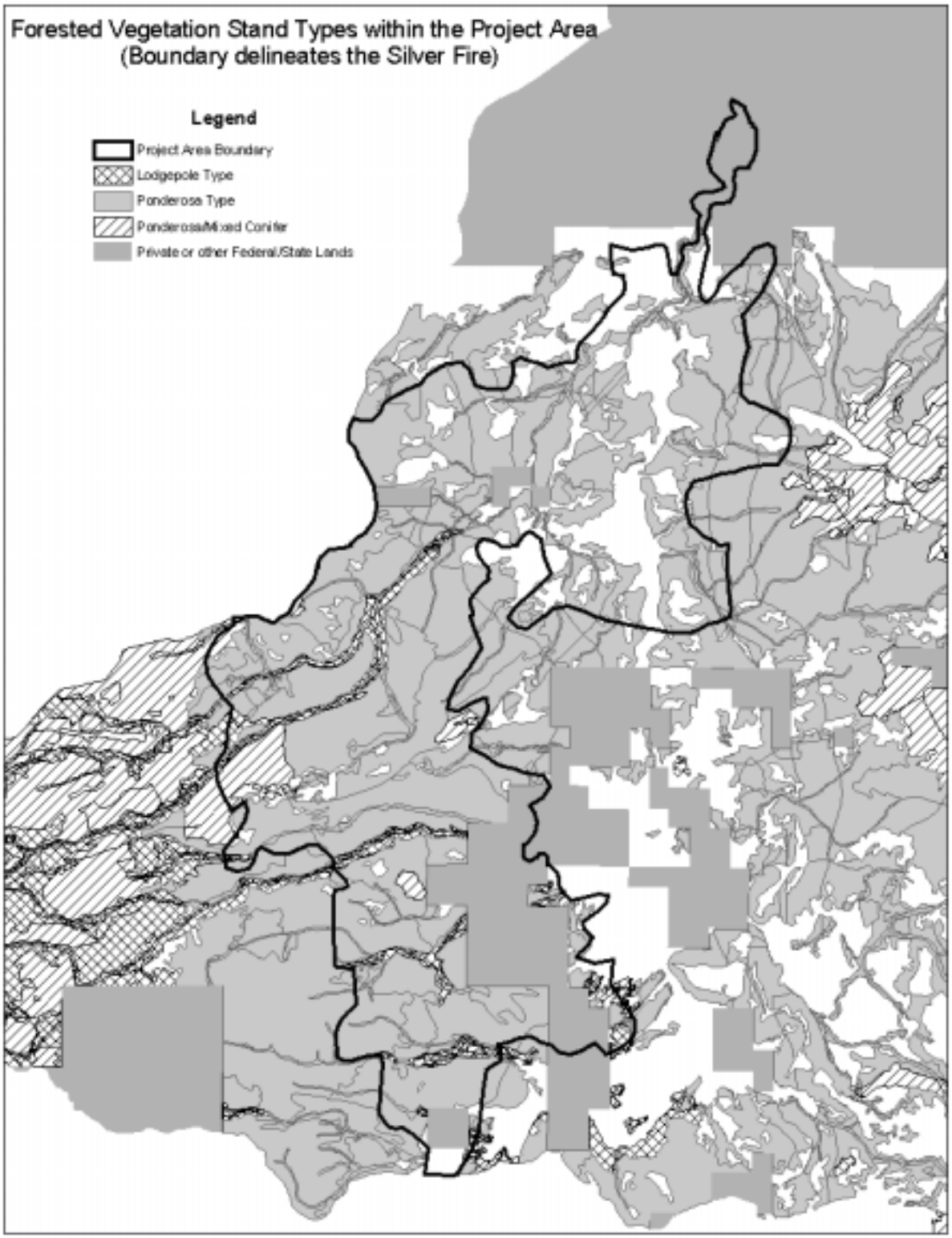
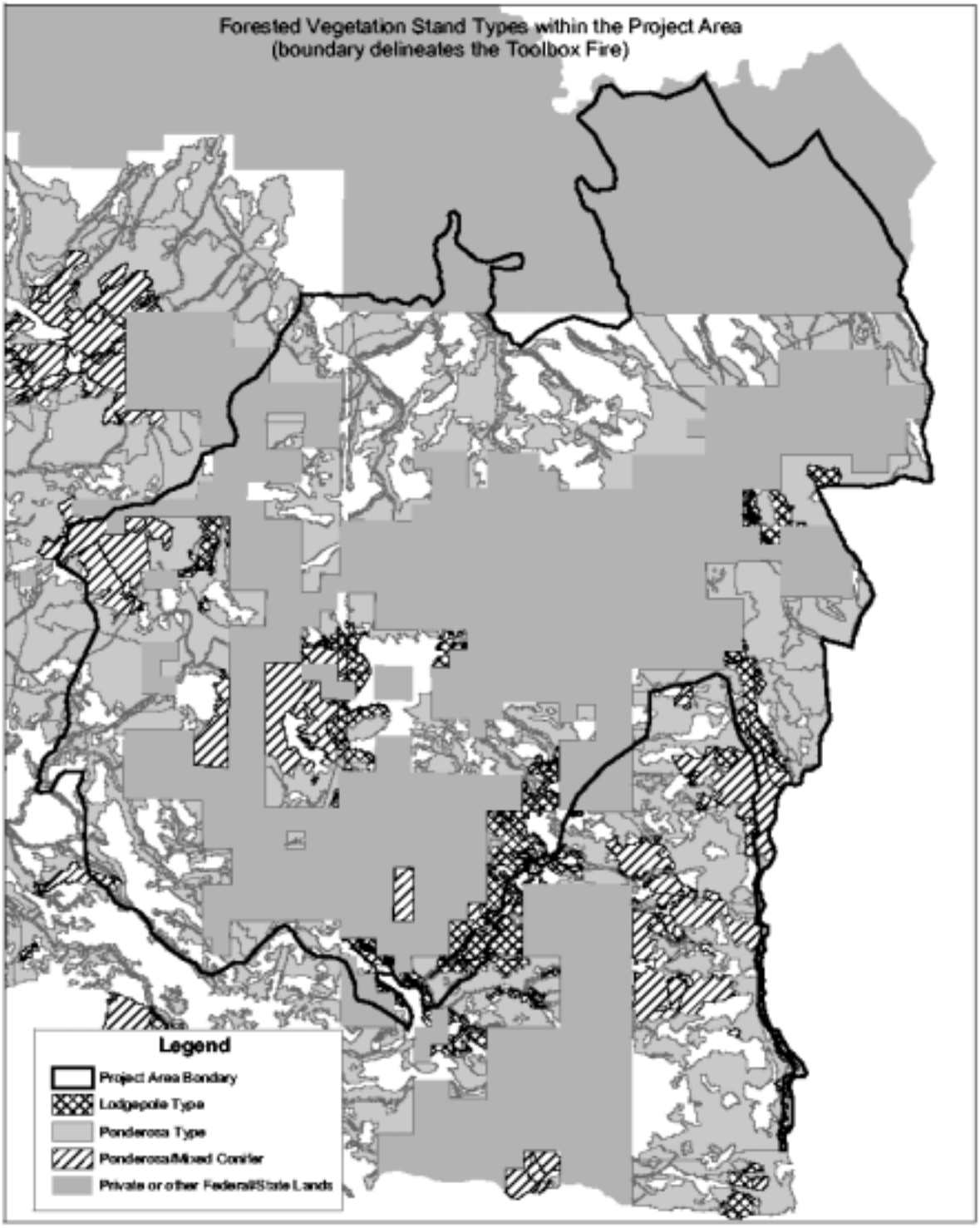


Figure 3.2 Forested Vegetation Stand Types within the Project Area - Toolbox Portion



Site productivity generally increases to the south and east sides of the project area and is directly correlated with the additional rain and snow found at higher elevations. The higher elevation areas also have a greater proportion of forested types, including patches of aspen, especially on Winter Rim. However, regardless of precipitation, all of the project area is classified as low or medium productivity for growing ponderosa pine.

Historically, reforestation by planting has been very successful on the lands within the project area. About 5,000 acres within the project area were in intensive even-age plantations, most of them 15 to 20 years old and densely stocked. Most plantations established on the lands later burned over by the Silver Fire experienced a 90 percent or greater survival rate after initial planting. The plantations established on sites later overrun by the Toolbox Fire averaged closer to an 80 percent survival rate after planting. Where planting failures did occur, they were likely to be found on relatively harsh sites, such as fringe or stringer units between non-forested areas. See the Forested Vegetation resource report for additional reforestation information and the five-year regeneration plan. Planting densities are designed to produce more open fire resistant stands.

All of the forested lands within the project area have had at least one, and most often two or three timber harvest activities in the past, in addition to those intensive treatments discussed in the past activities analysis. However, some of these past timber harvests were very light, removing only a few trees per acre. As a consequence, although extensive *acreage* had been harvested or thinned, most of the forested acres were still very densely stocked (until the 2002 fires). Most forest stands in the project area were also in a multi-storied, multi-aged condition.

Insect and Disease Disturbance Agents

There are numerous insects and pathogens present, as a natural condition, in this area. Historically, bark beetles have been a major natural factor in controlling stand density in the ponderosa pine types that dominate the area. In recent years root rot seems to have become a more active cause of mortality.

Bark beetle outbreaks, while episodic, are a primary, and the single most significant, cause of mortality in the pine type of this area, and alone are capable of causing widespread mortality. While beetles prefer low-vigor trees, and stands of low vigor facilitate population increases, as population levels increase they can successfully colonize and kill vigorous trees. Both western and mountain pine beetles are always present at endemic levels and, periodically, at epidemic levels.

The epidemics seem to have a periodicity of 60 to 80 year intervals and were, along with fire, probably a major contributor to the maintenance of stocking level control in the large tree component. The last major epidemic in ponderosa pine in the area was from 1920 to 1940. The last epidemic in lodgepole pine was from the 1970s to the 1980s. Outside of epidemic conditions, bark beetles kill individual trees, and a low level of mortality is currently ongoing. Insects are attracted to trees under stress from lack of resources (water, nutrients, sun) due to vegetative competition. Most of the stands in the area are either at, or close to, a level of stocking that has been established as the threshold above which increasing mortality occurs.

While both western and mountain pine beetles have their unique individual characteristics, these differences have become less significant in the multi-sized stands now present, and often both species are working in the same stand and sometimes even the same tree.

Western pine beetle, Dendroctonus brevicomis, is periodically destructive to ponderosa pine, especially larger older pines. While a primary cause of mortality, presence of western pine beetle may also be an indicator of presence of root rot. Western pine beetle can cause mortality of 60 to 90 percent of the stand. Western pine beetle has a limitation on attacking smaller trees as it needs to have a wide enough cambium layer to be able to enter and move through. The western pine beetle is larger than the mountain pine beetle, so will attack the larger trees. Generally, western pine beetles cannot successfully attack trees less than 6 to 10 inches or greater diameter breast height (dbh).

Mountain pine beetle, Dendroctonus ponderosae, is the primary bark beetle colonizing lodgepole pine and smaller ponderosa pine. It can attack trees from 4 to 8 inches dbh to the largest ponderosa pine. Populations often build up in lodgepole or smaller pine and then move into all size classes. Mountain pine beetle alone has been responsible for significant, landscape level mortality of large pines, but it more often operates in those trees along with the western pine beetle. Currently there is mountain pine beetle mortality occurring in both lodgepole pine and ponderosa pine in the project area. This is a recent increase in the last few years, and appears to be related to a slow, steady expansion of epidemic population levels spreading from the Winter Rim area. It is a smaller beetle than *brevicomis* and can successfully attack trees with smaller cambium layers than *brevicomis*, such as smaller trees or slower growing trees (whether large or small).

Pine engraver, Ips pini, is considered second in destructiveness only to *Dendroctonu*s. *Ips* is especially adept at overwintering in slash and dead stumps and producing multiple generations in a single season. They can successfully overwinter in most stages of development. Therefore, their populations can increase even more rapidly than other bark

beetles. Locally *Ips* has generally only caused small patch killing and has not been considered a major, primary cause of mortality. This may be only because other *Dendroctonus* species followed so quickly. With the large amount of small-diameter trees now present this pattern of mortality could change to more aggressive killing and include more, and larger, trees.

Fir Engraver, Scolytus ventralis, is a major pest of true firs. It attacks pole sized trees and the tops of mature trees. Trees infected with root rot are especially prone to attack and often the pattern of top killing from *Scolytus* will identify root rot pockets. *Scolytus* can breed in slash and windthrow, and kill trees as well as tops.

The two species of root rot that predominate in the area are:

Annosus Root Rot – Heterobasidion annosum

Armillaria Root Disease – Armillaria ostoyae

While these are two distinct species, for the purpose of prescription development they have many similarities.

- They are soil fungi that may be very large underground organisms.
- They do cause mortality, either primarily or with other pathogens or insect activity.
- Vigorous stands on suitable sites show little weakening or mortality from root rots.
- There seems to be an increasing virulence in root disease activity in the region; it may have been less active in "natural" stands.
- Spread is either through root-to-root contact, or from airborne spores produced by ground-level fruiting bodies (mushrooms) colonizing cambium exposed through wounding.
- These organisms can generally survive as either a parasite or saprophyte.
- Decreasing the amount of below-ground root mass and maintaining open stands with fewer trees per acre is the long-term management strategy for root rot management
- Short-term mortality may be increased following mechanical thinning, fuels treatment, or fire activities due to a combination of reduction in host population and direct wounding of residual stand.

Bark beetle activity, primarily mountain pine beetle, had been increasing in the project boundary for several years before the 2002 fires. Just prior to the outbreak of the fires, evidence of the previous year's (2001) beetle-caused mortality was becoming visible in the form of trees with red needles. The mortality appeared significantly more extensive than that noted for the year before (2000). However, the fires occurred before the mortality was completely inventoried, so its true extent is unknown. It is unlikely that bark beetle populations were adversely affected by the fire because the fire burned with such variable intensity and left plenty of "reservoirs" of beetle habitat. There now are fewer green trees, so beetle attacks may be more concentrated on the residual green trees. This in turn can produce more mortality in the trees that managed to survive the 2002 fires.

Other insect and disease disturbance agents, such as western spruce budworm, Douglas-fir tussock moth, pandora moth, and dwarf mistletoe are also present within the project area, but their influence on post-fire conditions is likely to be relatively insignificant.

Historic Range of Variability

Before the 2002 fires took place, forested vegetation communities within the Silver Creek and Silver Lake watersheds were outside the Historic Range of Variability (HRV) because they were deficient in stands with late and old structure (LOS). The best landscape-level data available to evaluate the Historic Range of Variability for the subsheds affected by the Toolbox Complex is satellite imagery data (known as ISAT data). This data was collected by Pacific Meridian Resources in 1994 and categorized by degree of canopy closure. The data is pixel-based, meaning that each individual unit of data represents 9,684 square feet, or just under a quarter of an acre.

For each pixel, the satellite captures a straight-down image of the crowns of whatever vegetation exists on that particular ¼ acre. This is a much finer scale than stand-level data and can tend to skew the data where (as for this project area) there is much small-scale variation within stands. In the ISAT data these fine-scale stand variations can often appear as low-density

tree, shrub, or grass types and cause a stand to be classified as low-density, when an on-the-ground stand examination would result in classifying the same area as a forested stand of moderate or even high density. This suggests that actual stand density conditions before the fires were likely to be somewhat higher than that estimated through use of the ISAT data.

ISAT canopy closure data is classified in the following categories:

- Grass, rock, or sparse vegetation
- Shrub, 15 to 25 percent canopy closure (CC)
- Shrub, 26 to 40 percent canopy closure
- Tree, 11 to 25 percent canopy closure
- Tree, 25 to 40 percent canopy closure
- Tree, 41 to 55 percent canopy closure
- Tree, 56 to 70 percent canopy closure
- Tree, 70 to 100 percent canopy closure

Historic (before fire suppression) LOS ponderosa pine and pine-associated stand types would most commonly be classified in the Tree 11 to 25 percent CC category, or even in a shrub or grass category, because of the low density of trees they contained. Frequent fire-return intervals tended to keep these stands very open. In the Pacific Northwest Region Interim Old Growth Definition for the Ponderosa pine series, Hopkins (1992) identified old-growth ponderosa pine stands typical of this area as containing:

- For areas of low site productivity: per acre, 10 to 30 trees of 21”(or greater) dbh with a Basal Area (BA) range of 24-72+, and two to six trees of 31” (or greater) dbh with a Basal Area of 11-32+, for a total stand basal area of 104+.
- For areas of moderate-high site productivity: per acre, 13 to 45 trees of 21” (or greater) dbh with a Basal Area range of 31-110+, and three to eight trees of 31” (or greater) dbh with a Basal Area of 14-40+, for a total stand basal area of 150+.

The above categories describe the Historic Range of Variability applicable to late and old ponderosa pine stands within the Toolbox project area. Both these categories are found within the project area. Most of the ponderosa pine stands within the project area would be classified as being at the low end of the moderate-high site productivity, with a maximum sustainable BA of 110-130. Stands on the more productive sites, such as those on higher, wetter sites with inclusions of white fir, may be capable of sustaining 150+ BA. This situation is found on only a small number of the project area acres.

The ISAT data, in conjunction with Hopkins’ work, can be used to compare the recent condition (both pre and post fire) of forested communities within the project area to the HRV identified for the project area. Consider a stand of the large, old single-story ponderosa pine type common before fire exclusion. On an average low-productivity site, this stand would likely have had 10 to 30 trees of 21” dbh or greater, per acre. At 10 trees to the acre (the low end of the range) the tree crowns (which is what the satellite camera sees) would be expected to be on the large side, because the individual trees would have less competition and would thus tend to grow larger. The following table shows how tree size and numbers of trees for old-growth ponderosa pine stands within HRV correlate to percent of canopy closure. The ISAT data, which is represented in terms of percent of canopy closure, can then be used to compare the recent (pre-fire) condition of stands within the project area to the Historic Range of Variability.

Table 3.28 Correlation of Tree Size and Numbers Within HRV to Percent of Canopy Closure

LOS Ponderosa Pine Stands	Diameter at breast height (inches)	# of trees per acre	Basal Area	Average Crown Area (sq.ft./acre)	% Canopy closure
Low Productivity Low range	2	10	23	3,500	8%
	31	2	11	1,550	3.5%
Total		**12**	**34**	**5,000**	**11.5%**
Low Productivity Highest Range	21	30	69	7,350	16.9%
	31	6	32	4,350	10.6%
Total		**36**	**101**	**11,700**	**26.8%**
Mod-High Productivity Low Range	21	13	30	4,550	10.4%
	311	3	16	2,325	5.3%
Total		**16**	**46**	**6,875**	**15.8%**
*Mod-High Productivity High Range****	21	45	103	15,750	36%
	31	8	42.4	6,000	13.7%
Total		**53**	**145**	**21,750**	**50%**

*very few acres in this category can sustain this stand density over time

In terms of the ISAT data, a stand is represented by an aggregation of the data from numerous 30-meter pixels (the number of pixels varies, depending on the size of the stand). Thus, one "stand" from the ISAT data would likely be represented as a combination of pixel data from the following categories:

- Tree CC 11-25 percent - (probably the classification that would most closely match an average LOS structure of a sustainable stand on an average productivity ponderosa pine type in this project area.)
- Tree CC 26-40 percent - (this classification would occur when a particular tree had a crown large enough to dominate a pixel, or when clumps or areas of heavier stocking were present within the pixel).
- Tree CC 41 percent and greater – (this classification would occur when an especially large clump of trees is centered in a pixel).
- shrub, grass or rock classifications – (would generally occur because of the amount of bare ground between trees).

The following table shows the Historic Range of Variability for stand density in LOS ponderosa pine stand types and LOS lodgepole pine types. These tables also show the percentage of nonforested habitat likely to be found within these stands that would be consistent with HRV. Two scenarios have been developed for LOS ponderosa pine to reflect differing within-stand distributions (Scenario 1 - a relatively clumpy distribution of trees across the stands versus Scenario 2 - a relatively even distribution of trees across the stands) and how those differing distribution scenarios would be interpreted in the ISAT classifications. Both are based on the same canopy closure situation described in this section.

Table 3.29 HRV for Stand Density in LOS Ponderosa and Lodgepole Pine Stand Types

Canopy Category	% Canopy Closure		
	Lodgepole Pine Scenario	Ponderosa Pine - Scenario 1	Ponderosa Pine - Scenario 2
Grass	50%	10%	
Rock, Sparse Veg.			
Shrub 15-25%	10%	10%	
Shrub 26-40%			
Tree CC 11-25%	40%	50%	90%
Tree CC 26-40%	0%	30%	10%
Tree CC 41-55%	0%	0%	0%
Tree CC 56-70%	0%	0%	0%

Notes:

- *In the lodgepole pine scenario, no precision between the grass/shrub component is implied.*
- *The two ponderosa pine HRV scenarios are designed to reflect the natural within-stand variation that is characteristic of ponderosa pine stands.* ***Scenario 1*** *reflects a relatively clumpy distribution of trees, meaning some acres within stands would be classified as nonforested types.* ***Scenario 2*** *assumes a relatively even distribution of trees within stands, which would mean very few acres would be classified as non-forested types. Both are based on the same total canopy closure values.*

No category is shown for Tree CC 71-100 percent since this degree of canopy closure would almost never be present in the ponderosa pine or lodgepole

Recent Conditions (Pre-fire) Compared to Historic Range of Variability

General characteristics of most of the forested acres in the Toolbox project area before the advent of regular fire suppression include the following:

- The stand types were primarily ponderosa pine. They were part of an ecological system that maintained a continuous canopy of mature ponderosa pine, with variations in density, but in a generally open stand condition. During this period of relatively low stand density, individual tree vigor was sufficient to produce adequate seed crops to perpetuate the stand.
- These low density, open park-like stand conditions were maintained by frequent (8 to 20 years) low-intensity fires. These fires occasionally killed a large tree, but, more importantly, killed almost all of the young tree reproduction, burned branches, and fallen snags on the forest floor and burned off the tops of brush and grasses.
- Most of the seed produced by a ponderosa pine does not disperse much farther than the height of the cone on the mother tree. Ponderosa seeds do have wings, but the seed is heavy and does not travel far from the tree. This suggests that stand openings created by fire or insect/disease mortality within ponderosa pine types would have rarely been greater than one acre, since otherwise the almost continuous ponderosa pine canopy documented in historic accounts before the 1900s would not have been present.
- Down wood generally would have been relatively rare. Most ponderosa pine lived 200 to 500 or more years, with stand densities ranging between 5 to 20 or so trees per acre. Pulses of mortality leading to snag creation and subsequent down wood were generally caused by bark beetle events. These events had a periodicity of every 60 to 100 years. Some reported bark beetle events did cause mortality of 50 to 60 percent of the stand, creating, at most, 10 snags per acre. As these fell or were burned through, that much large wood would be on the ground, probably until the next fire occurred in 10 to 15 years. However, then there would be almost no down wood or snags present for another 60 to 100 years in that stand.

After regular fire suppression began (circa 1900) the general condition common to all subsheds is that most forested stands were very dense compared to HRV, and more stands exhibited multi-storied structure than was characteristic for HRV. The

following discussions, organized by stand type, compare conditions present in recent time (1900s to 2002) with the Historic Range of Variability defined for each stand type.

Ponderosa Pine Stand Types

Since the advent of regular fire suppression (circa 1900) the condition of the Ponderosa pine stand types began to move away from HRV as stands became denser. Just before the 2002 fires, these stands were considered to be outside of HRV and outside the range of adaptability of ponderosa pine to sustain a conifer stand type. Within the project area, the pre-fire condition included more overall acres of ponderosa pine stands, compared to HRV. However, because these stands exhibited a degree of density and multi-storied structure that was well outside of HRV, without frequent human intervention in the form of tree cutting, fuels treatment, and careful application of prescribed fire they were at high risk for stand replacement fire, insect infestations, or both. These conditions were in fact a contributing factor to the intense fire behavior in some parts of the Toolbox Complex.

Tree distribution within the ponderosa pine stand types is also an important factor that is not fully captured in the ISAT data. Historic accounts indicate that the non-forested grass and shrub habitats within ponderosa pine stand types were generally distributed fairly evenly at no more than one to two openings per acre, rather than being present in large patch sizes. There is a high confidence in this characterization, as it is supported both by consistent descriptions in old reports (late 1800s/early 1900s) and by the growth and reproductive mechanisms of the species itself. Ponderosa pine seed is relatively heavy and, as a rule, does not disperse very far from the parent tree. Over time, stands would tend to develop relatively uniform spacing, with small openings created as an individual tree or small clump of trees died from insects, windthrow, root rot, or small patches of "torching" from the frequent, low-intensity fires that moved through the stands on an average of every 8 to 20 years.

The following two bar graphs depict the degree to which ponderosa pine stand types within the project area have departed from the Historic Range of Variability. Each of the two distribution scenarios described above is displayed in a bar chart. The vertical axis measures acres of departure from the HRV condition, and the zero point on the vertical axis represents the Historic Range of Variability. The horizontal axis displays the ISAT canopy closure percentages relevant to ponderosa pine stand types. Thus, a bar appearing above the "zero line" on the graph would indicate that in 1994 there were *more* acres of stands in that particular density condition than would have been expected, compared to HRV. A bar that shows below the zero line indicates that in 1994, compared to HRV, there were *fewer* acres of stands in that particular density condition than would have been expected.

Figure 3.3 ISAT Data Showing the Distribution of Ponderosa Pine LOS, by Percent of Canopy Closure, Within Silver Lake and Silver Creek Watersheds (Scenario 1)

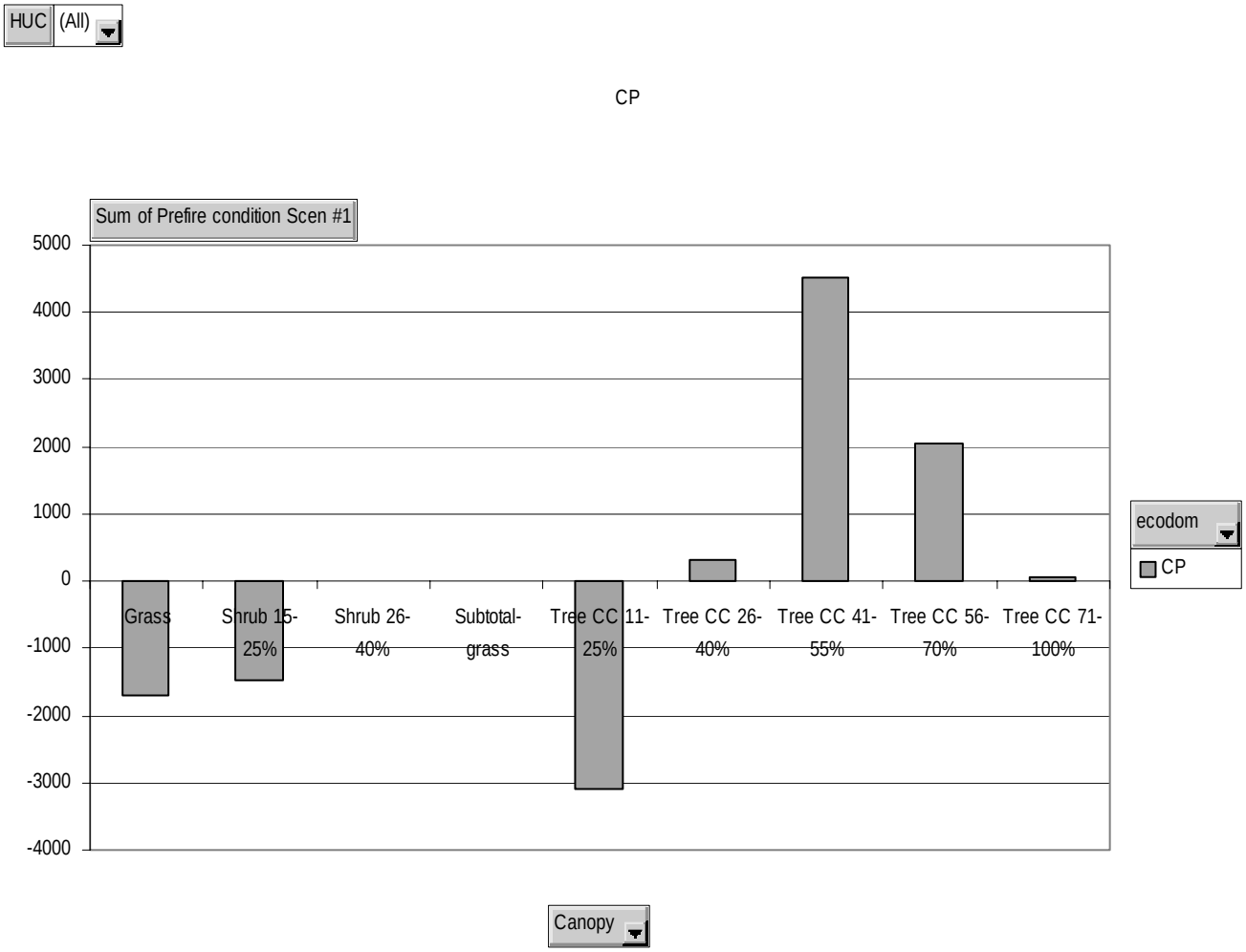
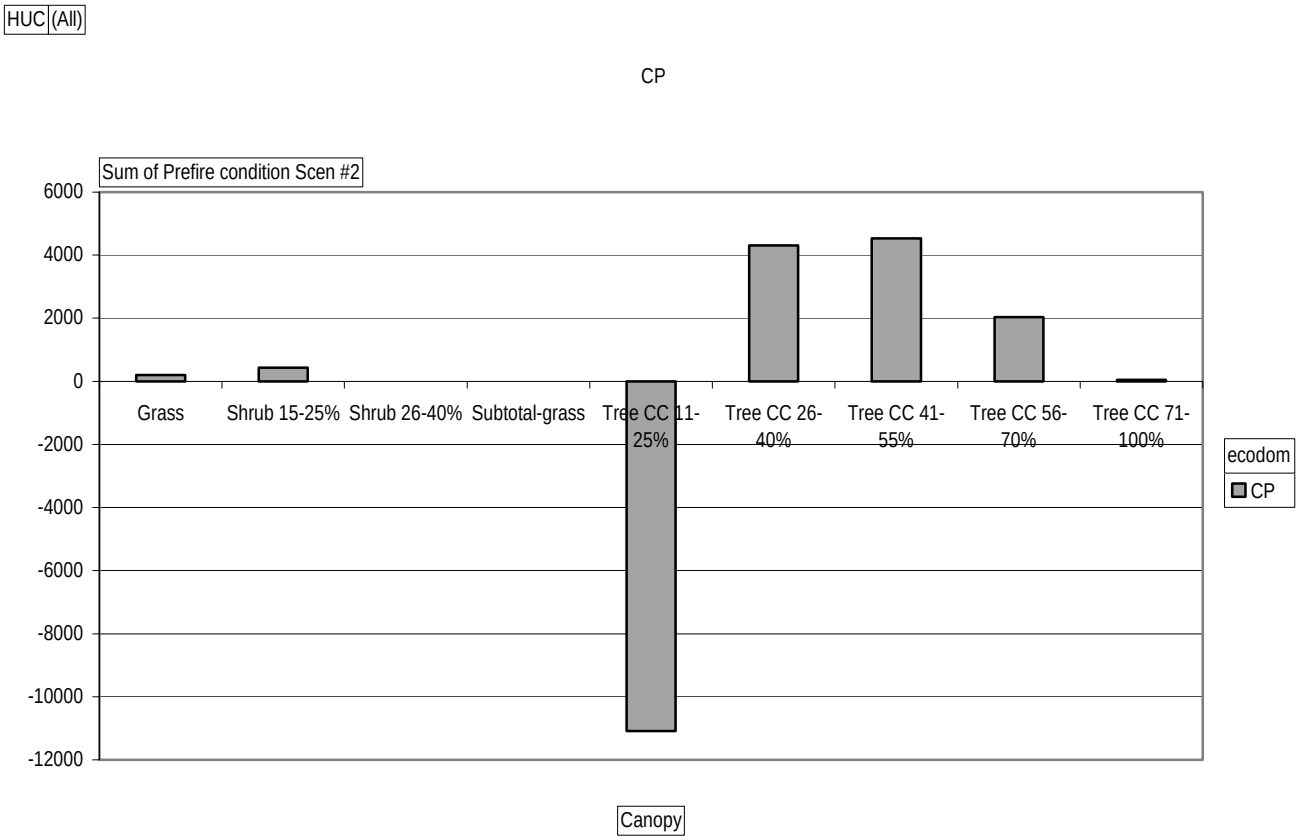


Figure 3.4 ISAT Data Showing the Distribution of Ponderosa Pine LOS, by Percent of Canopy Closure, Within Silver Lake and Silver Creek Watersheds (Scenario 2)



Mixed Conifer (CW) Stand Types

The CW classification in the project area represents a mix of ponderosa pine and white fir. This stand type occurs primarily on the higher, wetter sites within the project area. A century of fire suppression has increased the proportion of white fir in these stands. While historically these sites supported a component of white fir, today's amounts are outside of HRV and act to reduce the long-term sustainability of these stands. The overabundance of white fir contributes to the excessive stand density and multi-storied structure that increases the risk of stand-replacement fire, insect infestations, or both. In a sustainable and historic condition the mixed conifer stand types would have a much lower component of white fir, would be dominated by ponderosa pine, and would exhibit the same general ecological dynamics as the ponderosa pine stand types.

Lodgepole Pine Stand Types

Determining the Historic Range of Variability (HRV) for lodgepole pine in this area is complicated. Several factors contribute to this complication:

- Lodgepole pine itself appears to be a highly variable species.
- Historic accounts and descriptions of this forest type vary widely.
- It is highly probable that there was much greater within-type variability over both time and space than appears in the lodgepole pine type seen today.
- It is also likely that the various plant community types that currently express themselves as "lodgepole" had greater *between*-type variations than are displayed now. Indications are that the between-type variations ranged from a ponderosa pine savannah type to nearly pure grass meadow.

Due to the small amount of lodgepole pine in the Toolbox project area, the HRV comparison only goes as far as displaying the likely conifer vs. non-conifer split that might have been more common. The estimates within the conifer and non-conifer types are not meant to be precise, but to display this split in general terms. The HRV analysis indicates that

relatively open stand types (Tree CC 11-25 percent) were more common than today and that non-forested habitats, primarily grass meadows, were a significant component of the lodgepole pine stand types. ISAT data indicates that within recent times (pre-fire) the lodgepole pine stands within the project area were greatly deficient in these non-forested habitat types and that canopy cover in the forested stands generally exceeded HRV.

Down Wood Component

Current estimates and guidelines for retention of down woody material vary, but in general they likely exceed the average amount of down wood present in ponderosa pine stand types during historic conditions (Lieburg and Munger). Before the advent of fire suppression, these stands did have pulses of mortality associated with occasional bark beetle epidemics, and that would have periodically increased the down wood component.

Most of the trees killed by bark beetles would have been fairly large, and generally these episodes killed fewer than 10 trees per acre. While the fuel added by that mortality would represent a high tonnage, most of that tonnage would have been concentrated in a few large boles and large limbs. A very small amount would have consisted of fine fuels such as small branches, twigs, and needles. In a forested community, fine fuels are the driver for intense fire behavior. Such scattered, large down fuels, in the context of the frequent, low-intensity fires experienced by these stands, would not lead to stand replacement fire mortality. Mortality might have occurred in small clumps, generally less than ½ acre.

Current Conditions (Post-fire) Compared to Historic Range of Variability

Overview

Forest Conditions after the 2002 Fire

The 2002 Silver and Toolbox fires created a wide range of vegetative mortality, sometimes at a relatively small scale. The Toolbox Complex did not generally burn as an even fire front. Instead, it spread by spotting and torching and expending from the new flame fronts established by the spotting and torching areas. The situations where a uniform fire front occurred were in areas of upslope runs, in areas where intensive underburning occurred (these were very limited), and in areas of uniformly thick stands. Fortunately almost none of the area burned hot enough to cause serious damage to the basic soil resource (2002 Toolbox Burned Area Emergency Rehabilitation Report). However the vegetative component did not fare as well.

Methods used to determine mortality included a post-fire aerial photo flight, in true color, and collection of data from 600 post-fire inventory plots (concentrated in areas needing additional assessment, such as old growth, partially-burned stands, and white fir-dominated sites). Thus, the vegetative mortality mapping used for this analysis is based on the visible evidence of mortality as of early September 2002. Mortality mapping was done in five-acre or larger units. Later additional ground verification was done.

Vegetative mortality within the fire area was mapped in four classes, based on visible crown mortality as of September 2002.

- ***Light mortality of 1 to 25 percent (shown on tables and charts as 1_mt)*** - These stands are a mosaic of dead patches, or understory mortality, within a mostly green stand. Torched out patches of dead rarely exceeded 2 to 3 acres. Bark beetle activity is present in these stands. This type also includes areas of white fir expansion into historically ponderosa pine dominated areas. This white fir expansion had increased mortality in the larger ponderosa pine, and the fire activity did cause more mortality in these areas.
- ***Moderate mortality of 25 to 50 percent (shown on tables and charts as 2_mt)*** - These stands were a mosaic of larger patches of predominately dead trees in a matrix of green trees or understory mortality. Torched out patches are often 3 to 5 acres and mortality extends more into the surrounding, less burned matrix. Bark beetle activity is present in these stands. These stands are in the condition most likely to incur future mortality from beetles and the lingering effects of the 2002 fire. These stands did receive more heat than the 1 to 25 percent mortality areas. The greatest additional mortality should occur in 2004, but may continue for several more years, although probably at a slower rate.
- ***Heavy mortality of 51 to 85 percent (shown on tables and charts as 3_mt)*** - These stands were predominantly fire-killed trees that included patches of unburned or lightly burned stands. Bark beetle activity was present, and these stands received a higher degree of heat. Due to this combination of factors, it is expected that increased mortality will occur and some of these acres may move into the 85 percent or greater mortality category.

- ***Extensive mortality of 86 percent or greater (shown on tables and charts as 4_mt)*** - These stands were predominantly fire killed, with very few live trees, and had received intense heat during the fire. In the near term, more mortality is expected in these stands.

Mortality ratings were not adjusted for bole damage in the white fir. Instead, these areas were manually added to treatment units. Also, the mortality mapping layer was not adjusted for areas of fire-damaged white fir (bole scorch). This damage was validated by formal plot data in several areas, and additional treatment acres to account for this condition were manually added into the activity layers. The mortality coding on the maps reflects only the visible crown damage apparent in the aerial photographs.

The following two maps display vegetative mortality rated within the different categories described above, for both fire portions of the project area. The Toolbox Portion map shows some small inclusions from the Winter Fire, which burned up the face of Winter Rim and a few hundred feet west on top of the Rim.

Figure 3.5 Vegetative Mortality Within the Silver Fire

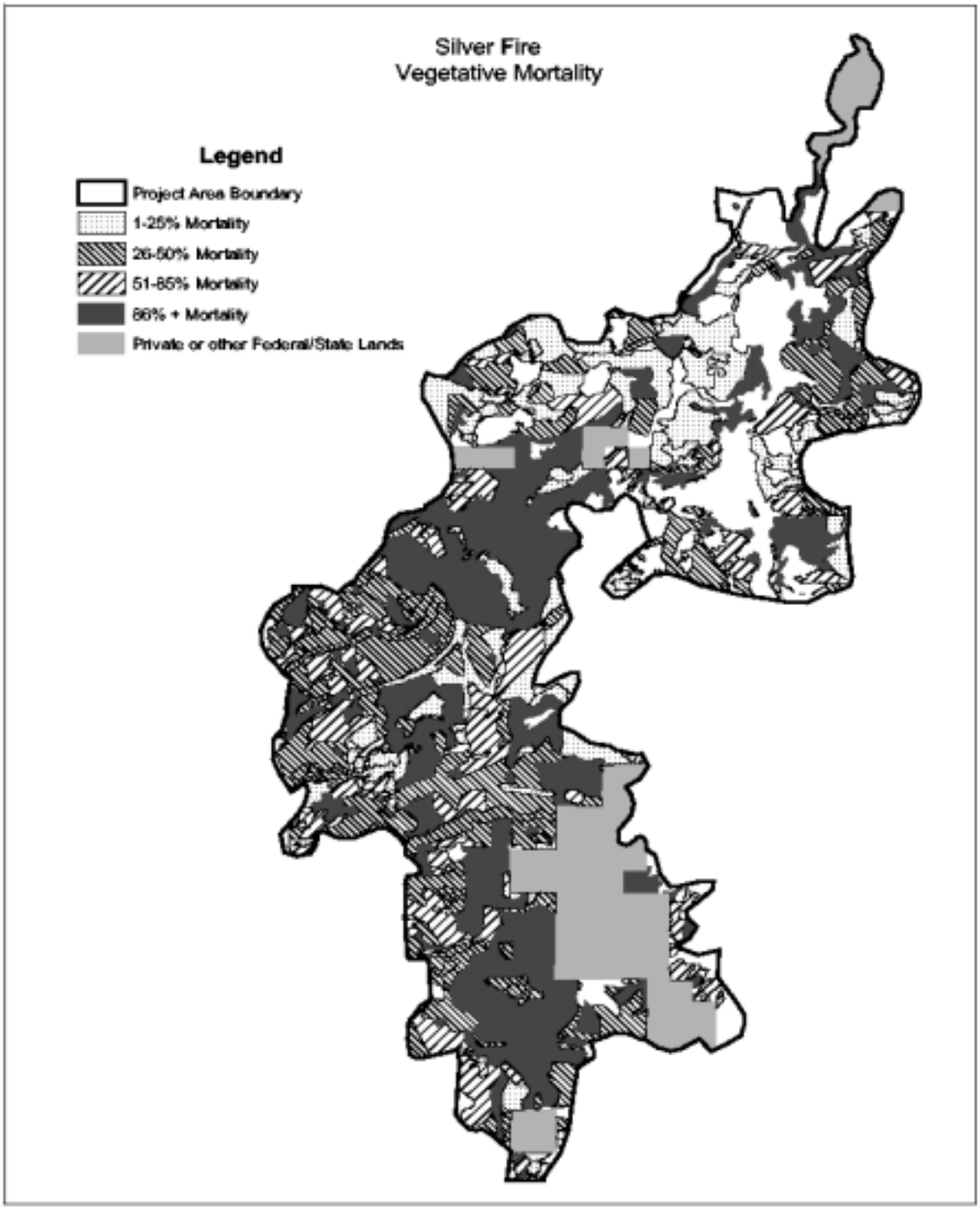
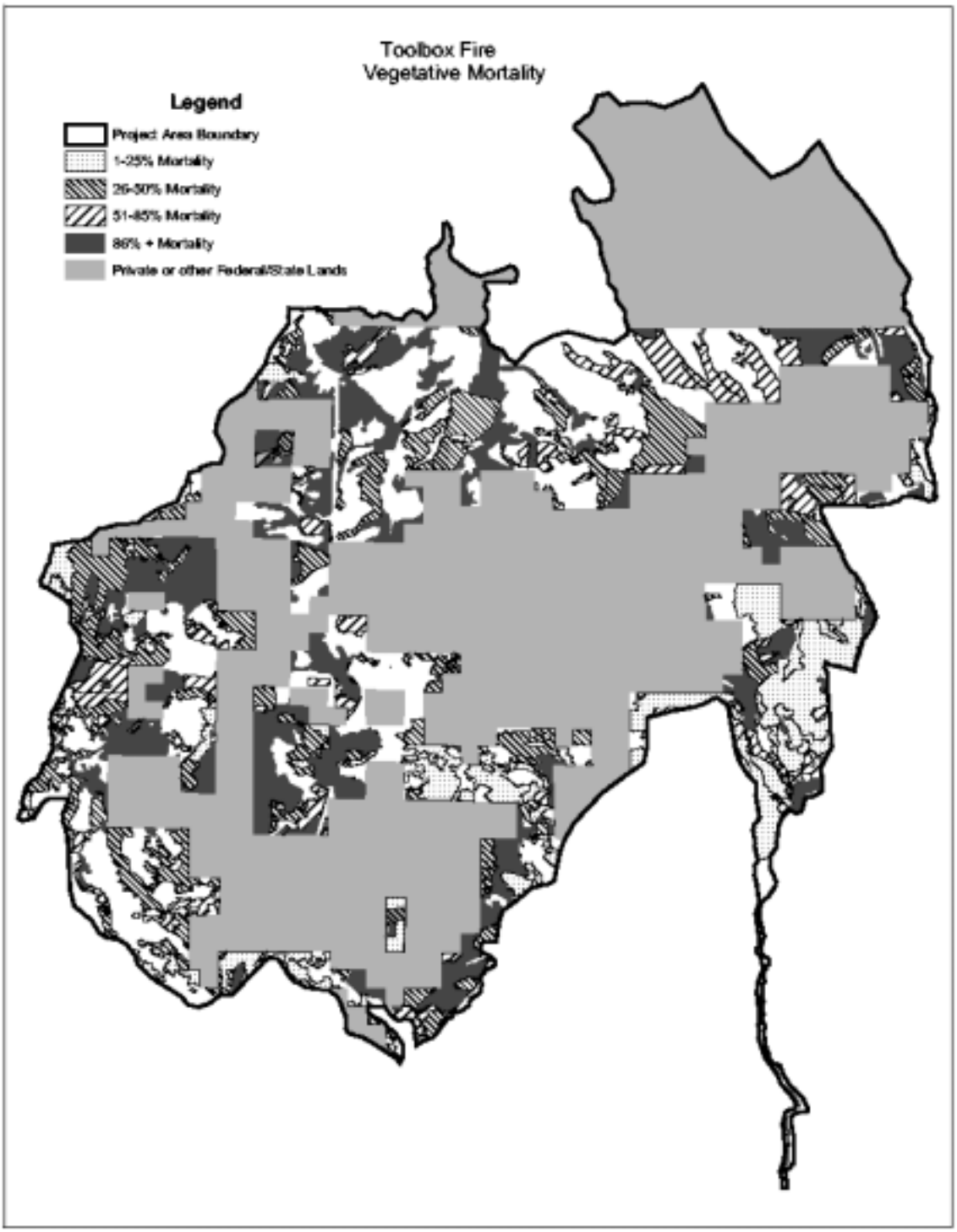


Figure 3.6 Vegetative Mortality Within the Toolbox Fire



LOS Stands

Late and old structural stages in all stand types have been further reduced across the landscape as a consequence of the fires. The following table summarizes the acres of LOS lost, either through total or partial loss of larger tree component, in the 2002 fires, by forest type:

Table 3.30 LOS Acres Lost

Forest Type	LOS Lost (Acres)
Ponderosa Pine (CP)	8,386
Mixed Conifer (CW)	1,699
Lodgepole Pine (LP)	1,244
Total	**11,482**

Likely Additional Mortality

Additional mortality from residual effects of the fire is expected to occur in ponderosa pine stand types in the next few years, and in the white fir component of mixed conifer stands within the next five years. Most of the expected white fir mortality will be as a result of cambium or root damage from exposure to resident heat following the actual fire, rather than as a consequence of damage to the crown. The tight canopy closures found in the mixed conifer stands tended to hold in the heat from the fire.

The potential for bark beetle attacks on fire-weakened trees is another factor expected to influence tree mortality in the next several years. Bark beetle numbers and activity had been rising dramatically in the few years before 2002, and many pockets of mortality from beetle hits had been apparent in the project area before the start of the fire. The likelihood of local epidemic populations of bark beetles is difficult to predict. If populations do increase even slightly, trees that have suffered some fire damage may not survive even a light infestation. Stands with relatively high density in the 26 to 50 percent mortality category are likely to see the greatest risk of bark-beetle-related mortality.

Ponderosa Pine Stand Types

When examined from the standpoint of sustainable canopy closure percentages, the post-fire numbers for the ponderosa pine stand types appear to be an improvement because there are now more non-forested openings within stands. However, this is misleading because the numbers alone do not recognize the *distribution* of nonforest habitats characteristic of HRV. In the historic/sustainable condition, these grass or shrub openings would be scattered across all acres, in tiny patches per acre. But the openings created by the fire are in large patch sizes of many acres, and are therefore also outside the range of sustainability. The post-fire condition of the ponderosa pine types is both outside HRV and outside the range of adaptability of ponderosa pine to maintain a conifer stand type.

Current post-fire conditions in the higher mortality areas of this stand type do not favor natural re-establishment of ponderosa pine stands. Natural regeneration of ponderosa pine occurs in infrequent pulses of regeneration, where abundant seed trees are present. These pulses of regeneration that (together with fire suppression) created the overstocked stands of the present era were the result of a combination of factors occurring simultaneously: 1) a fully stocked stand of mature seed-producing trees, 2) open stand conditions which favored unobstructed seed dispersal, 3) periodic light fires that prepared a more favorable seedbed, 4) a good moisture year, and 5) a good seed production year. These factors are not present in the post-fire stand condition. Instead, the following factors will act against natural regeneration of ponderosa pine in the higher mortality areas:

- A high variation of green tree stocking is present, but in understocked areas few seed trees are present and they are not well distributed throughout the area.
- The understocked stands have a large amount of dead standing material that will be a physical barrier to seed dispersal by wind. By the time most of the standing dead trees fall, the mineral soil seedbed prepared by the fire and preferred for ponderosa pine regeneration will have become occupied with competing vegetation and will not be a favorable seedbed.
- Good moisture and seed production years are highly variable.

Mixed conifer (CW) Stand Types

The post-fire condition of these stands remains outside the Historic Range of Variability, both in terms of stand density and multi-storied structure. LOS stands within this stand type have suffered a decrease of almost 1,700 acres. Additional mortality is expected in the white fir component but will not likely become apparent for another two to four years. White fir is very sensitive to resident heat damage to roots or cambium, but this is not photo-identifiable or noticeable at any distance from the tree

Lodgepole Pine Stand Types

Relatively few acres of the lodgepole pine stand type are found within the Toolbox project area, though these acres did sustain mortality from the fire. Approximately 1,240 acres of LOS were lost. Within the project area, these stand types have moved closer to HRV because the trees killed by the fire will create more acres in non-conifer habitat types (see earlier discussion on HRV for this stand type). However, the *distribution* of these newly created non-conifer habitats is more concentrated in a few areas, compared to what would be expected within HRV.

Riparian Plant Communities

Effects of the wildfire have been, and will be, beneficial to the regeneration of riparian vegetation. Conifer competition has been a major negative impact to the health and vigor of riparian hardwood and surface vegetation for some time. In these vegetation types, the absence of fire or other disturbance events allows conifers to dominate the riparian areas at the expense of the native riparian vegetation, notably aspen, willow, black cottonwood and a wide variety of wet-site grasses, forbs, and rushes.

Most of the riparian areas burned quite hot, resulting in extensive conifer mortality. This will stimulate a strong regenerative response from the riparian vegetation. Most riparian species maintain their root crown during average intensity fires and regenerate post-fire quite easily.

The risk to the longevity and structural development of the riparian vegetation is the risk related to the dead trees that will fall to the ground and become fuel. A heavy fuel loading in a narrow canyon can produce a very hot fire. This fire may be outside the range of adaptability for the riparian species, especially in areas of higher fuel concentration. A subsequent reburn is not a question of if, but of when. Over time these down fuels will decay, reducing the potential damage from a reburn. However, if a fire does occur, there could still be damage to the shade-producing riparian vegetation and potentially consumption of the in-channel coarse woody debris. This would lead to a riparian condition deficient in both shade and large wood. The extent of this condition is open to speculation, depending on the reburn situation.

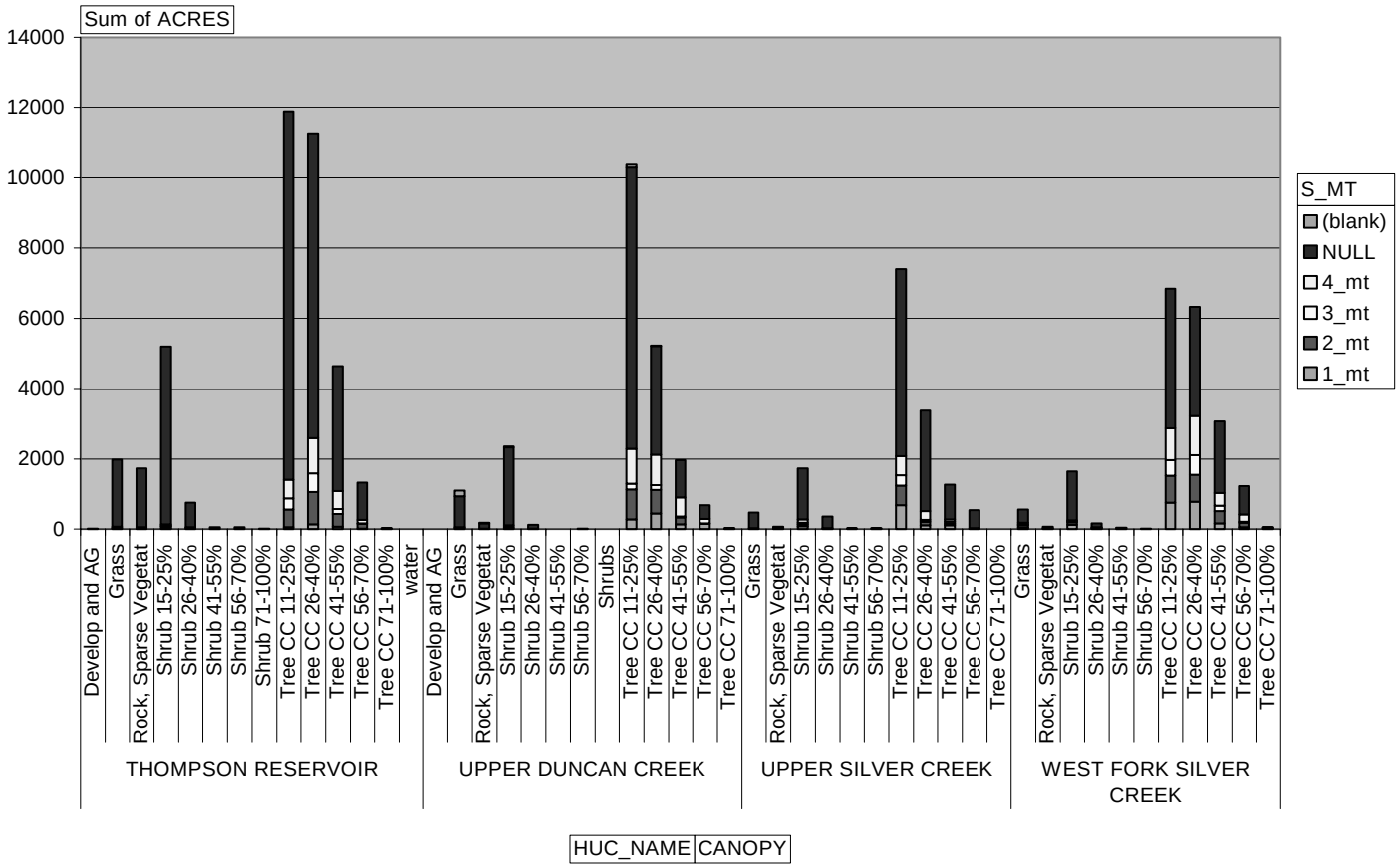
The upland vegetation condition also has some effect on the condition of riparian communities. The mortality from the fires again provided a benefit by reducing the large shrub and conifer component, which will result in more subsurface water moving into the riparian areas.

Relationship of Post-Fire Condition to Historic Range of Variability

The following bar graphs depict the amounts of mortality within the Toolbox project area, by subshed and by ISAT canopy closure category. Notable on these charts are the large amounts of unburned vegetation in every subshed, and the proportionately higher amounts of mortality in the stands with higher canopy closures.

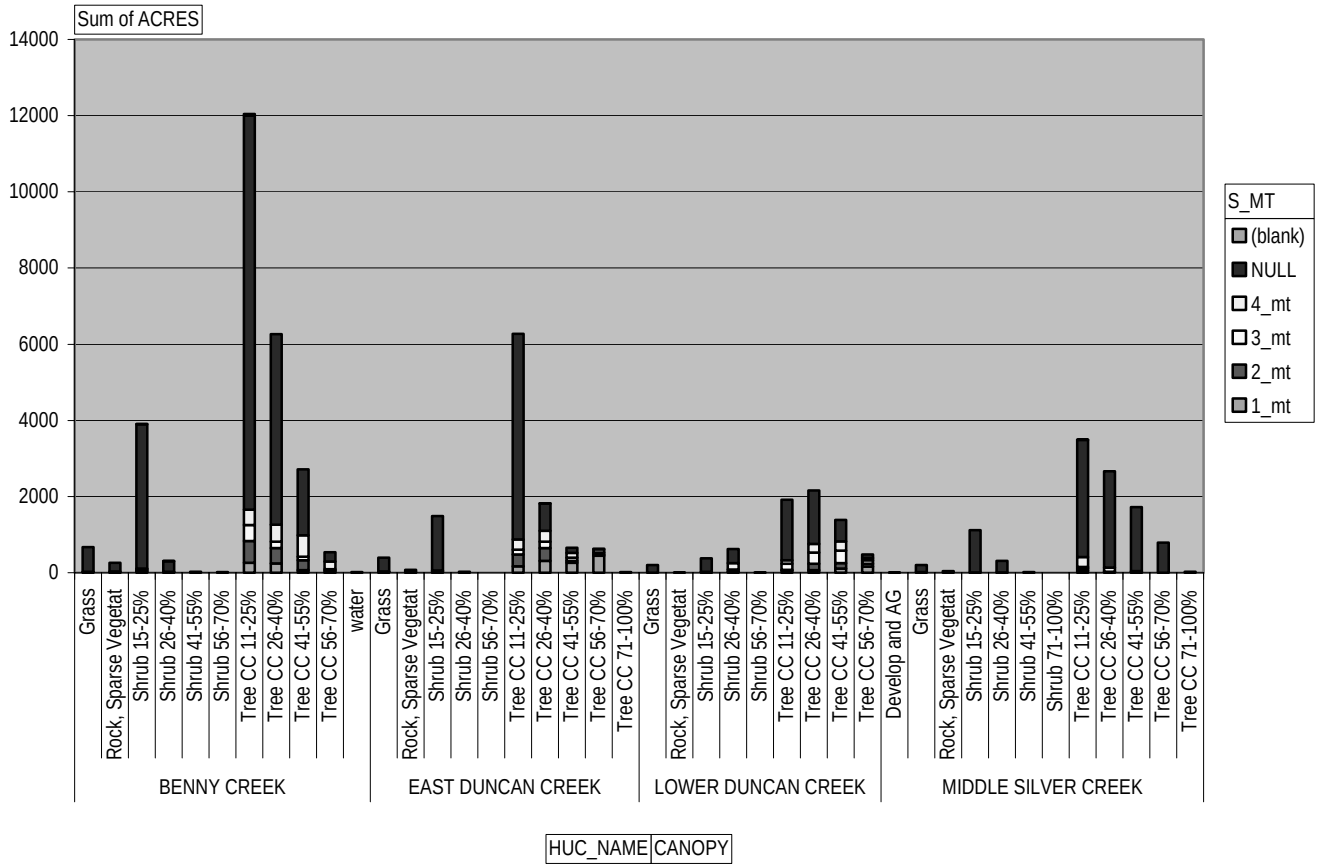
The last two bar graphs in this group show how stand conditions have shifted with respect to HRV as a result of the 2002 fire. This project proposes to remove only dead and dying trees (except for the noncommercial plantation thinning). Thus, the relevance of HRV analysis to this project is to gain understanding that will be useful in developing objectives and silvicultural prescriptions for the creation of forests that are sustainable over the long term.

Figure 3.7 Current Condition - Percent Mortality or Null (Unburned), by ISAT Satellite Imagery Classification by Subshed



Note: In many cases the denser CC (Canopy Closure) areas received proportionally higher mortality.

Figure 3.7 Current Condition - Percent Mortality or Null (Unburned), by ISAT Satellite Imagery Classification by Subshed (continued)



Note: In many cases the denser CC (Canopy Closure) areas received proportionally higher mortality.

The following charts are a summary of the post-fire condition. These charts show the shift in ponderosa pine stand type densities, using ISAT data categories, for the two ponderosa pine scenarios described above.

Figure 3.8 Summary of the Toolbox Fire Recovery Project Post-fire Condition – Scenario 1

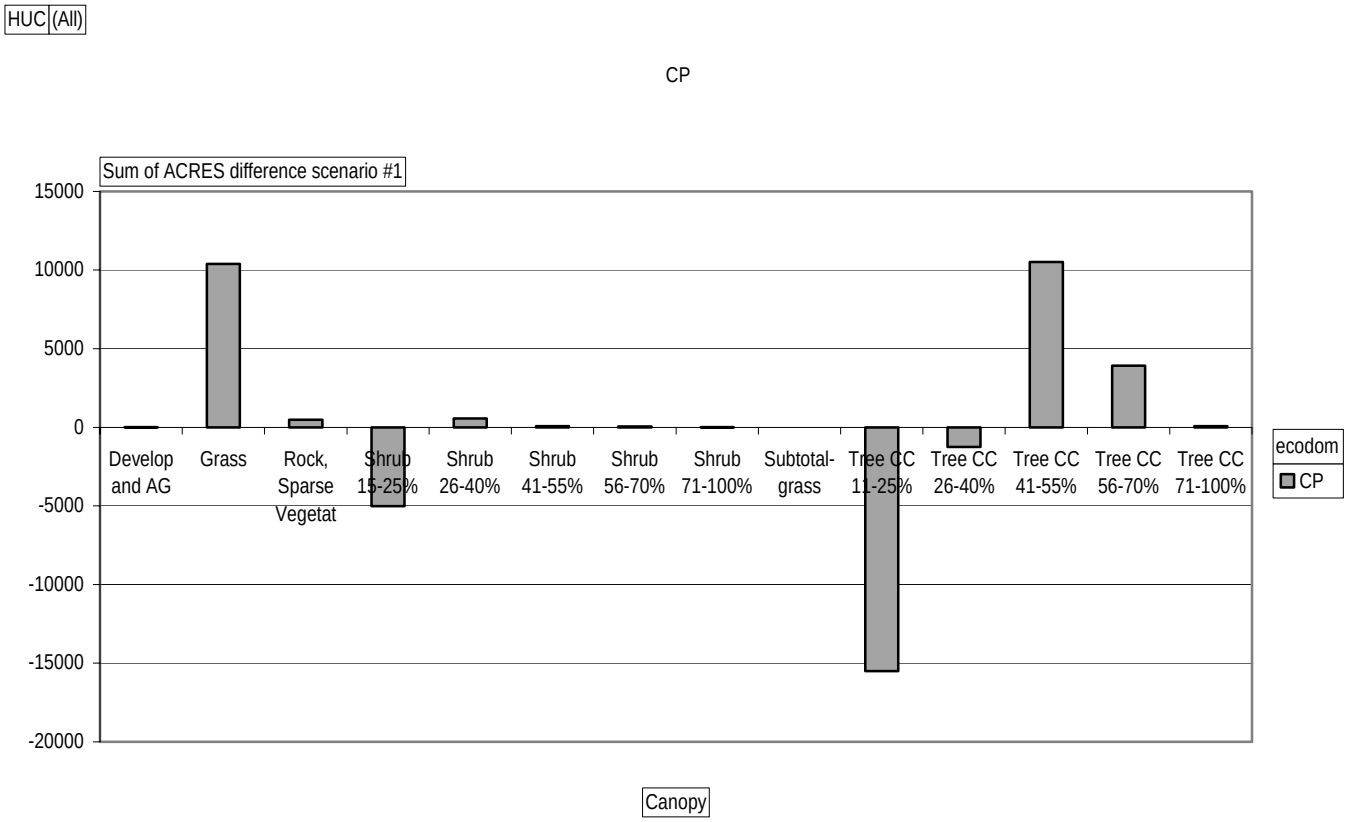
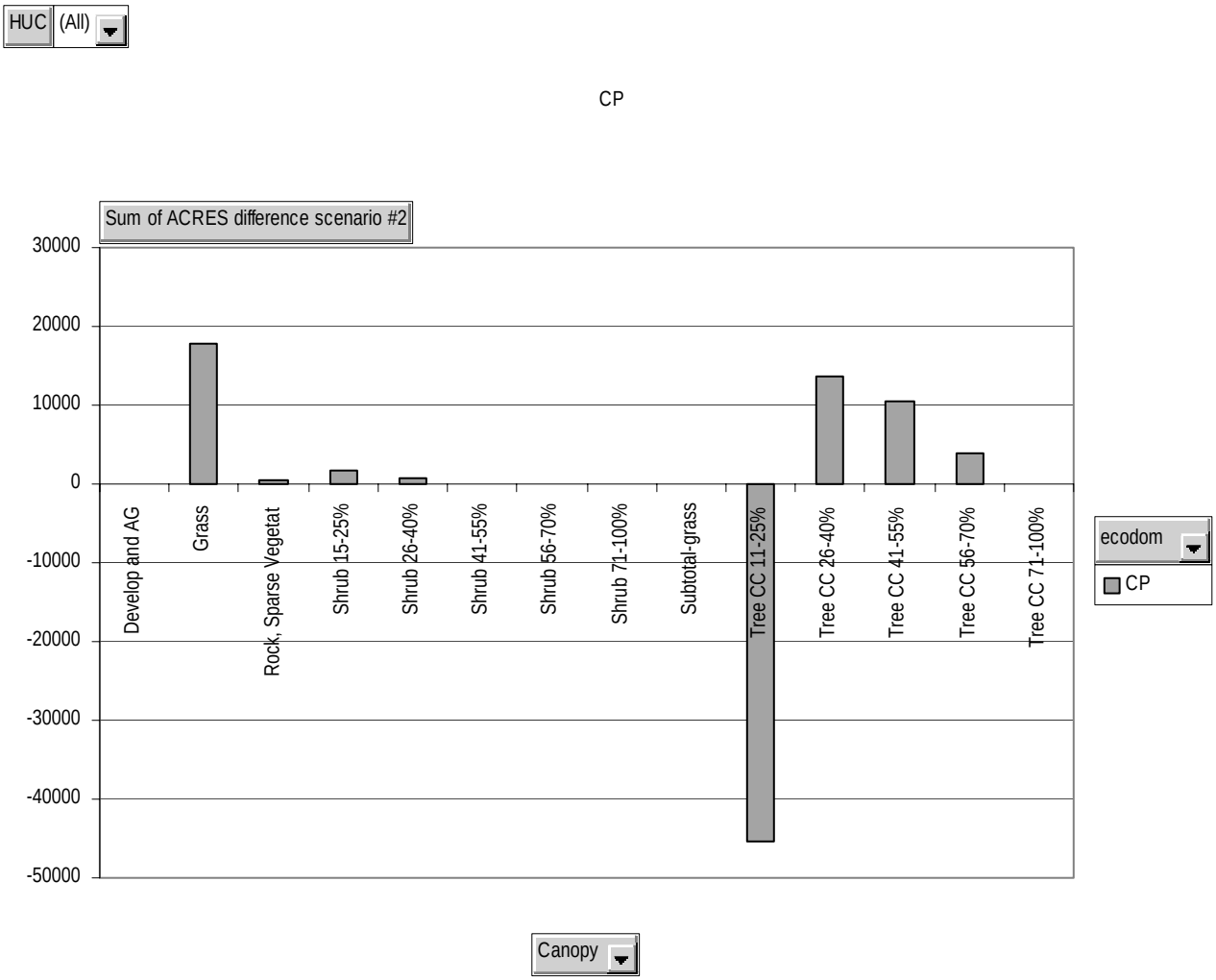


Figure 3.9 Summary of the Toolbox Fire Recovery Project Post-fire Condition – Scenario 2



Past Management Activities and Their Role in Shaping Landscape Diversity

Geographic Information System (GIS) records for the Ranger District and the Forest were used to complete a detailed analysis of past management activities and their role in shaping the landscape on which the 2002 fires occurred. The analysis data and detailed discussions can be found in the project file. GIS data layers used to conduct the analysis included the Silvicultural Activities Tracking layer, SAT layer, various fuels treatment layers, and the wildfire history layer. These layers record activities dating back to the early 1970s. Prior to this time, vegetation management treatments emphasized individual selection of large, old trees at high risk of dying within 10 years (known as "high-risk" cutting) as well as salvage and planting in stand replacement fires. This high-risk cutting generally removed only a few trees per acre. The major effect of such treatments was to reduce snag levels for the decade or so after the harvest. The only effect that might have persisted to recent times would be some possible reduced levels of down wood that these large "high-risk" trees might otherwise have become. In addition to the intensive treatments discussed above, all of the forested lands within the project area have had at least one, and most often two or three timber harvest activities in the past.

To summarize the analysis, acres of past treatment activities were grouped into categories of harvest activity—intermediate harvest, even-age regeneration harvest, uneven-age regeneration harvest, and salvage harvest, and further divided into treatment categories that included these harvest activities in association with various combinations of follow-up treatments, including thinning, planting and/or underburning. Acres that received no harvest but did have thinning, planting, and/or underburning were also assessed, as well as acres that received fuels reduction treatments such as mowing or removal of small trees (4 inches dbh and smaller).

Past treatment activities were compiled from the GIS records to show cumulative activities on a given site. Acres of treatment are not truly additive, since many acres in the project area have received multiple treatments, while many other acres have received no treatments. Overall, 100 percent of the forested acres within the project area received one or more treatments.

These acres of past treatment activities were then correlated with the various areas of vegetative mortality resulting from the 2002 fires, to examine whether there might be a tie between past treatment activities and fire behavior and results. Many of the treatments carried out in the 1970s had silvicultural objectives and prescriptions at cross-purposes with the present-day understanding of what conditions are needed to maintain sustainable ponderosa pine stands. These treatments were prescribed during the era of intensive timber management, with the primary purpose of maximizing growth while allowing for numerous re-entries. The result was that many of these stands had the larger trees removed but were still left quite heavily stocked. For many different reasons, the anticipated re-entries often did not occur and this contributed to the overstocked condition present in many stands within the project area at the time of the 2002 fires. Still, for those stands that did receive treatments that reduced density, the analysis shows a correlation between lower density and lowered susceptibility to fire mortality. The maps on the following pages display past harvest, planting, and fuels reduction units across the eight subsheds and within the project area.

Figure 3.10 Past Harvest Activities – Silver Portion

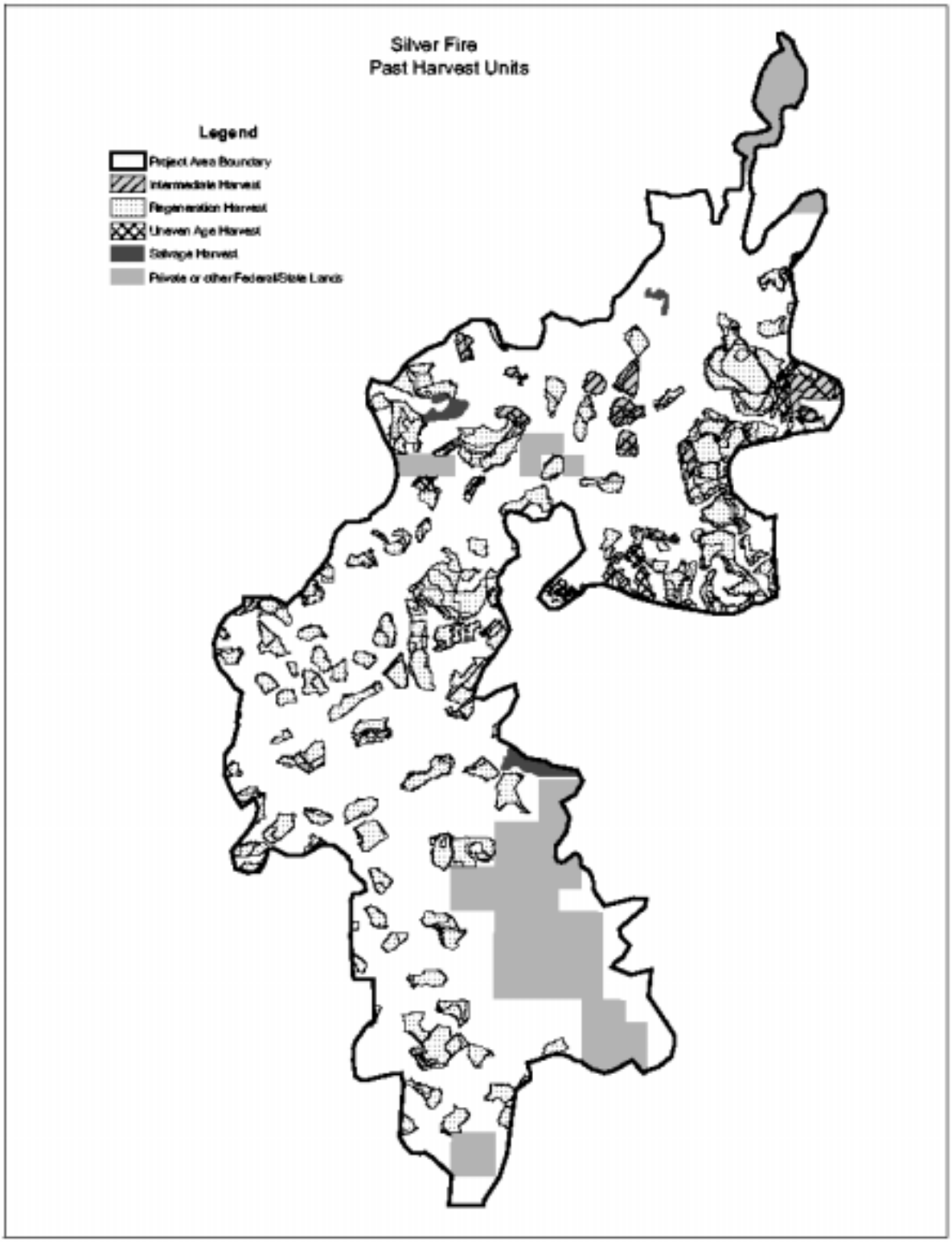


Figure 3.11 Past Harvest Activities – Toolbox Portion

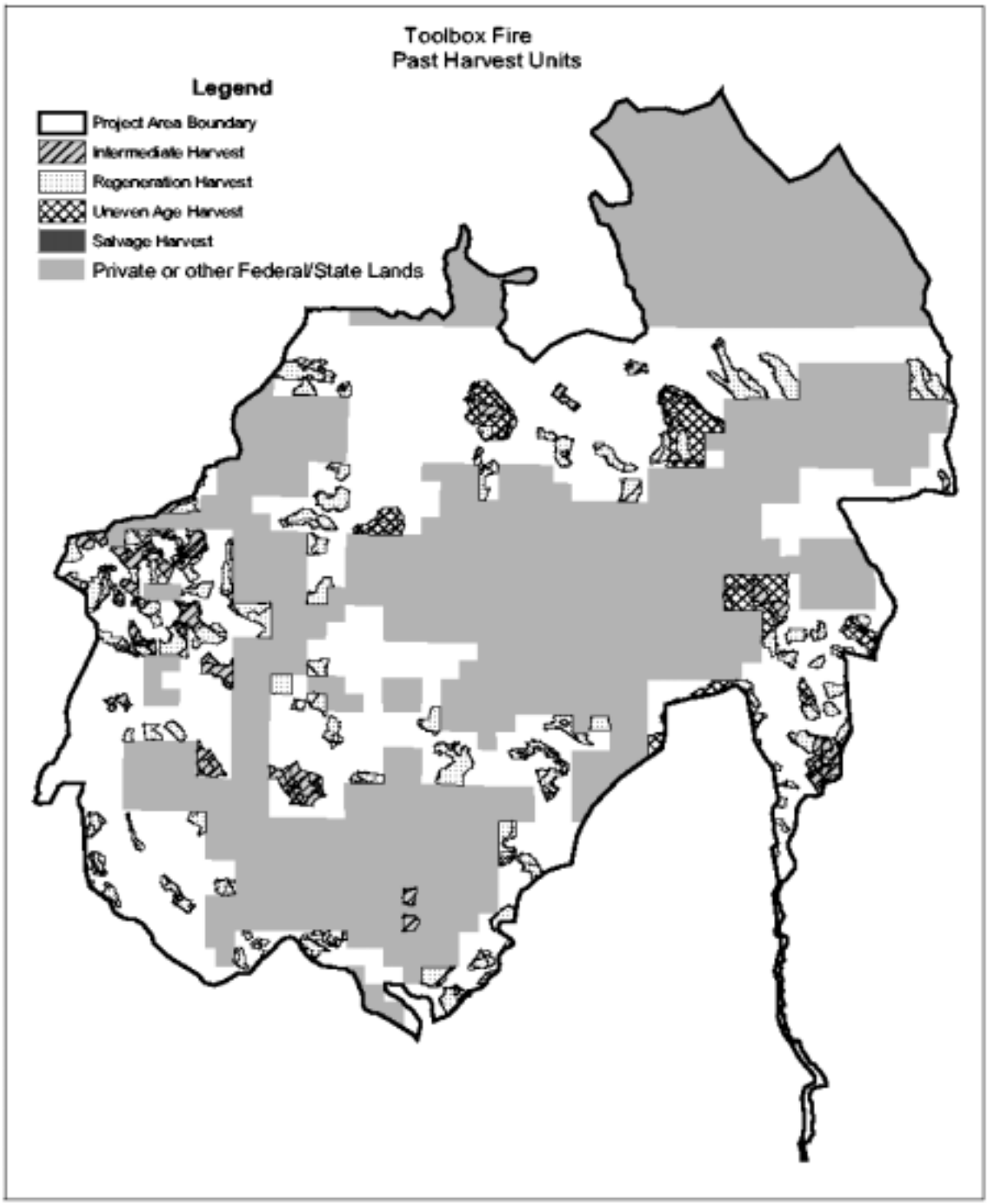


Figure 3.12 Past Planting Activities – Silver Portion

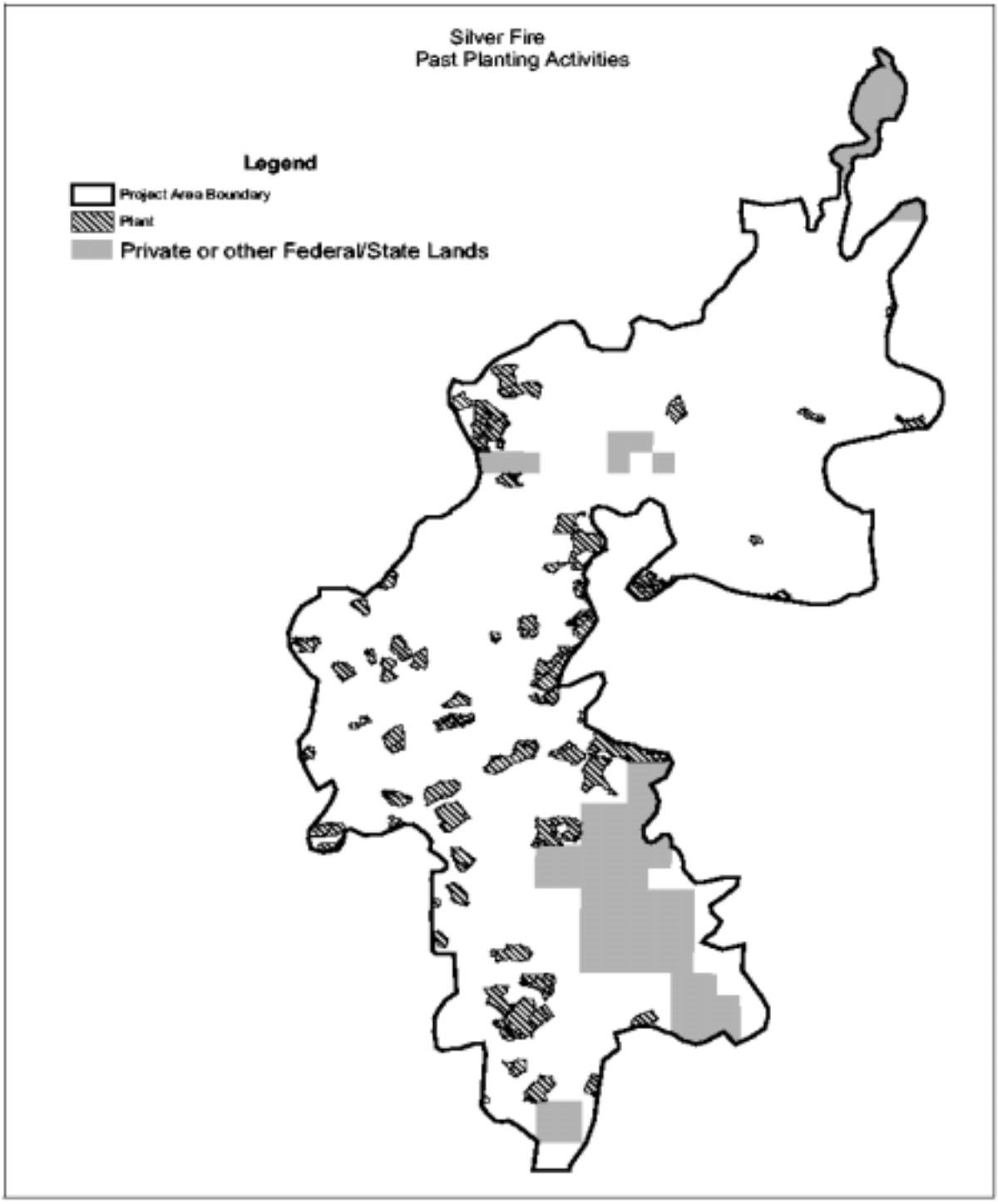


Figure 3.13 Past Planting Activities – Toolbox Portion

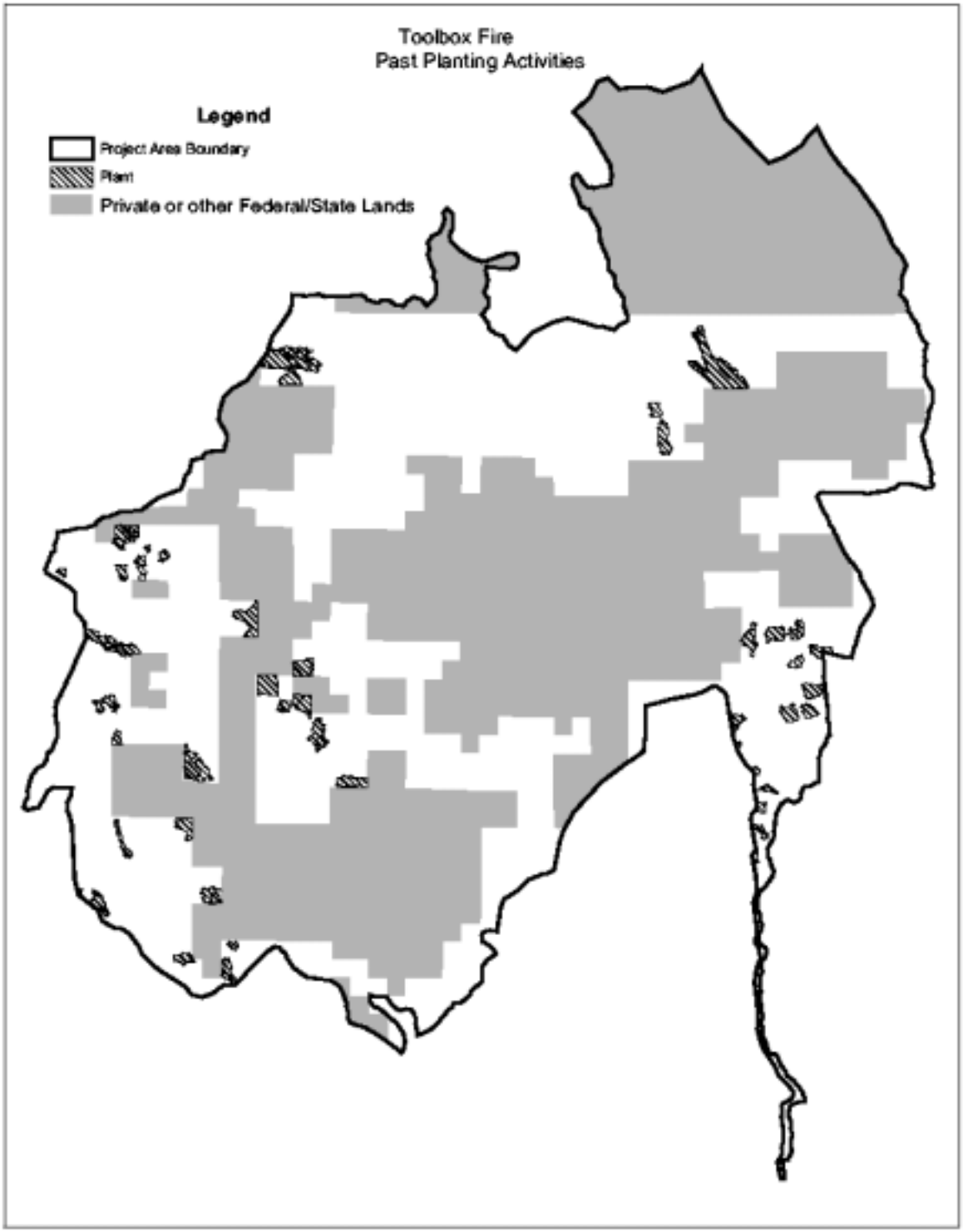


Figure 3.14 Past Fuel Reduction Activities – Silver Portion

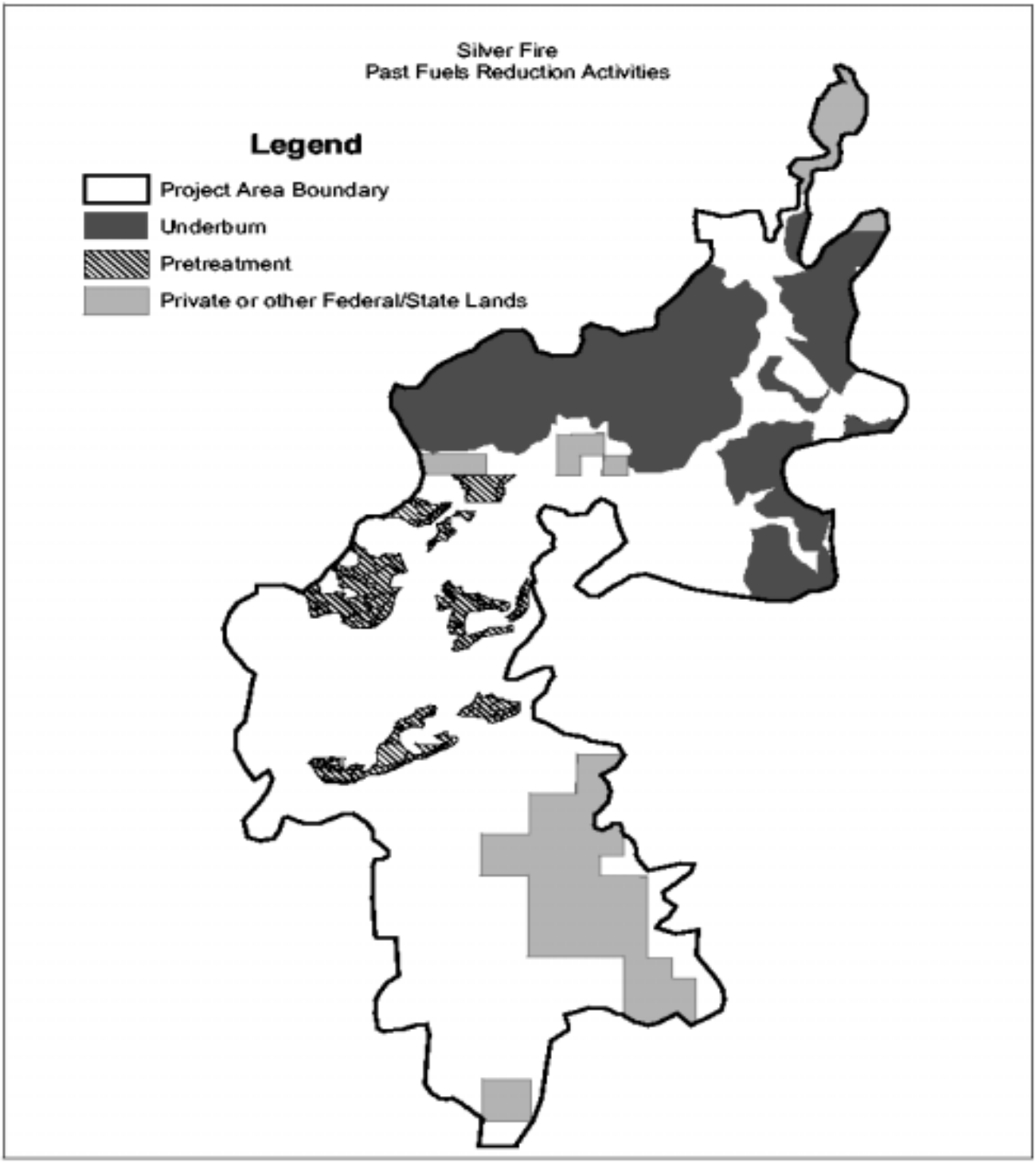
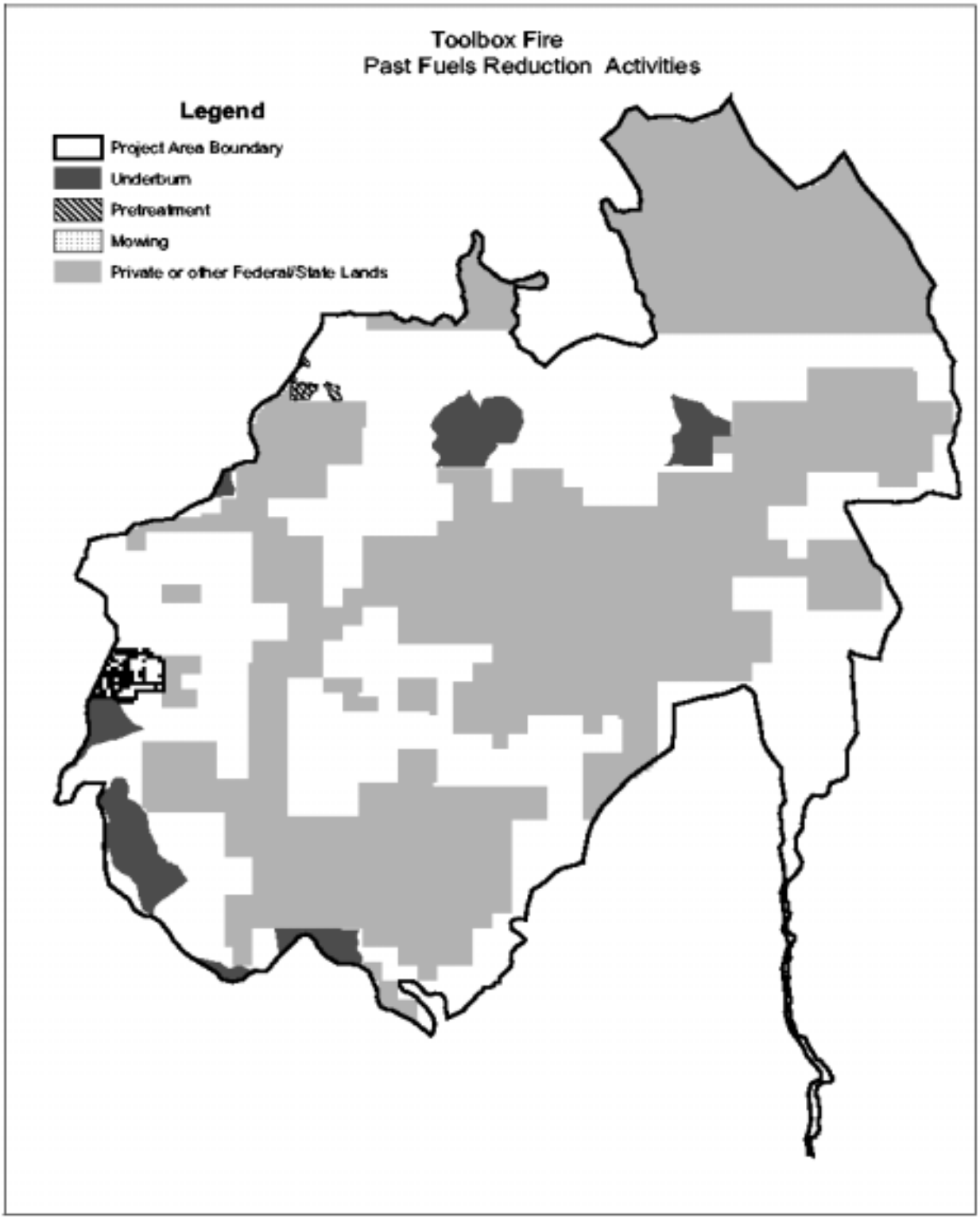


Figure 3.15 Past Fuel Reduction Activities – Toolbox Portion



Environmental Consequences

Background

This section presents the environmental effects predicted for the different alternatives, including the "No Action" Alternative (A) on the forested plant communities within the project area. The alternatives to the proposed action were developed to evaluate different potential responses to the purpose and need, and to key issues raised during public scoping.

Determination of Dead and Dying Trees

Predicting whether conifers damaged by wildfire will live or die is not an exact science. Yet it is important to establish criteria for when to consider a tree as dead and to anticipate likely mortality conditions so salvage harvest, reforestation, fuels reduction, wildlife leave areas, and riparian area rehabilitation treatments can be designed to accomplish their objectives without unnecessary expense and logistic difficulties. For instance, consider a stand with 60 percent of its trees killed by fire, and another 30 percent so damaged that they are at high risk of dying within two years. If the planned treatment for that stand is to salvage the dead trees, reduce fuels and reforest, it would be expensive, inefficient and potentially damaging to soils to enter the stand twice--once to remove the already-dead trees and a year or two later to remove the now-dead 30 percent component.

The challenge is to predict with a high degree of confidence which trees have sustained enough damage to make mortality very likely within one to three years following the fire. Much attention has been given to this issue by researchers (Agee, 1993; Ryan, 1982; Wagener, 1961). The following discussion considers only the primary effects of fire on tree mortality. Secondary effects, such as mortality from future insect infestations, are discussed elsewhere in this section.

According to Wagener, the minimum requirement for vigorous ponderosa pine living after a fire is moderate (less than 25 percent) cambium injury and 15 to 25 percent or more green foliage. The Toolbox project area is generally poor vigor. This data was for trees not under drought stress mid-season and with 50 percent or greater live crown. Ryan (1982) concludes that few trees survive the loss of more than 80 percent of their crown length after a fire. Agee (1993) has shown that the amount of time in which fire damage kills white fir cambium is about half the time fire damage takes to kill ponderosa pine cambium, due to bark thickness. White fir is basically twice as susceptible to mortality from fire as is ponderosa pine.

For many years the standard of 30 percent or less live crown (for mature trees that have achieved much of their height growth potential) was used as the key indicator of imminent mortality on the Fremont-Winema National Forests. This standard means if a tree retains less than 30 percent bright green crown following a fire, it is regarded as very likely to die within one year. This 30 percent standard was a modified version of *Guidelines for Estimating the Survival of Fire-damaged Trees in California* (Wagener, 1961). Wagener also identifies 50 percent live crown as the minimum criterion for survival of ponderosa pine in a mid- or late-season fire.

Within the last decade, managers have used varying standards of live crown retention as an indicator of survival or mortality when trying to decide which trees are likely to die and should be salvaged. In the seven years prior to 2002, the Fremont-Winema National Forests experienced three fairly large fires: the Thomas fire, the Lone Pine fire, and the Robinson Springs fire. For these fire areas, the guideline used for predicting which trees were very likely to die varied between the 20 percent live crown minimum or the 30 percent live crown minimum. The experience gained in relation to these fires indicated that it is far more likely that a tree with 20 to 30 percent live crown will die, than that a tree with less than 20 percent crown will recover. This is consistent with findings by Wagner (1961), Ryan (1982), and Agee (1993).

Using researchers' findings in combination with this local experience, silviculturists for the Fremont-Winema National Forests have determined that for the purposes of the Toolbox project, a tree with less than 20 percent bright green crown will be considered dead.

White fir is highly susceptible to cambium death from heat damage. This occurs generally at the root collar or within the first few feet above the ground. Random sampling of "green" trees has been conducted during spring and early summer of 2003 (Pierce, 2003). This sampling consistently has confirmed that "green" white fir less than 21 inches dbh that show even light char on a portion of the bole have dead cambium the entire circumference of the bole. In "green" trees greater than 21 inches dbh, the cambium death has been more variable.

For the purposes of the Toolbox Fire Recovery Project salvage, any white fir with less than 20 percent bright green crown will be removed. In addition, any white fir less than 21 inches dbh, regardless of crown condition, will be removed as fire-damaged if bole char is visible for 30 percent or greater circumference of the bole or root collar.

Direct and Indirect Effects

Alternative A (No Action)

The effects of Alternative A on forested plant communities are described first, as this alternative provides a baseline against which readers can evaluate the advantages and drawbacks of the action alternatives. Alternative A assumes no human intervention to change environmental conditions within the Toolbox project area. No commercial salvage harvest, thinning, or tree cutting would take place other than hazard trees that must be cut for public safety. No lands would be reforested, and the road system would remain as it is today. No prescribed burning or other fuels reduction treatments would take place; dead trees would be left to follow their expected path of decay and eventual collapse to the forest floor. Stream channels and riparian areas would be left to recover without intervention.

The following narratives describe predicted forested community development in a no-action scenario over the next 30 to 60 years. For the purposes of this section, short-term is considered to be 30 years or less. This assessment is done for each mortality mapping category (1-25 percent, 26-50 percent, 51-85 percent, 86-100 percent), as predicted conditions vary somewhat within these different categories. (Mortality mapping was completed as of early September 2002. Significant increases from fire damage are expected to develop by summer 2003. Additional mortality from bark beetles is anticipated, especially in the 26-85 percent mortality range.) In the average conifer stand, no harvest, fuels treatment, planting, later harvest or thinning, or cultural treatments would take place.

First 30 Years:

1 to 25 Percent Vegetative Mortality

The conifer component still overstocked for sustainable condition. Essentially all dead has fallen, resulting in increased fuel loading. By the end of the period 1 to 3 inch fuels are deteriorating. Stress related mortality is slowly killing larger trees. Dense young regeneration has developed adjacent to live trees, interspersed with heavy fuels. There is significant damage to young regeneration but little mortality from falling dead. The small mortality pockets from the fire have mostly seeded in with conifers, but also have an abundant grass/shrub component. Additionally, multiple wildfires would have occurred in this time period, which would have caused additional pockets of mortality and, potentially, soil damage in pockets of heavier down fuel.

26 to 50 Percent Vegetative Mortality

Patches of conifer component are still overstocked for sustainable condition. Bark beetle mortality has continued for many years. Many of these stands now have greater than 50 percent mortality from a combination of fire and insects. Essentially all dead has fallen, resulting in increased fuel loading. By the end of the period 1 to 3 inch fuels are deteriorating. Dense young regeneration has developed adjacent to live trees, interspersed with heavy fuels. There is significant damage to young regeneration but little mortality from falling dead. The mortality pockets from the fire have an abundant grass/shrub component. Some conifer establishment has occurred at the edge of the burned area where seed trees were present. Depending on the virulence of the bark beetle activity, many additional larger trees have been killed and more of these acres have moved into the 50 percent mortality category. Aspen regeneration in areas of high mortality that are subwatered is present, but less abundant than in the 50 percent or greater mortality areas. Additionally, multiple wildfires would have occurred in this time period, which would have caused additional pockets of mortality and soil damage (Hall, 2003) in pockets of heavier down fuel.

51 to 85 Percent Vegetative Mortality

Only small patches of residual live mature conifers remain. Many larger conifers succumbed to fire damage, and the remaining ones received concentrated bark beetle attacks from broods that developed in the recently dead trees. Most of the area has little conifer stocking, but does have an abundant, vigorous shrub component growing in a heavy fuel bed from the down trees. Aspen regeneration in subwatered areas is abundant. Surviving mature conifers are receiving competition stress from the immediately adjacent natural regeneration. Essentially all dead has fallen, resulting in increased fuel loading. By the end of the period 1 to 3 inch fuels are deteriorating. Prescribed fire cannot safely be reintroduced into the stand to kill the excess regeneration due to the high fuel loading. At the end of the 30-year period the remaining LOS trees are slowing dying due to the stress provided by the regeneration from that mother tree. Fuel loadings range from 60 to 120 tons (Hall, 2003). Due to the expense, only a few small areas have been precommercially thinned and had fuels treatment. Additionally, multiple wildfires would have occurred in this time period, which would have caused additional pockets of mortality and soil damage (Hall, 2003) in pockets of heavier down fuel.

86 to 100 Percent Vegetative Mortality

Almost no residual live mature conifers remain, and natural regeneration of pines has only occurred within 100 or so feet of these residual trees. Many larger conifers succumbed to fire damage, and the remaining ones received concentrated bark beetle attacks from broods that developed in the recently dead trees. The area does have an abundant, vigorous shrub component growing in a heavy fuel bed from the down trees. Aspen regeneration in subwatered areas is abundant. The few surviving mature conifers are receiving competition stress from the immediately adjacent natural regeneration. Essentially all dead has fallen resulting in increased fuel loading. By the end of the period 1 to3 inch fuels are deteriorating. Prescribed fire cannot safely be reintroduced into the stand to kill the excess regeneration due to the high fuel loading. At the end of the 30-year period the remaining LOS trees are slowly dying due to the stress provided by the regeneration from the mother tree. Fuel loadings range from 60 to 120 tons (Hall, 2003). Due to the high cost of fuels treatment, only a few small areas have been precommercially thinned and had fuels treatment. Additionally, multiple wildfires would have occurred in this time period, which would have caused additional pockets of mortality and soil damage (Hall, 2003) in pockets of heavier down fuel.

<u>30 – 60 Years Post-fire:</u>

1-25% Vegetative Mortality

The conifer component is highly stocked with trees less than 8 inches dbh. Few larger trees are present. By the end of this period much of the 3 to 8 inch fuels have deteriorated, but the larger fuels from both the fire kill and subsequent mortality are still present. Very high small tree conifer stocking is present across essentially all of the area. The fire-killed pockets have been regenerated and the continuing stress-related mortality has only killed the larger trees, leaving the reproduction. The ponderosa is mostly in a stagnated state. Aspen is nearly absent. Shrub and herbaceous vegetation is nearly absent. Most of the existing reproduction is too highly stocked to produce cones with significant viable seed. Only the occasional tree growing under less competition is developing large tree structure and is capable of reseeding the immediate area if necessary. Conditions that would contribute to stand high intensity and stand-replacement wildfire have persisted. If fires occur, the result would be the creation of patches of various sizes that are mostly shrubs, some aspen, and herbaceous vegetation.

26-50% Vegetative Mortality

The conifer component is highly stocked with trees less than 8 inches dbh. Few larger trees are present. By the end of this period much of the 3 to 8 inch fuels have deteriorated, but the larger fuels from both the fire kill and subsequent mortality are still present. Very high small tree conifer stocking is present across essentially all of the area. The fire-killed pockets have been regenerated and the continuing stress-related mortality has only killed the larger trees, leaving the reproduction. The ponderosa is mostly in a stagnated state. Aspen is nearly absent. Shrub and herbaceous vegetation is nearly absent. Most of the existing reproduction is too highly stocked to produce cones with significant viable seed. Only the occasional tree growing under less competition is developing large tree structure and is capable of reseeding the immediate area if necessary. Conditions that would contribute to stand high intensity and stand-replacement wildfire have persisted. If fires occur, the result would be the creation of patches of various sizes that are mostly shrubs, some aspen, and herbaceous vegetation.

51-85% Vegetative Mortality

The majority of the area is shrubs, aspen, and herbaceous vegetation. There are small patches of highly stocked conifers, generally with trees less than 8 inches dbh. Few larger trees are present. By the end of this period much of the 3to 8 inch fuels have deteriorated, but the larger fuels from both the fire kill and subsequent mortality are still present. The fire killed pockets have regenerated to shrubs, aspen, and herbaceous vegetation. Conditions that would contribute to stand high intensity and stand-replacement wildfire have persisted. If fires occur, the result would be the creation of patches of various sizes that are mostly shrubs, some aspen, and herbaceous vegetation.

86-100% Vegetative Mortality

The majority of the area is shrubs, aspen, and herbaceous vegetation. There are small patches of highly stocked conifers, generally with trees less than 8 inches dbh. Few larger trees are present. By the end of this period, much of the 3 to 8 inch fuels have deteriorated, but the larger fuels from both the fire kill and subsequent mortality are still present. The fire killed pockets have regenerated to shrubs, aspen, and herbaceous vegetation. Conditions that would contribute to stand high intensity and stand-replacement wildfire have persisted. If fires occur, the result would be the creation of patches of various sizes that are mostly shrubs, some aspen, and herbaceous vegetation.

Vegetative Management Activities Common to All Action Alternatives

All action alternatives share the common long-term silvicultural objective of restoring Late and Old Structure (LOS) forested communities, in accordance with Regional Forester's Eastside Forest Plans Amendments #1 and #2, across the project area, on the sites where they would normally occur. The Historic Range of Variability (HRV) would be used as a reference point to ensure that silvicultural prescriptions promote the development of forest conditions that are sustainable over the long term.

The fire behavior that resulted in the sites of higher vegetative mortality over much of the Toolbox Complex was outside the range of historical fire behavior for ponderosa pine and mixed conifer (ponderosa pine-dominated) stand types in this area. It is also likely that re-occupancy of these extensive burned areas with mature ponderosa pine through natural seeding would take hundreds of years. Regeneration of ponderosa pine by natural seeding occurs in relatively infrequent pulses, depending on favorable conditions for seed production, and the presence of numerous seed trees. Consumption of the seed by small mammals, and the fact that ponderosa pine seed is heavy and generally does not disperse very far from the parent tree (Barrett, 1966) also slows the re-establishment of ponderosa pine across large areas.

All action alternatives would propose the same set of silvicultural prescriptions to achieve the re-establishment of LOS forested communities within the project area. What would vary among alternatives is how many acres would be treated and where the treatment units would be located. All action alternatives propose some amount of planting, as most areas no longer have enough seed trees to assure natural regeneration.

Proposed Stand Prescriptions

The following section summarizes the proposed stand prescriptions common to all action alternatives. Because additional mortality is expected in the next one to three years, the prescription would be applied according to the stand condition at the time of treatment, not at the time of the vegetative mortality mapping (September 2002). The conifer species to be planted would include ponderosa pine and lodgepole pine, if the natural regeneration expected for this species did not occur.

Salvage Harvest

- For stands to be treated, all merchantable trees (generally 14 inches dbh and above, although this would depend on the degree of deterioration at the time of harvest) that were outside of designated wildlife leave areas would be removed if they exhibited less than 20 percent bright green crown, or in the case of white fir, showed bole scorch to 30 percent or more circumference of the bole, regardless of crown condition. The extent to which salvage harvest would be applied to a given stand depends on how hot the stand burned, what the burning pattern was, and the extent of resulting mortality (immediate or likely within the next two years). For:
    - Lighter-mortality areas with previous entries—most commonly, these were stands that had been treated before the 2002 fire with one or more harvest entries, followed by thinning and one or more underburning treatments. Often very little mortality occurred, and that was primarily in small clumps or individual trees. Generally, these dead trees would not be salvaged, but would be retained to provide snag habitat and future organic matter to aid soil development. Small clumps or individual trees that pose a hazard to public safety because of their proximity to roads or recreation use areas would be salvaged and planted, if no adequate seed source were present for natural regeneration. If these salvage areas were smaller than 10 acres, wildlife leave clumps would not be designated (see Wildlife section for further discussion on how wildlife habitat needs are addressed).
    - Lighter-mortality areas with fewer or no previous entries—often, in stands with few or no previous entries, enough ladder fuels were present that the fire created a series of repetitive, small "torching" burns instead of a true crown fire. These torching burns resulted in heavy mortality, ranging from small clumps of trees to patches of several acres or more. Small clumps of mortality of a few acres or less that are surrounded by a live stand would be left for habitat and soils purposes, as with the category above. The same approach described above would be used for hazard trees and wildlife leave clumps.
    - Heavier-mortality areas—most commonly, these were thickly-stocked stands with trees of many size classes, old woody brush component (most often bitterbrush), or both. Although these stands may have had past entries, those entries did not remove enough to reduce the high fuel load and ladder fuels. Fire in these stands progressed by spotting, torching, or as a wind-driven flaming front, and generally resulted in complete or nearly complete mortality. The patches that remained unburned also remain very densely stocked. Wildlife leave areas and clumps would be provided in these heavier mortality areas. The remaining merchantable trees

that have less than 20 percent bright green crown (or in the case of white fir, have 30 percent or greater circumference or more of the bole scorched, regardless of crown condition) would be removed.

Natural Regeneration

- Reforestation by natural regeneration would be favored in areas with an adequate seed source (except for white fir), or where enough natural regeneration has already developed from soil seed bank. The regeneration objective established by the Forest Plan is 100 seedlings per acre. On a relatively small, lightly burned site, a few mature trees with high seed production would be enough to naturally regenerate the area over time. In situations where the stand has been salvage harvested, is below minimum stocking of residual live trees, and has not naturally regenerated at four years post-harvest, planting would occur in year five to meet the five-year regeneration requirement.

Planting (Factors applicable to all areas of conifer planting)

- Would not require planters to plant seedlings within 150 feet of an aspen plant greater than 5 feet tall.
- Would require planters to pull or clip any seedlings planted within 50 feet of an aspen plant greater than 5 feet tall.
- Would not plant within 50 feet of a riparian area.
- Would not plant within 35 feet of an acceptable, live pine tree with at least 40 percent live crown.
- Would not plant in meadow encroachment areas (shown on the following map). These areas are along edges of units and total 337 acres.
- Planting prescriptions would be site specific and time specific. The objective would be 100 well-distributed (over at least 80 percent of the stand) seedlings per acre that are expected to survive to maturity. Planting density would be adjusted to site conditions and designed for that objective. Plantation survival on these sites historically had often been 80 to 90 percent or better, although those seedlings were often planted the spring following the harvest activity. For the Toolbox project, seedlings are not available and have to be grown in the nursery, which means there will be a time lag of two years or more between when sites are salvaged and when they are planted. The planting window (moisture and temperature conditions that favor good survival) is often short in this area, averaging six weeks for a given site; however, yearly fluctuations are very wide. It is estimated that initial planting for the project as a whole would not be complete until spring of 2008. See the Forested Vegetation resource report for additional past survival data and the reforestation plan (by alternative) to insure timely reforestation.
- Each year post-fire would allow for increasing establishment of competing surface vegetation to occur. Conifer seedlings compete very poorly against well-established grass and brush, and higher seedling mortality would occur as competing vegetation increased. Hand scalping, up to 3 feet by 3 feet, would occur as part of the planting operation to remove plants immediately adjacent to the seedling, to help reduce such competition. However, this treatment would not greatly reduce competition for moisture from nearby well-established, deep-rooted vegetation. Past local experience has demonstrated success with this treatment. See the Forested Vegetation resource report for additional information.
- Planting densities would range between 130 to 400 seedlings per acre, depending on the amount of competing vegetation. The higher numbers would occur only on sites with thick, well-established competing vegetation. This condition would only be expected to occur in the last years of planting. The need for higher planting densities would be based on local, site-specific experience with seedling mortality rates.

Site Preparation

- In order to implement reforestation, site preparation to remove trees that would be hazardous to planting contractors (under Occupational Safety and Health Administration (OSHA) guidelines) would sometimes be necessary. Fire-killed trees can become a hazardous working environment as time passes and they begin to decay. Consultation with Oregon OSHA will be used as a guide to how much site preparation would be needed to remove standing dead trees for the purposes of hazard abatement. In areas where it was determined that site preparation for hazard abatement was needed, all dead standing trees outside of wildlife areas would be felled, lopped and scattered. Where concentrations of down material prevented access to planting spots additional treatment (either low-ground pressure mechanical treatments or burning) would occur. Mechanical treatments could include

bunching, mastication (with a slashbuster or similar equipment), roller-chopper, grapple piling, or yarding if a market developed.

Treatment Proposed in Alternatives C, D, G, and H

Noncommercial Thinning of Plantations Burned in the 2002 fires

There were approximately 5,000 acres of plantations, generally in 20 to 40 acre units, scattered throughout the fire area. The effect of the fire on these plantations varied widely. A key aspect to the pattern of mortality in the plantations is that where there was mortality, it was generally complete (close to 100 percent). Mortality within individual plantations is highly variable as far as how much of that plantation burned. Many plantations have complete mortality for ¼ to ½ of the plantation exposed to the hot side of the fire, and have no mortality in the rest of the plantation.

These plantations had most often been planted at densities of 500 to 800 trees per acre. Most plantations had survival rates greater than 90 percent and were 15 to 20 years old in 2002. This resulted in tight, thick young stands, with individual tree growth rates that had slowed due to competition. Some self-pruning of the lower branches had begun but most of the young trees still have enough lower branches to provide deer hiding cover.

The prescription proposed for the live portions of the plantations is to thin them to a density that will maintain, for a much longer period of time, the mule deer hiding cover qualities of the stand. Therefore, a first stage thinning, leaving between 125 to 170 trees per acre, would be conducted as part of this project. This density would only slightly increase individual growth rates and would not alone be sufficient to move stands to an LOS condition. However, it would maintain existing growth rates and cover qualities much longer. At the next precommercial entry, the stand would be larger and more economical to treat (because it would be less dense and fewer additional trees would need to be removed) than if this first entry thinning had not occurred.

Table 3.31 Growth Projection for Thinned Plantations

Stand Growth Basal Area (GBA)	126			
Year	**Trees/ac**	**DBH**	**BA/a**	**SDI**
2005	600	3	29.5	87
2015	120	6.5	27.9	61
2025	120	9.3	56.6	107
2035	120	11	82	144
2045	120	12.64	105	175
2055	120	13.8	124	201
2065	50	14.2	55.3	88
2075	50	16.2	71.9	109
2085	50	17.9	87	127
2095	50	19.3	101	143
2105	50	20.5	114	158
2115	50	21.5	126	171

Figure 3.16 Meadow Encroachment Areas That Would Not Be Included In Planting – Silver Portion

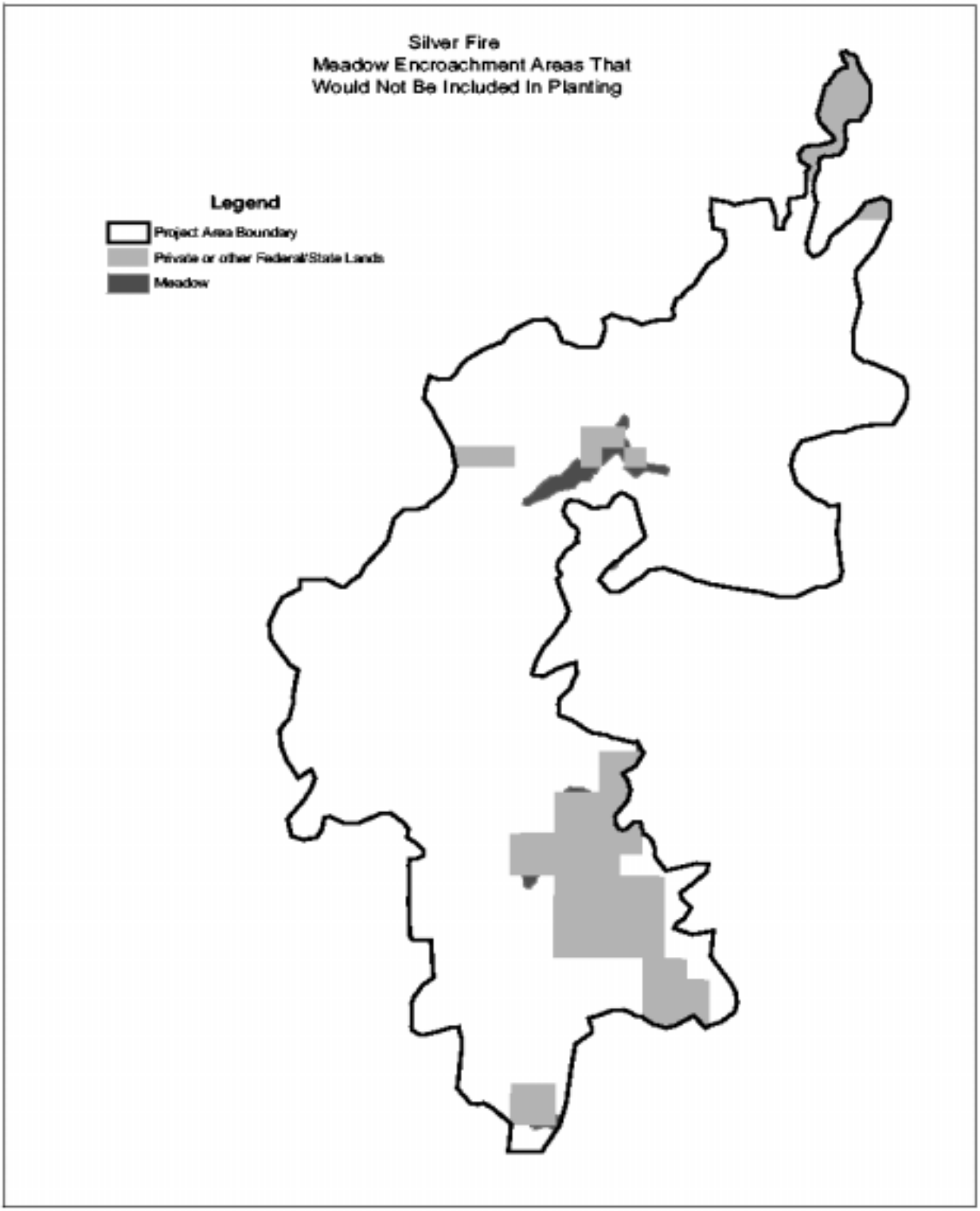
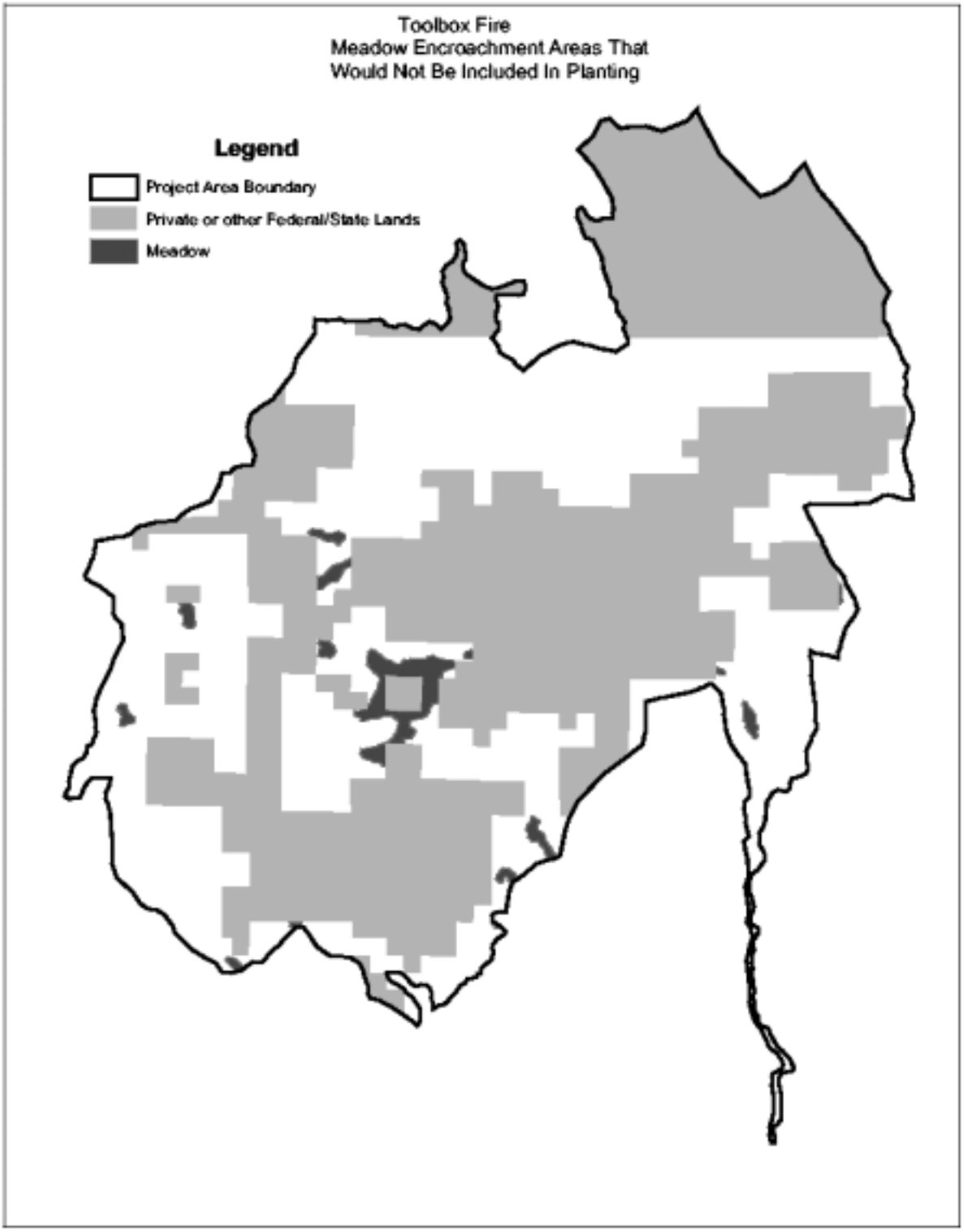


Figure 3.17 Meadow Encroachment Areas That Would Not Be Included In Planting – Toolbox Portion



Future Foreseeable Treatments

Future treatments such as non-commercial and commercial thinning would be needed to maintain the relatively open stand conditions that most favor the development and sustainability of LOS ponderosa pine stand types in this area. Initial plantings would be designed to develop a low density tree stocking. However, one effect of planting fewer seedlings per acre is that as those seedlings mature, they can begin to produce viable seed at a relatively young age, in some cases as young as 10 years. Vigorous, low density ponderosa pine would be expected to be producing natural regeneration by the time it is 20 years old. This would create the need for noncommercial thinning in the near future and commercial thinnings farther down the road.

Direct and Indirect Effects Common to All Action Alternatives

Effects of Excluding Treatments within Riparian Habitat Conservation Areas

No fuels treatments or conifer planting is planned within Class 1 RHCAs except for 22 acres in Alternative C. Most of the riparian areas experienced a high degree of mortality in the conifer component and moderate mortality in the riparian vegetation. The riparian corridors generally had a high stocking level. In the higher mortality areas this will produce a high fuel loading in 10 to 20 years as the dead trees fall. The riparian vegetation would be expected to respond vigorously in this same time period, since competition with conifers for light, nutrients, and moisture has generally been eliminated.

If, in the future, the heavy down fuels were to ignite, the likely high-intensity fire could jeopardize the long term success of reestablishment of riparian vegetation. Any wildfire with a fuel loading that heavy would severely damage riparian vegetation and soils (Hall, 2003). In the absence of fire, the down wood component would provide exceptional stream shading and protection. In areas that burn, it would be expected that most of the down wood would be consumed. Some of the large down logs would contain a very high moisture content from being in contact with water. These would be expected to persist after a wildfire, even one of high-intensity. The expected down fuel loading is likely to result in very hot fires at some time in the future for some of these areas. The timing and extent is difficult to predict, but the fire spread observed in the Toolbox Complex, especially in the Silver Fire area, was up the riparian corridors. These corridors experienced some of the most intense fire activity within the Toolbox Complex.

Some natural regeneration of conifers could occur in areas with seed producing ponderosa pine at the edge of riparian canyons. Because of the significant slope and height differences, reseeding could easily occur as far as 200 feet from the parent tree. Most of the riparian buffers are not greater than 600 feet in total width. Light natural regeneration could lead to development of future large wood that could provide for the future in-stream wood component.

Long Term Site Productivity

Long term site productivity would be maintained, and potentially enhanced by all action alternatives. One risk to long-term site productivity is the future effect of a hot surface fire burning in concentrations of down wood. This could have a negative effect on soil productivity (for further information see the Forested Vegetation Resource Report in the Toolbox Planning Record.). This effect could result from increases in fuel loading, especially large down logs, as the trees killed by the 2002 fires began to fall. All action alternatives would remove some of these dead trees. All of the proposed alternatives would retain some portion of the existing and future down wood. As the years go by, tree mortality would be expected to continue, although at a much lesser rate. As these trees fall, they would contribute to future soil organic matter.

Ground-based skidding would be restricted to sites with slope and soil types that would not be likely to develop detrimental compaction (based on experience with similar past similar activities and Forest Plan standards and guidelines). Other sites would either be helicopter yarded or would not be harvested. Planned fuels treatment activities would help to start the nutrient cycling process with which these sites evolved. On those sites where fuels treatment includes mastication, this breakdown of tree boles and limbs into small pieces would accelerate development of future soil organic matter.

Direct and Indirect Effects That Vary By Alternative

Stand Development

The following tables compare, for one acre in a hypothetical stand that experienced 100 percent mortality and was replanted with 130 ponderosa pine seedlings, how the stand on that acre would be expected to develop, with and without stocking control by means of thinning or underburning

The following table displays growth projections of planted stands with stocking level control maintained by fire or precommercial thinning in a 100 percent mortality area using Growth Basal Area (Hall, 1987).

Table 3.32 Growth Projections of Planted Stand – Stocking Level Control Maintained

Stand GBA		**126**			
Year	**Trees/ac**	**DBH**	**BA/a**	**SDI**	
2005	130	0.1	0.0	0	
2015	130	4.6	15.0	37	
2025	100	7.8	33.0	67	
2035	100	10	59	107	
2045	100	12.3	83	139	
2055	100	13.7	103	166	
2065	100	14.3	111.5	177	Commercial thinning, remove 50 Trees /ac
2075	50	15.8	68.5	105	
2085	50	17.5	84	123	
2095	50	19.0	98	140	
2105	50	20.2	112	155	
2115	50	21.3	124	169	Selection Harvest, remove 30 TA
Stand GBA\			126		

The following table displays growth projections of planted stand (with stocking level control not maintained) in a 100 percent mortality area using Growth Basal Area (Hall, 1987). Introduction of estimated natural reproduction into the formula was random. Pulses of reproduction are estimated at 400 seedlings per event, based on the condition of existing stands in the area. The subsequent reduction of trees per acre to 100 estimates the likely mortality that would result from intertree competition, insects and/or disease.)

Table 3.33 Growth Projections of Planted Stand - Stocking Level Control Not Maintained

Year	Trees/ac	DBH	BA/a	SDI
2005	130	0.1	0.0	0
2015	130	4.6	15.0	37
2025	100	7.8	33.0	67
	400	0.1	0.0	0
2035	100	10	58	106
	400	3	16	48
2045	100	11.85	77	131
	400	4.173	38	98
2055	100	12.9	90	150
	400	5.2	58	139
2065	100	13.2	94.9	156
Commercial thin 50 ta	400	5.5	66.3	154
2075	50	14.0	53.7	86
	400	6.4	88.0	193
2085	50	14.8	60	94
	400	7.1	111	232
2095	50	15.4	65	100
	400	7.7	130	264
2105	50	15.9	69	105
	400	8.0	138	278
2115	50	16.3	72	109
	400	8.4	153	301

The following narratives provide a summary description of the estimated effects on stand development over time in the different mortality categories, with sample scenarios applying the different sets of treatments proposed in the alternatives. These are compared with a sample scenario of "no treatments" (the No Action alternative) for that mortality category. The extent to which these predicted effects would occur across the project area landscape varies among alternatives, depending on how many acres in the particular alternative would receive the different treatment combinations. These narrative summaries are followed by tables that display, for each alternative, how many acres would be treated and with what treatment combination (as well as how many acres would receive no treatment).

Projections of potential stand development and growth were estimated using Growth Basal Area (Hall, 1987) growth formulas. The introduction of reproduction into the formula was random, and slight differences between scenarios are not meant to be significant. Pulses of reproduction are estimated at 300 or 400 seedlings per event, and, again, there is no significance of one choice over another. The numbers are based on the condition of existing stands in the area. Mortality would start to occur after the stand exceeded the stand GBA, i.e. the basal area for the type where growth drops below the threshold for susceptibility to bark beetle related mortality.

1-25 Percent Mortality Category (These stands are a matrix of lightly burned areas with patches of high to complete mortality, less than 5 acres in size. The majority of the area is densely stocked with multi-storied stands).

***Sample Scenario 1*:** Treatments occurring: Salvage; Fuels Treatment; Planting or Natural Regeneration; Future Precommercial Thinning and Underburning. Future commercial thinning.

Condition at year 2015: multi-storied stand. Stand includes, a few larger trees, some trees of this size class have already died from fire/beetle mortality, Most of the larger dead was removed by salvage harvest. Fuels were treated. Snag and future down wood is being recruited from light continuing bark beetle mortality in the stand. Larger patches of high mortality were planted or have naturally regenerated.

Condition at year 2025: some large trees are still persisting, excessive understory has been precommercially thinned, and fuels are treated. The stand is at low risk of stand replacement fire. Next understory removal can be done by fire. Individual tree vigor is moderate to low, due to heavy pockets of residual pre-fire stocking. Future harvest is a viable option for stocking control in that material.

Condition at year 2075; stand has been commercially thinned. Stand is very close to a single story structure although not yet an older mature stand. Most trees are greater than 14" dbh. Individual tree vigor is improving and grasses, forbs, shrubs and occasional aspen are responding well.

Condition at year 2115: Stand has developed into a large single story stand. Average stand diameter is 21" with a few 30" dbh trees. Stand is now overstocked and either natural mortality or a commercial harvest to remove approximately 50 percent of the stand. Periodic underburning has maintained stocking level control.

Sample Scenario 2*:** Treatments occurring: Salvage; ***No Fuels Treatment; Planting or Natural Regeneration; Future Precommercial and Commercial Thinning, and Underburning.

Condition at year 2015: Two pre-fire stand structures
Multi-storied Stand: Stand includes, a few larger trees, some trees of this size class have already died from fire/beetle mortality; Most of the larger dead was removed by salvage harvest. Small accumulations of fuels are present. Snag and future down wood is being recruited from light continuing bark beetle mortality in the stand. Larger patches of high mortality were planted or have naturally regenerated.

Single Storied Stands: Stand is still dominated by a larger tree component. Natural regeneration has been abundant in areas where a mineral seedbed was created. Underburning will be necessary to maintain the single story condition and stocking level control.

Condition at year 2025: The two pre-fire stand conditions are becoming more similar in structure, although the pre-fire multi-storied is still a much younger, smaller stand. The understory has been precommercially thinned, and fuels are treated. This fuels treatment was higher cost due to lack of post salvage fuels treatment, but these fuels were relatively light. The stand is at low risk of stand replacement fire. Next understory removal can be done by fire. Individual tree vigor is moderate to low, due to heavy pockets of residual pre-fire stocking. Future harvest is a viable option for stocking control in that material.

Condition at year 2075: stand has been commercially thinned. Stand is very close to a single story structure although not yet an older mature stand. Most trees are greater than 14" dbh. Individual tree vigor is improving and grasses, forbs, shrubs and occasional aspen are responding well.

Condition at year 2115: Stand has developed into a large single story stand. Average stand diameter is 21" with a few 30" dbh trees. Stand is now overstocked and either natural mortality or a commercial harvest to remove approximately 50 percent of the stand. Periodic underburning has maintained stocking level control.

***Sample Scenario 3*:** No Harvest, No Fuels Treatment, No Foreseeable actions.

Condition at 2015: Pockets of dead trees and increasing fuel loading in these pockets. Rest of stand highly stocked, and some additional natural regeneration is occurring where the fire created a mineral soil seedbed. This is very favorable to Ponderosa regeneration establishment. The stand structure is not much changed from the pre-fire condition. Most of these stands

Condition at 2075: Most of the larger trees have died due to stress related mortality. Heavily stocked understory.

Condition at 2115: Another perturbation event has occurred, either fire or insect or disease activity. Stocking has been reduced considerably. Two scenarios occur. Much of the area is nearly complete mortality from a stand replacement event. However some of the could have a light enough stocking remaining to have potential to develop a sustainable stand if natural role of fire is allowed to maintain stocking level control.

25-50 percent mortality category (These stands are a matrix of moderately burned stands with patches of high to complete mortality greater than 5 acres in size. An increase in bark beetle mortality would be expected in these stands).

***Sample Scenario 1*:** Treatments occurring: Salvage; Fuels Treatment; Planting or Natural Regeneration; Future Precommercial Thinning/Whipfelling and Underburning. Future commercial thinning.

Condition at 2015: Increased mortality due to fire and bark beetles reduced live tree component for several years after the fire. The salvage harvest removed much of the mortality but not all of it, and did treat most of the fuels. Young trees either from post-fire natural regeneration or planting are growing vigorously, and are starting to produce seed and progeny of their own. There is a vigorous grass/forb, shrub and some aspen component.

Condition at 2025: Stocking level control in the progeny of the regenerated stand will be controlled by thinning/whipfelling activities. Some large trees have survived and now they are doing very well. Future understory stocking level control can be maintained by fire.

Condition at 2075: Commercial thinning has removed approximately 50 14"dbh, after that treatment the residual stand is a sustainable, with frequent low intensity underburns, single story stand of trees 14" to 30" dbh. There is a vigorous grass/forb, shrub and some aspen component.

Condition at 2115: Stand has developed into a large single story stand. Average stand diameter is 21" with a few 30" dbh trees. Stand is now overstocked and either natural mortality or a commercial harvest to remove approximately 50 percent of the stand. Periodic underburning has maintained stocking level control.

***Sample Scenario 2*:** Treatments occurring: Salvage; *No* Fuels Treatment; Planting or Natural Regeneration; Future Precommercial Thinning/Whipfelling and Underburning. Future commercial thinning.

Condition at 2015: Increased mortality due to fire and bark beetles reduced live tree component for several years after the fire. The salvage harvest removed much of the mortality but not all of it, but a heavy fuel load remains. Young trees either from post-fire natural regeneration or planting are growing vigorously, and are starting to produce seed and progeny of their own. There is a vigorous grass/forb, shrub and some aspen component.

Condition at 2025: Two conditions; 1. If funds are available to treat the heavy residual fuel loading: Stocking level control in the progeny of the regenerated stand will be controlled by thinning/whipfelling activities. Some large trees have survived and now they are doing very well. Future understory stocking level control can be maintained by fire. Or **2. if funds are not available to treat the heavy residual fuel loading:** Increased regeneration from seed from the planted and residual trees are establishing a pulse of regeneration that is the beginning of a multi-story stand condition. This understory will have the effect of greatly slowing growth and vigor of the entire stand. Slowly more of the larger residual trees are dying until very few are left. The stand is mostly a stagnated small tree stand in a heavy fuel bed. Most of the trees are not

large enough for bark beetle mortality unless Ips becomes active. These areas would be in a condition that, in the event of fire, it would be a stand replacement event.

Condition at 2075: In stands that received stocking level control: Commercial thinning has removed approximately 50 14"dbh, after that treatment the residual stand is a sustainable, with frequent low intensity underburns, single story stand of trees 14" to 30" dbh. **In stands that did not receive stocking level control:** Many acres have burned. These acres are developing a vigorous grass/forb, shrub, and aspen component in some of the areas. There are also areas of soil damage where only a few of the most vigorous pioneer plants are starting to colonize.

Condition at 2115: In stands that received stocking level control and fuels treatment. Stand has developed into a large single story stand. Average stand diameter is 21" with a few 30" dbh trees. Stand is now overstocked and either natural mortality or a commercial harvest to remove approximately 50 percent of the stand. Periodic underburning has maintained stocking level control. **Stands that did not receive stocking level control are in similar situation as in 2075.**

Sample Scenario 3: No Harvest or fuels treatment; no foreseeable actions.

Condition at 2015: Bark beetle activities have been very active in this stand condition. Many of the mid to larger size trees that survived the fire have died from bark beetle attacks, However the few that have survived were gaining in individual tree vigor, however now the natural regeneration that has established immediately adjacent to the residual live trees is beginning to reduce the vigor of the parent trees. More than half of the area is almost devoid of conifers, but does have vigorous grass/forb, shrub and aspen vegetation.

50-100 percent mortality category (These areas range from heavily burned stands that are expected to show significant increases in mortality in summer 2003 to stands that are almost completely dead. There are small patches of lightly burned trees in a matrix of fire-killed trees. An increase in bark beetle activity would be expected in these stands).

Sample Scenario 1: Treatments occurring: Salvage; Fuels Treatment; Planting or Natural Regeneration; Future Precommercial Thinning/Whipfelling and Underburning. Future commercial thinning.

Condition at 2015: Bark beetle mortality has continued in these stands. Salvage has removed many of the dead trees, but not all. None were removed from the wildlife clumps. And these clumps were not planted, but eventually will reforest from seed from the adjacent residual or planted trees. Natural regeneration or planting has reforested the high mortality areas, small patches of less burned trees are scattered throughout these areas, but they are very scarce. The regenerated trees are starting to produce viable seed and progeny of their own. A vigorous grass/forb, shrub, and aspen component has developed.

Condition at 2025: Precommercial thinning/whipfelling and fuel treatment has occurred to remove young regeneration, and also accomplished ladder fuel reduction. Stand structure has developed such that future understory stocking level control can be maintained by fire. The residual large trees are increasing in vigor and provide a scattering of LOS trees, but certainly not a stand condition.

Condition at 2075: Commercial thinning has occurred, removing 50 or so 14" dbh trees per acre. The stand size is 14"-30"+, most of the trees are 14-16", but have good individual tree vigor. Stand stocking is about 50 trees per acre.

Condition at 2115: Stand is a LOS stand with most trees 20" dbh or larger, understory stocking has been removed by periodic underburning. Individual trees growth has slowed to a point where either significant bark beetle mortality or harvest will occur. Either should remove about half of the stand.

Sample Scenario 2: Treatments occurring: Salvage; No Fuels Treatment; Planting or Natural Regeneration; Future Precommercial Thinning/Whipfelling and Underburning. Future commercial thinning.

Condition at 2015: Increased mortality due to fire and bark beetles reduced live tree component for several years after the fire. The salvage harvest removed much of the mortality but not all of it, but a heavy fuel load remains. Young trees either from post-fire natural regeneration or planting are growing vigorously, and are starting to produce seed and progeny of their own. There is a vigorous grass/forb, shrub and some aspen component.

Condition at 2025: Two conditions; 1. If funds are available to treat the heavy residual fuel loading: Stocking level control in the progeny of the regenerated stand will be controlled by thinning/whipfelling activities. Some large trees have survived and now they are doing very well. Future understory stocking level control can be maintained by fire. Or **2. If funds are not available to treat the heavy residual fuel loading:** Increased regeneration from seed from the planted and

residual trees are establishing a pulse of regeneration that is the beginning of a multi-story stand condition. This understory will have the effect of greatly slowing growth and vigor of the entire stand. Slowly more of the larger residual trees are dying until very few are left. The stand is mostly a stagnated small tree stand in a heavy fuel bed. Most of the trees are not large enough for bark beetle mortality unless Ips become active. These areas would be in a condition that, in the event of fire, it would be a stand replacement event.

Condition at 2075: In stands that received stocking level control: Commercial thinning has removed approximately 50 14"dbh, after that treatment the residual stand is a sustainable, with frequent low intensity underburns, single story stand of trees 14" to 30" dbh. **In stands that did not receive stocking level control:** Many acres have burned. These acres are developing a vigorous grass/forb, shrub, aspen component in some of the areas. There are also areas of soil damage where only a few of the most vigorous pioneer plants are starting to colonize.

Condition at 2115: In stands that received stocking level control and fuels treatment. Stand has developed into a large single story stand. Average stand diameter is 21" with a few 30" dbh trees. Stand is now overstocked and either natural mortality or a commercial harvest to remove approximately 50 percent of the stand. Periodic underburning has maintained stocking level control. **Stands that did not received stocking level control are in similar situation as in 2075**

Sample Scenario 3: No Harvest or fuels treatment; no foreseeable actions.

Condition at 2015: Bark beetles have been somewhat active in the remaining live component of this stand condition. Many of the mid-size to larger-size trees that survived the fire have died from bark beetle attacks. The few that have survived are gaining in individual tree vigor. More than half and in some cases, most of the area is virtually devoid of conifers, but does have vigorous grass/forb, shrub and aspen vegetation.

The following table summarizes, by action alternative, the number of acres in each mortality category that would receive the treatment combinations described in scenarios 1, 2, and 3 (no action) above.

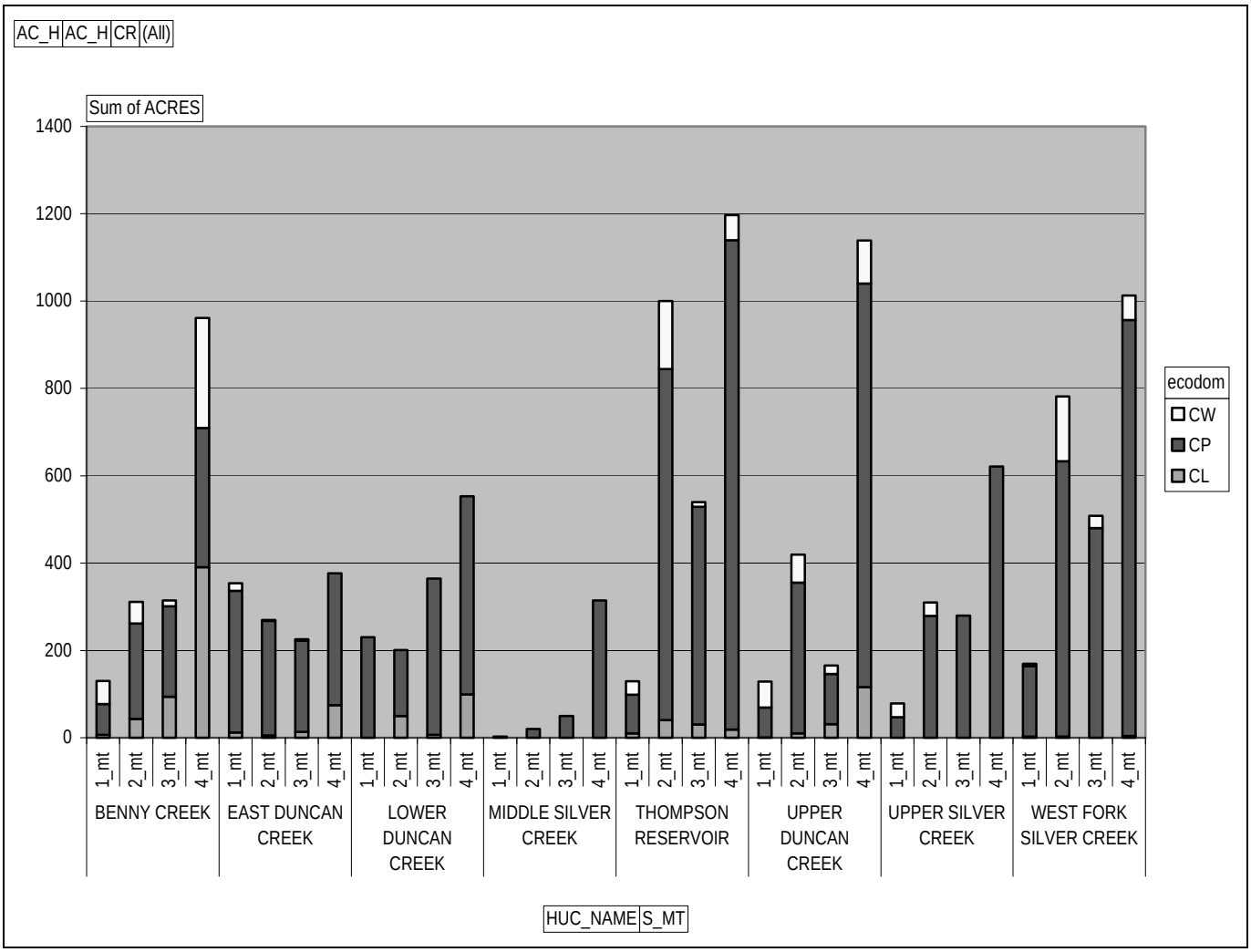
Table 3.34 Summary of Scenarios 1, 2, and 3 Treatment Combinations

Mortality Class	Acres	Scenario 1 Harvest/Fuels Treatment					Scenario 2 Harvest/ No Fuels Treatment					Scenario 3 (No Action) Acres with No Harvest or Fuels Treatment				
		Alternative					Alternative					Alternative				
		C (acres) (% of total)	D (acres) (% of total)	E (acres) (% of total)	G (incl. buffer acres)	H (acres) (% of total)	C (acres) (% of total)	D (acres) (% of total)	E (acres) (% of total)	G (acres) (% of total)	H (acres) (% of total)	C (acres) (% of total)	D (acres) (% of total)	E (acres) (% of total)	G (minus buffer acres)	H (acres) (% of total)
1-25% Veg. Mortality	6727	270 4%	214 3%	253 4%	269+ 272 = 541 8%	259 4%	975 14%	107 2%	639 9%	975 14%	968 14%	5,482 81%	6,407 95%	5,835 87%	5,211-(1,065) =4146 62%	5,500 82%
26-50% Veg. Mortality	9408	1,784 19%	1,155 12%	1,317 14%	1,778+ 339 = 2,117 23%	1,585 17%	1585 17%	83 1%	867 9%	1,584 17%	1,446 15%	6,039 64%	8,171 87%	7,223 77%	5,707-(1,370) =4337 46%	6,377 68%
51-85% Veg. Mortality	5360	1,831 34%	1,213 22%	1,590 30%	1,823+ 97 = 1,920 36%	1,568 29%	664 12%	67 1%	435 8%	663 12%	642 12%	2,866 53%	4,080 76%	3,335 62%	2,777-(602)= 2,175 41%	3,150 59%
86%-100% Veg. Mortality	12339	5,669 46%	3,148 25%	5,149 42%	5,658+ 132 = 5790 47%	5,159 42%	536 4%	52 0%	384 3%	536 4%	506 4%	6,134 50%	9,139 74%	6,806 55%	3,013-(1,599) =4414 36%	6,674 54%

Alternative G, which focuses on fuels reduction to promote long-term sustainability, includes proposals for fuels treatment on additional acres, compared to some of the other action alternatives. While the other alternatives limit fuels treatment to acres that would be expected to develop 20 tons or more of fuel loading per acre as the dead trees fall, Alternative G proposes fuels treatment on all harvest units within ¼ mile of the boundary between any private lands and National Forest System lands, whether or not the predicted fuel loading would exceed 20 tons per acre. Additionally, Alternative G would treat fuels on some lands within the project area that are outside of salvage units altogether (see the fire and fuels section for more detail). The additional acres to be treated in Alternative G are broken out in the table above as "buffer" acres

The following bar graphs display salvage harvest proposed in each alternative, by subshed, stand type, and mortality category.

Figure 3.18 Alternative C Proposed Harvest by Subwatershed, Ecodom, and September 2002 Vegetative Mortality.



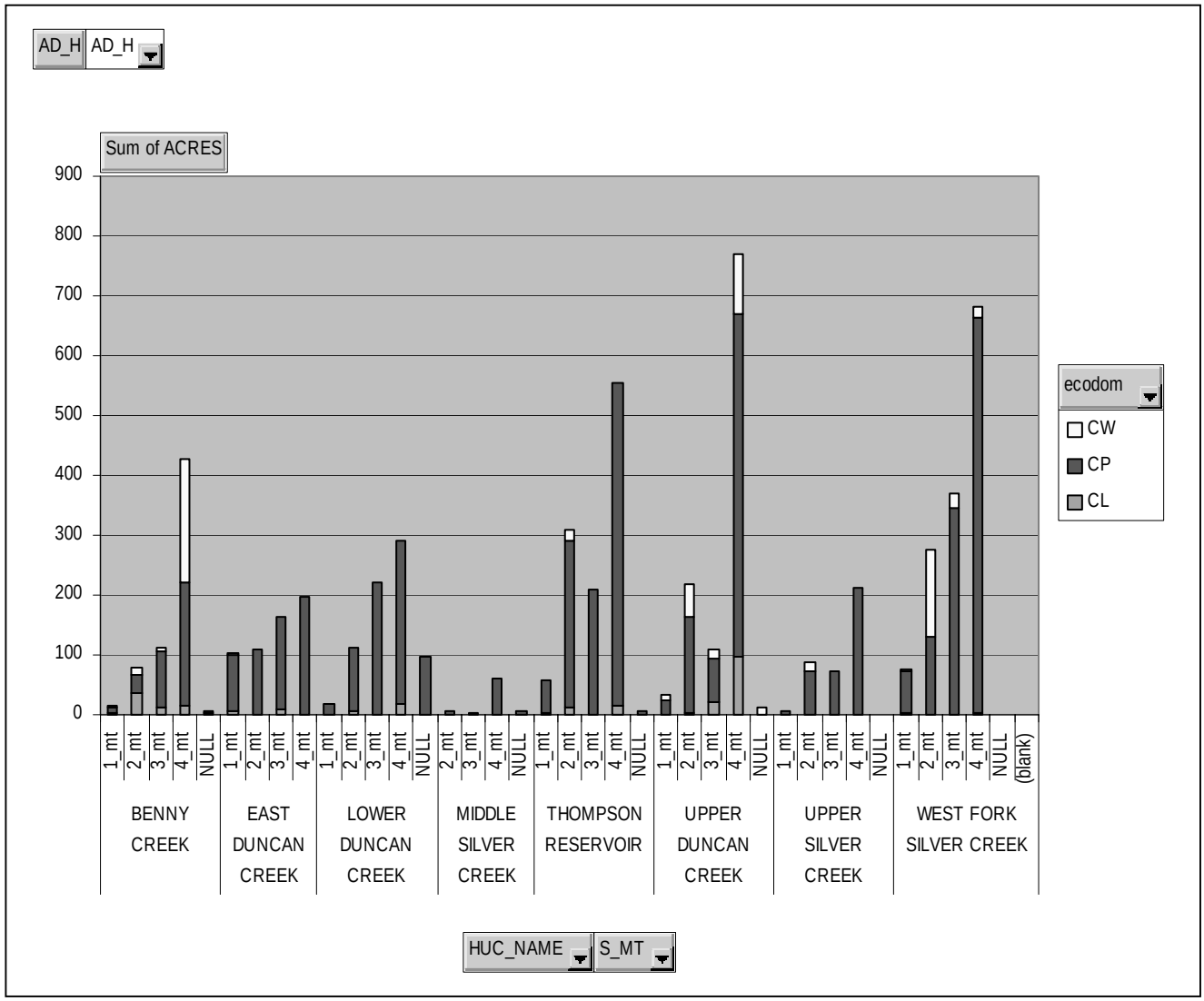
1_mt = 1 to 25 percent mortality of large shrubs, juniper and conifers

2_mt = 26 to 50 percent mortality of large shrubs, juniper and conifers

3_mt = 51 to 85 percent mortality of large shrubs, juniper and conifer

4_mt = 86 or greater percent mortality of large shrubs, juniper and conifers

Figure 3.19 Alternative D Proposed Harvest by Subwatershed, Ecodom, and September 2002 Vegetative Mortality



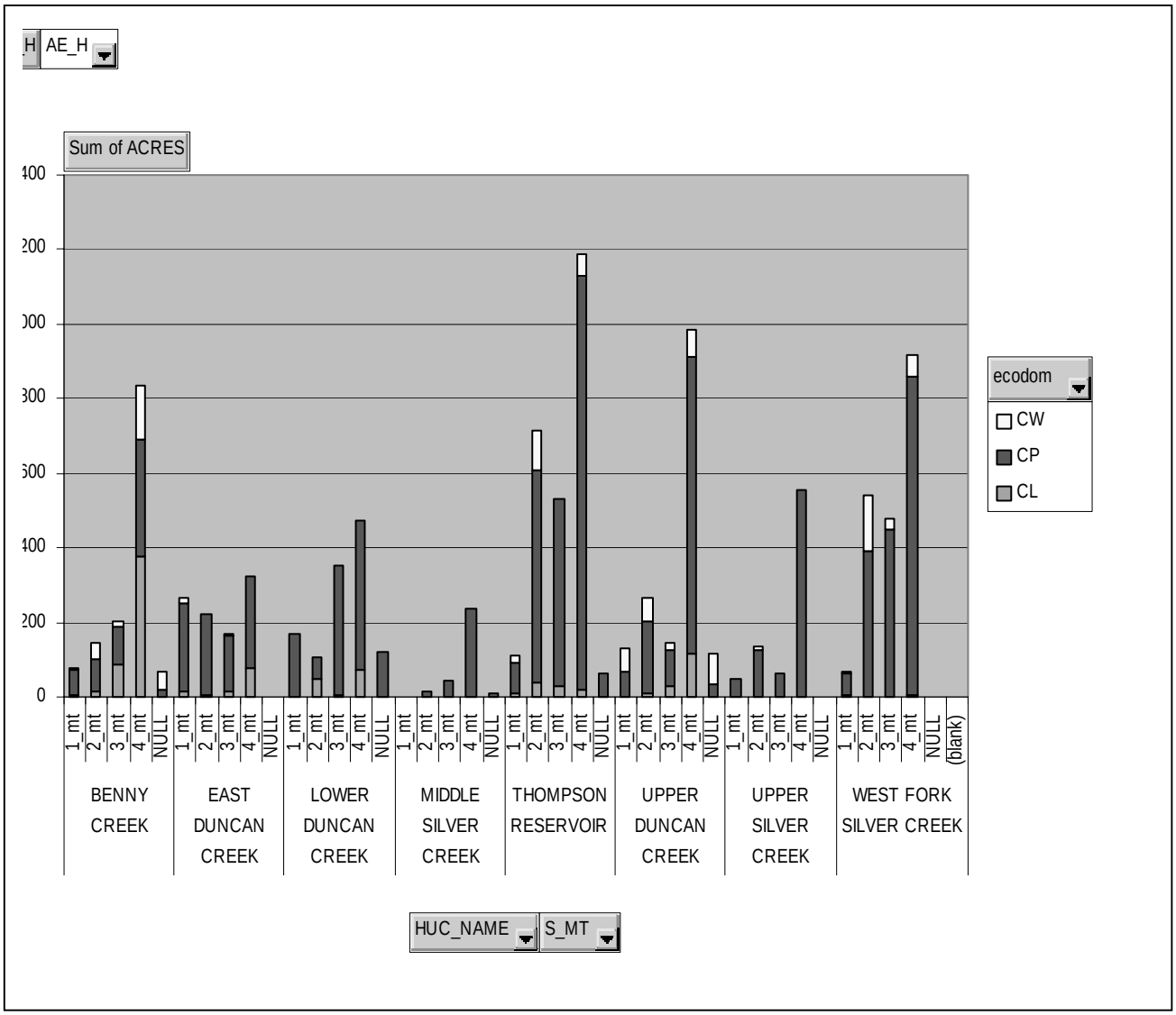
1_mt = 1 to 25 percent mortality of large shrubs, juniper and conifers

2_mt = 26 to 50 percent mortality of large shrubs, juniper and conifers

3_mt = 51 to 85 percent mortality of large shrubs, juniper and conifer

4_mt = 86 or greater percent mortality of large shrubs, juniper and conifers

Figure 3.20 Alternative E Proposed Harvest by Subwatershed, Ecodom, and September 2002 Vegetative Mortality



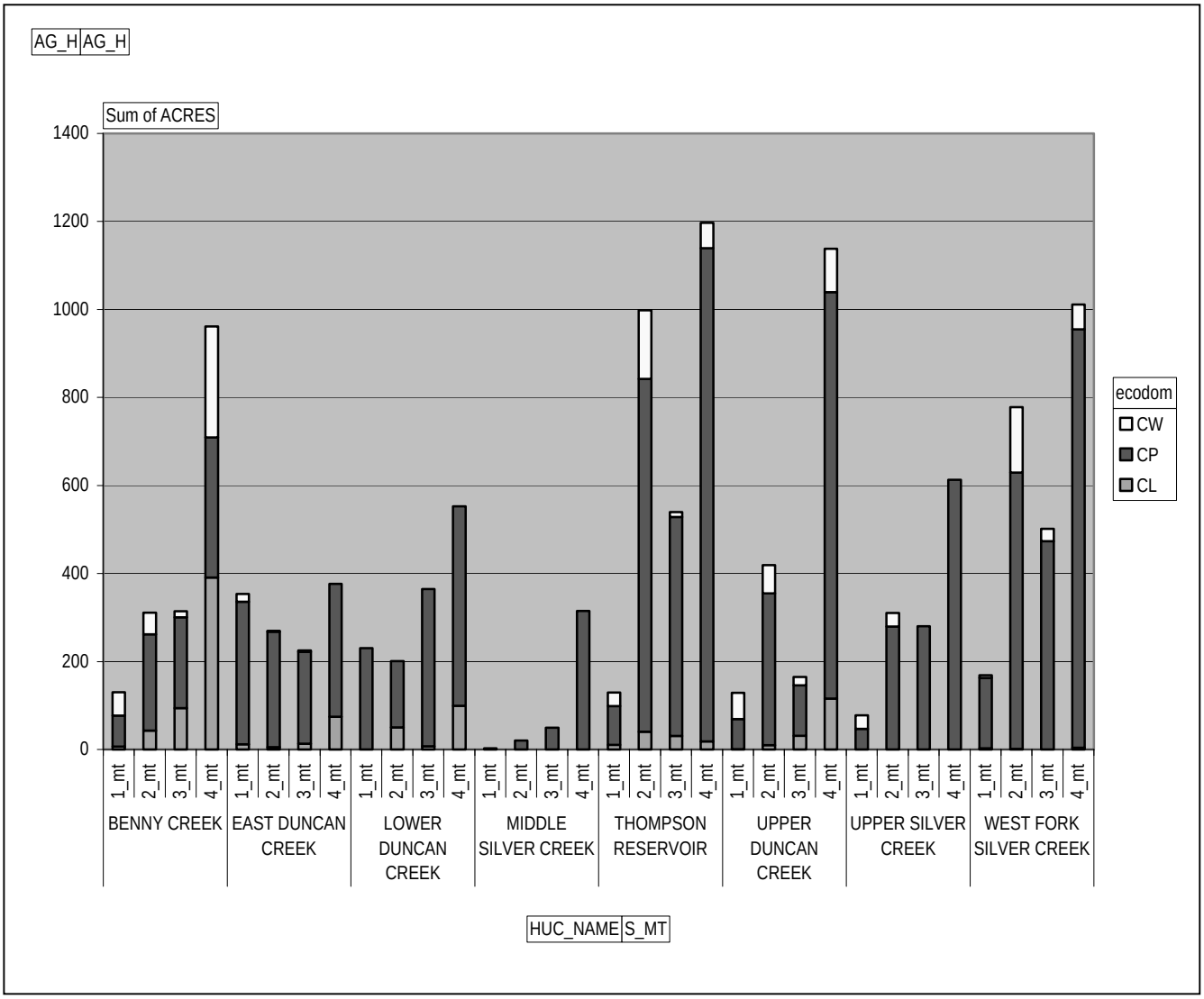
1_mt = 1 to 25 percent mortality of large shrubs, juniper and conifers

2_mt = 26 to 50 percent mortality of large shrubs, juniper and conifers

3_mt = 51 to 85 percent mortality of large shrubs, juniper and conifer

4_mt = 86 or greater percent mortality of large shrubs, juniper and conifers

Figure 3.21 Alternative G Proposed Harvest by Subwatershed, Ecodom, and September 2002 Vegetative Mortality



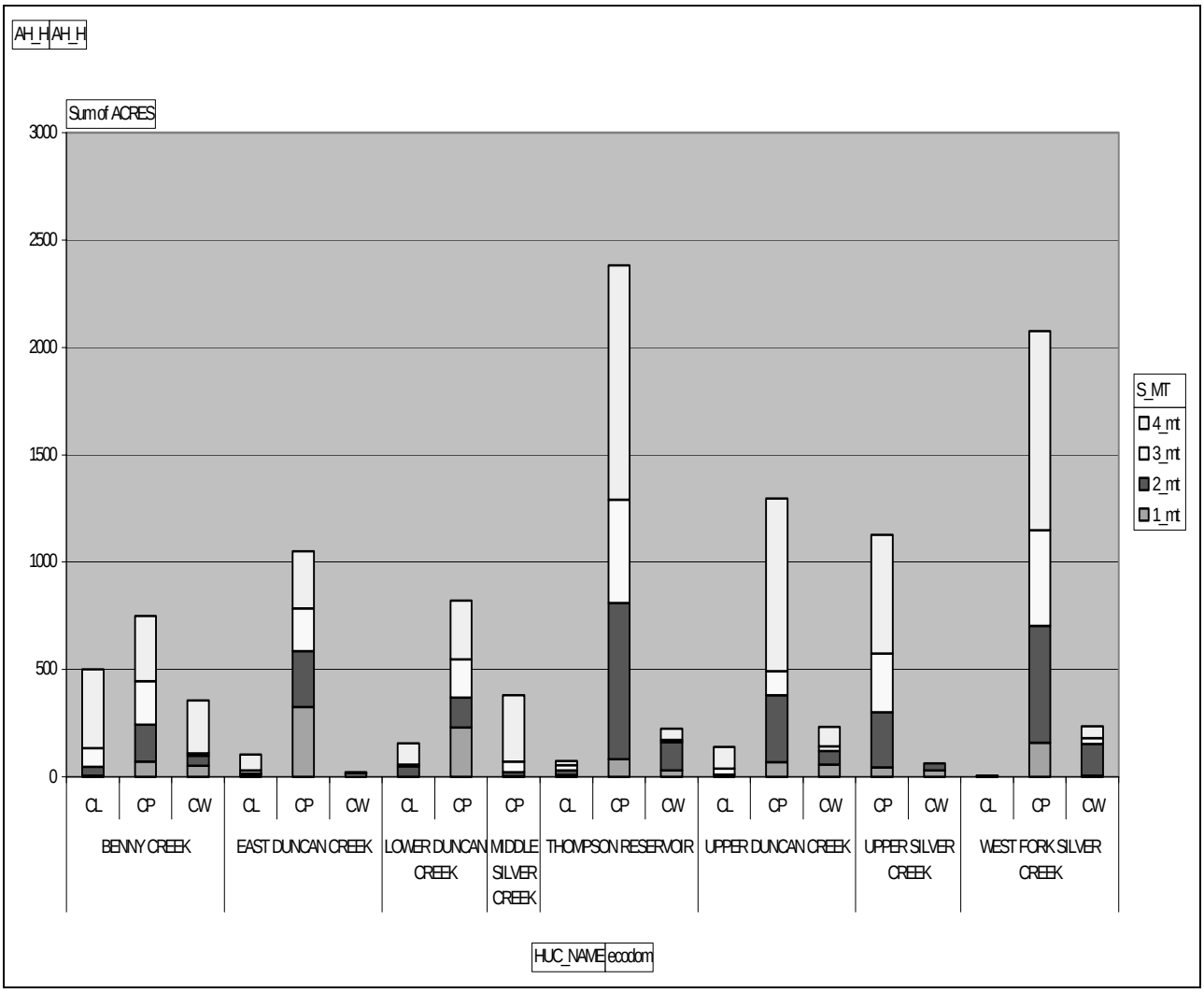
1_mt = 1 to 25 percent mortality of large shrubs, juniper and conifers

2_mt = 26 to 50 percent mortality of large shrubs, juniper and conifers

3_mt = 51 to 85 percent mortality of large shrubs, juniper and conifer

4_mt = 86 or greater percent mortality of large shrubs, juniper and conifers

Figure 3.22 Alternative H Proposed Harvest by Subwatershed, Ecodom, and September 2002 Vegetative Mortality..



1_mt = 1 to 25 percent mortality of large shrubs, juniper and conifers

2_mt = 26 to 50 percent mortality of large shrubs, juniper and conifers

3_mt = 51 to 85 percent mortality of large shrubs, juniper and conifer

4_mt = 86 or greater percent mortality of large shrubs, juniper and conifers

Effects of Proposed Treatments on Forest Stand Types Within the Project Area

Ponderosa Pine Stand Types

Salvage Harvest

Salvage harvesting would reduce the potential for large, down fuels within the project area. Successful development and maintenance of sustainable ponderosa pine LOS stands depends on reducing unnaturally high fuel loads to the point that fire can be reintroduced into the stand without significant damage to the future LOS trees. In about 20 years, the seedlings planted after the fire would have progeny of their own, and the stand would need to be treated to keep density conditions favorable for the development of LOS. At about the same time, without earlier removal by salvage, most of the large dead trees would have fallen.

Removing the dead, merchantable-sized trees would significantly reduce the potential fuel loading from the fire-killed trees. This in turn would make it easier and less costly to achieve LOS stand conditions, by allowing the use of prescribed fire for stand development and maintenance. Abundant large down wood can become a barrier to future fuels reduction, from both cost and logistical standpoints. While many treatment options are available to reduce smaller size slash, boles from large down trees are difficult to burn, require large machinery to move, can cause damage to young reproduction if moved, and would be very expensive to cut, pile, and burn on site. In the dry climate of this area, such larger fuels could persist for up to a century.

Salvage harvests, along with proposed fuels and site preparation treatments, would also reduce the potential for future intense, "hot" fires that have stand replacement potential. If a fires starts in areas where the large, fire or beetle-killed trees have fallen; the high fuel loading would create a very hot fire. "Should fire occur in this heavy fuel, all live trees would be killed and the soil surface sterilized to a degree inhibiting regeneration." (Hall, 2003). At the least, a subsequent wildfire could result in loss of the stands that were planted or naturally regenerated after the Toolbox Complex. This loss would further retard the development of LOS stands within the project area.

Sexton (1998) showed a two-year benefit in species richness and density for shrubs and herbaceous vegetation in unsalvaged versus salvaged plots. This benefit may be attributable to an improved microclimate for the first year of establishment of germinants. Local experience has repeatedly shown that in first year burned areas, salvaged or not, there is early spring-summer germination of many species, including pines that do not survive the summer. Under all action alternatives, all first-year germinants would have the benefit of site modification from dead cover, as no salvage would be proposed during that season (spring/summer of 2003).

Salvage harvesting would also facilitate reforestation within the project area. Stands that were partially burned (1 to 50 percent mortality) are perhaps in worse condition to achieve LOS than before the fire. Because they have a seed source, are overstocked, and now have a receptive seed bed for increased conifer reproduction, many new seedlings would be expected to establish naturally, increasing the need for stocking control to maintain appropriate densities. The effect of salvage harvests in these partially burned stands would be to remove the larger fuels and facilitate future thinning and reintroduction of fire.

In the more heavily burned stands (51 to 100 percent mortality), the many standing dead trees would be likely to pose hazards for planting crews by about 2007, when they would begin to fall in large numbers. The stands that were heavily stocked before the 2002 fires would now be developing a deep fuelbed that would restrict access to desirable planting spots. These larger dead trees would need to be removed before planting could proceed, in areas where salvage harvest had not occurred. Since by 2007 the large material would have no merchantable value, federal funds would be needed to accomplish the removal. Additionally, the large, dead material would be quite expensive to remove. If funds were not available in a timely manner, progress toward re-establishment of LOS stands in these areas could be significantly delayed.

In stands that could be planted before the dead trees become a hazard; the large, dead trees would eventually pose the same fuel loading problems described earlier. In addition, the planted trees would be damaged as the larger trees fall. While a few would be killed outright, the larger problem to LOS development would be enough permanent deformity in the developing trees that they would never develop into LOS.

Mechanical Fuels Treatments and Prescribed Burning

Mechanical fuels treatments (as distinguished from salvage harvesting) are designed to reduce fuels from smaller dead trees, in the 1 to 9 inch dbh range. These size classes represent the highest number of trees in most ponderosa pine stand types. The effect of the fuels treatments would be to reduce fire hazard from unplanned ignitions and, by accelerating the decay of these smaller fuels, to allow earlier reintroduction of prescribed fire into the stand. This earlier reintroduction of

fire would reduce the cost of both future fuels treatments and future stocking level control treatments needed to maintain appropriate stand densities. Without fuels treatment and reintroduction of fire, stand conditions similar to those that supported the spread of the Toolbox Complex would develop. Such stand conditions are well outside the Historic Range of Variability.

Site Preparation – Hazard Tree Falling

This activity would fall standing dead trees in planting areas that pose a hazard to planting crews. Most of this activity would occur several seasons after the 2002 fires. One thousand or less acres of site preparation would likely occur during the first growing season and could negatively affect some of the first year germinants. The degree of that effect would also be dependent on that year's weather, if mild or extreme. Site preparation would have effects similar to those for fuel treatments, but to a lesser degree. Trees would be felled, lopped, and scattered. It is expected that most trees would shatter on falling, and this would accelerate the decay process somewhat. Some additional mechanical or fire treatments could be applied to units where the down material posed a barrier to accessing planting spots.

Reforestation by Planting

The effect of reforestation by planting would be to re-establish light density ponderosa pine stands in areas with an inadequate seed source and to speed the re-establishment of Late and Old Structure (LOS) ponderosa pine stands within the project area. Mortality at the scale represented by the project area is outside of the range of adaptability of ponderosa pine to naturally reforest, in any time frame less than several hundred years. Ponderosa pine stand types in this area are characterized by:

- Stand structure dominated by low numbers of trees, most being mature trees in the larger size classes, with few smaller trees present.
- Small, generally less than 1 acre, areas of mortality, resulting from fire or bark beetles killing individuals or small clumps of trees.
- Infrequent pulses of regeneration. Ponderosa pine seed, in an occupied stand, disperses only about 100 feet from the tree, or about a distance equal to the cone height. Ponderosa seed establishes best on a mineral soil seedbed, such that as prepared by fire. Rodents eat large amounts of the seed and very little is actually able to germinate.

Without planting, very little ponderosa pine establishment would occur in areas that lack enough seed trees. Therefore, without planting, development of a sustainable stand of LOS could take up to several hundred years. The actual time would depend on the distance to seed producing trees, how far their progeny were able to spread, how quickly those trees produced seed, and how far they spread it. As no grass seeding occurred, native vegetation response and rapid replanting of ponderosa pine will maintain a mycorrhizal fungi component (Amaranthus, et al.).

Mixed Conifer Stand Types (White Fir Expansion into Pre-fire Suppression Ponderosa Pine Types)

Salvage Harvest

The effects of salvage harvest on this forest type are virtually identical to the effects that would be expected in the pure ponderosa pine stand types. There are a few differences with respect to expected vegetative regeneration. Salvaging the dead overstory could reduce the short-term benefit that the dead overstory would provide in terms of a better microclimate for regenerating species. However, the vegetative species that the dead cover would favor would not be the pioneer species best suited to restoration of a sustainable ponderosa pine type. More shade-tolerant species, such as white fir, could be favored, at the expense of the associated early seral species desired for the more sustainable pine-dominated type. Salvage harvests would open up the stands and possibly limit the success of white fir natural regeneration. This in turn could favor re-establishment of the more open ponderosa pine stands that are closer to the Historic Range of Variability.

Fuels Treatments

The effects of this activity on the areas of white fir expansion would be essentially the same as for the ponderosa pine stand types. Please see the ponderosa pine discussion above.

Site Preparation – Hazard Tree Falling

The effects of this treatment would be the same as that described for the ponderosa pine stand types above.

Reforestation by Planting

The effect of reforestation by planting would be to re-establish ponderosa pine in areas with an inadequate ponderosa seed source. Ponderosa pine seed source has been deficient in these areas, even pre-fire, for several reasons:

- These types are at higher elevations. Ponderosa pines at these elevations produce a good seed crop at an interval of 10 to 25 years rather than the 3 to 5 years common at lower elevations.
- Due to the extent of white fir expansion into these stands, most ponderosa pine is of poor vigor and not capable of significant seed production. They also are generally older, and also produce fewer seed.
- Many ponderosa pines had died, either before or during the fire.

Large white fir, however, is often not immediately killed by fire. The fire-damaged white fir may produce several seed crops prior to dying and is an abundant seed producing species.

Planting ponderosa pine would lead to development of more sustainable LOS stands. The effect of not planting on these types in high mortality areas (greater than 50 percent mortality) would be development of a heavy shrub component with some white fir regeneration. The effect of not planting in partially burned areas would be to develop a stand of even denser, smaller white fir than the pre-fire stand.

Lodgepole Pine Stand Types

There are relatively few acres of the lodgepole pine stand types within the Toolbox project area. For the purposes of this discussion, those acres are further divided into moist lodgepole pine/meadow, wet riparian lodgepole, and dry lodgepole types. The effects are different for each type.

Salvage Harvest

The effect of salvage logging on the dry type would be to remove some of the future dead fuel. In the dry type the average diameter is generally on the larger side, so salvage harvest, or firewood cutting could be used to remove some of this fuel. If not removed, the dead trees would pose a future hazard to soils once they fell, in terms of the heat damage that could result from an ignition in the down material. This forest type did not co-evolve with frequent low-intensity fire and is fairly susceptible to fire damage, even from a relatively “cool” fire. Thus, prescribed fire would not commonly be used as a management tool for developing old stands of lodgepole pine. Fuels removal through salvage harvest would be primarily to modify the fuel loadings such that they do not contribute to future high intensity, large-scale fires.

The effect of salvage logging on the moist LP/meadow type would be to remove fuels and begin the process of meadow restoration in these stands, many of which lack the non-forested meadow component, compared to HRV.

The effect of salvage harvest on the wet riparian stand types would be to remove some fuel. Most of the acres in this stand type would not have any salvage harvest planned. Most of the trees in this stand type are smaller diameter and highly stocked. The dead trees in these stands would not create much of a fuels hazard.

Fuels Treatment

Mechanical fuels treatments in lodgepole pine types would be used to reduce wildfire hazard and thus protect the stands and soil from damage by fire.

Reforestation by Planting

The effects of reforestation by planting would vary dramatically by type. Lodgepole pine is not serotinous in this area (serotinous cones are those that require heat from a fire to open and release the seed). Regeneration is by direct seeding, or by seed already existing in the soil seedbank.

Locally the dry lodgepole pine stand type has an erratic history of natural regeneration. Some acres within this type have not naturally regenerated from many years after they have experienced a fire. Other acres have regenerated very densely; however, it took many years for that regeneration to occur. In the latter case, it is likely that the stand regenerated from seed already in the soil, as no seed trees remained in most areas after the fire. This suggests that lodgepole pine moved into these areas after the advent of fire suppression and that, before fire suppression, the stand was probably a ponderosa pine/grass type, very sparsely stocked with ponderosa pine. The effects of replanting to lodgepole pine would be to ensure conifer regeneration on these sites. Future planting of ponderosa pine could start a long-term conversion process back to a ponderosa pine savannah. However, if lodgepole pine regenerated at a low enough density to grow to maturity, that would also be a sustainable condition.

The moist and riparian lodgepole stands would be expected to regenerate heavily to lodgepole pine without any need for planting. The meadow component would not be planted.

Effects of the Alternatives on Development of Sustainable Forested Vegetated Communities

The alternatives differ in how they would influence the development of sustainable Late and Old Structure (LOS) stands across the Toolbox project area.

Table 3.35 Acres of Proposed Treatment Combinations by Alternative (Includes acres for which no treatment would be proposed), and Relationship to Development of LOS Within the Toolbox Project Area.

Alternative	Salvage Harvest	Fuels Trtmt	Site Prep	Planted (1)	Mature Dead Stands Retained	Areas most likely to develop into sustainable LOS stands in the future: acres with fuels trtmts and 50% site preparation	Areas planted in which future high fuel loading would reduce sustainability of "new" forests": acres of planting w/o fuels treatments or site prep	Future forest that would retain high-density clumps and mod. fuel loads (2)	Future "forest-type" in non-forested condition (3)
	Acres								
A	0	0	0	0	29,000	0		14,000	20,000
C	14,441	10,244	5,301	20,750	14,559	12,894	7,856	14,000	1,000
D	6,367	5,680	4,830	20,750	22,633	8,095	12,655	14,000	1,000
E	11,490	6,723	5,330	20,750	17,510	9,388	11,362	14,000	1,000
G	14,419	11,354	3,580	20,750	14,581	13,144	7,606	8,404	1,000
H	13,031	9,070	4,695	20,750	15,969	11,417	9,333	14,000	1,000

(1) This acreage would increase if additional fire or beetle-related mortality developed within the stands in the next 1-3 years, or if replanting was needed due to high seedling mortality. Detailed data on planting schedules and expected survival rates is available in the project file.

(2) Consideration of fuel loading based on Sept. 2002 mortality levels. Sustainability of these stands would be reduced.

(3) These are acres that historically would have been in a forested condition.

Effects of Alternative A on the Development of Sustainable Forests

- An estimated 20,000 acres that would normally (if consistent with HRV) support forested vegetative communities would develop vigorous shrub-grass vegetation instead, because of a lack of seed trees. Generally, reestablishment of conifer seedlings, except in very small localized pockets, would take 30 to 75 or more years. Development of LOS structure (in the absence of stand-replacing wildfire) could take up to 300 years across most acres, due to the lag time in reestablishing conifers and the solid establishment of competing vegetation. About 20 to 30 percent of the area could develop LOS structure in 150 to 200 years. This LOS structure would be multi-storied and not a stable, sustainable stand.

- Because no fuels reduction would occur, higher mortality forested stand types would have very heavy fuel loadings. The larger fuels could persist for 50 to 100 years. This fuel loading would eliminate the use of prescribed fire without very expensive mechanical pretreatments. It would also create a fuelbed, which would support the spread of severe, stand-replacement wildfires. This in turn would increase the potential for soil

damage occurring from burning of large, down fuels and the potential for establishment of non-native vegetation and noxious weeds (see Noxious Weeds section).

- In areas of white fir expansion, white fir reproduction will be more successful than ponderosa pine. In this alternative, white fir would re-establish relatively quickly in areas historically dominated by ponderosa pine. Stand densities would increase. White fir is a relatively short-lived species and susceptible to mortality from a number of insect and disease agents. Over time, as white fir died in these stands, fuel loads would increase and the potential for the spread of severe wildfire would also increase. Acres in this condition would move farther away from a long-term sustainable condition.
- The roughly 14,000 acres that burned with less than 50 percent vegetative mortality would develop as a mosaic of:
  - Residual overstocked patches,
  - Regenerated overstocked patches.
  - Moderate to heavy fuel loading,
  - Forested stand type that regenerated to shrub/grass vegetation with very few trees. These conditions would not be sustainable over the long term, though they could provide some habitat diversity.

Effects of Alternative C on the Development of Sustainable Forests

- An estimated 1,000 acres that would normally (if consistent with HRV) support forested vegetative communities would develop vigorous shrub-grass vegetation instead, because of a lack of seed trees. Generally, reestablishment of conifer seedlings, except in very small localized pockets, would take 30 to 75 or more years. Development of LOS structure (in the absence of stand-replacing wildfire) could take up to 300 years across most acres, due to the lag time in reestablishing conifers and the solid establishment of competing vegetation. About 20 to 30 percent of the area could develop LOS structure in 150 to 200 years. This LOS structure would be multi-storied and not a stable, sustainable stand.
- No fuels reduction or effective site preparation would occur on approximately 7,856 acres of planted forested type. The acres of higher mortality forested types that did not receive such treatment would exhibit very heavy fuel loadings. Development of single story, low-density sustainable stands would be difficult and expensive on these acres. The larger fuels could persist for 50 to 100 years. This fuel loading would eliminate the use of prescribed fire without very expensive mechanical pretreatments. It would also create a fuelbed that would support the spread of severe, stand-replacement wildfires. This in turn would increase the potential for soil damage occurring from burning of large, down fuels and the potential for establishment of non-native vegetation and noxious weeds (see Noxious Weeds section). As dead trees fell on these acres, they would damage some of the conifer regeneration. Such damage would limit its ability to develop LOS structure and provide infection opportunities for insect and disease agents.
- Approximately 12, 894 acres would be planted or naturally regenerated, and would receive enough fuels treatment so that, if maintained by underburning, sustainable LOS stands would be expected to develop.
- The roughly 14,000 acres that burned with less than 50 percent vegetative mortality would develop as a mosaic of:
  - Residual overstocked patches,
  - Regenerated overstocked patches.
  - Moderate to heavy fuel loading,
  - Forested stand type that regenerated to shrub/grass vegetation with very few trees. These conditions would not be sustainable over the long term, though they could provide some habitat diversity.
- Noncommercial thinning of plantations burned in the 2002 fires would occur on approximately 2,214 acres. This thinning would reduce fuel hazards and accelerate development of LOS.
- Prescribed burning would occur on 3,572 acres, reducing fire hazard by reduction of ladder fuel and surface fuel component. This would also reduce costs for future stocking level control treatments.

- Aspen enhancement would occur on 690 acres of riparian aspen, and 7 acres of riparian areas would have deciduous species planting. These treatments would increase habitat diversity within the project area.

Effects of Alternative D on the Development of Sustainable Forests

- An estimated 1,000 forested type non-stocked acres, lacking adequate seed trees, would develop vigorous shrub-grass vegetation. Generally, reestablishment of conifer seedlings, except in very small localized pockets, would take 30 to 75or more years. Development of LOS structure (in the absence of stand-replacing wildfire) could take up to 300 years across most acres, due to the lag time in reestablishing conifers and the solid establishment of competing vegetation. About 20 to 30 percent of the area could develop LOS structure in 150 to 200 years. This LOS structure would be multi-storied and not a stable, sustainable stand.

- No fuels reduction or effective site preparation would occur on approximately 12,655 acres of planted forested type. The acres of higher mortality forested types that did not receive such treatment would exhibit very heavy fuel loadings. Development of single story, low-density sustainable stands would be difficult and expensive on these acres. The larger fuels could persist for 50 to 100 years. This fuel loading would eliminate the use of prescribed fire without very expensive mechanical pretreatments. It would also create a fuelbed that would support the spread of severe, stand-replacement wildfires. This in turn would increase the potential for soil damage occurring from burning of large, down fuels and the potential for establishment of non-native vegetation and noxious weeds (see Noxious Weeds section). As dead trees fell on these acres, they would damage some of the conifer regeneration. Such damage would limit its ability to develop LOS structure and provide infection opportunities for insect and disease agents.

- Approximately 8,095 acres will be planted or naturally regenerated, and receive enough fuels treatment so that, if maintained by underburning, sustainable LOS stands would be expected to develop.

- The roughly 14,000 acres that burned with less than 50 percent vegetative mortality would develop as a mosaic of:
    - Residual overstocked patches,
    - Regenerated overstocked patches.
    - Moderate to heavy fuel loading,
    - Forested stand type that regenerated to shrub/grass vegetation with very few trees. ,These conditions would not be sustainable over the long term, though they could provide some habitat diversity.

- Plantation noncommercial thinning would occur on approximately 2,214 acres. This would reduce fuel hazard and accelerate development of LOS.

- Prescribed burning would occur on 2,450 acres, reducing fire hazard by reduction of ladder fuel and surface fuel component. This would also reduce costs for future stocking level control treatments.

- Aspen enhancement will occur on 690 acres of riparian aspen and 7 acres of riparian would have deciduous species planting. These treatments would increase habitat diversity within the project area.

Effects of Alternative E on the Development of Sustainable Forests

- An estimated 1,000 forested type non-stocked acres, lacking adequate seed trees, would develop vigorous shrub-grass vegetation. Generally, reestablishment of conifer seedlings, except in very small localized pockets, would take 30 to 75 or more years. Development of LOS structure (in the absence of stand-replacing wildfire) could take up to 300 years across most acres, due to the lag time in reestablishing conifers and the solid establishment of competing vegetation. About 20 to 30 percent of the area could develop LOS structure in 150 to 200 years. This LOS structure would be multi-storied and not a stable, sustainable stand.

- No fuels reduction or effective site preparation would occur on approximately 11,362 acres of planted forested type. The acres of higher mortality forested types that did not receive such treatment would exhibit very heavy fuel loadings. Development of single story, low-density sustainable stands would be difficult and expensive on these acres. The larger fuels could persist for 50 to 100 years. This fuel loading would eliminate the use of prescribed fire without very expensive mechanical pretreatments. It would also create a fuelbed that would support the spread of severe, stand-replacement wildfires. This in turn would increase the potential for soil

damage occurring from burning of large, down fuels and the potential for establishment of non-native vegetation and noxious weeds (see Noxious Weeds section). As dead trees fell on these acres, they would damage some of the conifer regeneration. Such damage would limit its ability to develop LOS structure, and provide infection opportunities for insect and disease agents.

- Approximately 9,388 acres would be planted or naturally regenerated, and would receive enough fuels treatment so that if maintained by underburning sustainable LOS stands would be expected to develop.
- The roughly 14,000 acres that burned with less than 50 percent vegetative mortality would develop as a mosaic of:
  - Residual overstocked patches,
  - Regenerated overstocked patches.
  - Moderate to heavy fuel loading,
  - Forested stand type that regenerated to shrub/grass vegetation with very few trees. These conditions would not be sustainable over the long term, though they could provide some habitat diversity.

Effects of Alternative G on the Development of Sustainable Forests

- An estimated 1,000 forested type non-stocked acres, lacking adequate seed trees, would develop vigorous shrub-grass vegetation. Generally, reestablishment of conifer seedlings, except in very small localized pockets, would take 30 to 75 or more years. Development of LOS structure (in the absence of stand-replacing wildfire) could take up to 300 years across most acres, due to the lag time in reestablishing conifers and the solid establishment of competing vegetation. About 20 to 30 percent of the area could develop LOS structure in 150 to 200 years. This LOS structure would be multi-storied and not a stable, sustainable stand.
- No fuels reduction or effective site preparation would occur on approximately 7,606 acres of planted forested type. The acres of higher mortality forested types that did not receive such treatment would exhibit very heavy fuel loadings. Development of single story, low-density sustainable stands would be difficult and expensive on these acres. The larger fuels could persist for 50 to 100 years. This fuel loading would eliminate the use of prescribed fire without very expensive mechanical pretreatments. It would also create a fuelbed that would support the spread of severe, stand-replacement wildfires. This in turn would increase the potential for soil damage occurring from burning of large, down fuels and the potential for establishment of non-native vegetation and noxious weeds (see Noxious Weeds section). As dead trees fell on these acres, they would damage some of the conifer regeneration. Such damage would limit its ability to develop LOS structure, and provide infection opportunities for insect and disease agents.
- Approximately 13,144 acres would be planted or naturally regenerated, and would receive enough fuels treatment so that if maintained by underburning sustainable LOS stands would be expected to develop.
- The roughly 14,000 acres that burned with less than 50 percent vegetative mortality would develop as a mosaic of:
  - Residual overstocked patches,
  - Regenerated overstocked patches.
  - Moderate to heavy fuel loading,
  - Forested stand type that regenerated to shrub/grass vegetation with very few trees. These conditions would not be sustainable over the long term, though they could provide some habitat diversity.
- About 5,596 acres of National Forest System land next to private land boundaries would have various fuels treatment activities. These treatments would reduce fire hazard, facilitate application of prescribed fire on federal lands, and reduce costs for future stocking level control treatments.
- Plantation noncommercial thinning would occur on approximately 2,214 acres. This would reduce fuel hazard and accelerate development of LOS.
- Prescribed burning would occur on 3,572 acres, reducing fire hazard by reduction of ladder fuel and surface fuel component. This would also reduce costs for future stocking level control treatments.

- Aspen enhancement will occur on 690 acres of riparian aspen and 7 acres of riparian would have deciduous species planting. These treatments would increase habitat diversity within the project area.

Effects of Alternative H on the Development of Sustainable Forests

- An estimated 1,000 forested type non-stocked acres, lacking adequate seed trees, would develop vigorous shrub-grass vegetation. Generally, reestablishment of conifer seedlings, except in very small localized pockets, would take 30 to 75 or more years. Development of LOS structure (in the absence of stand-replacing wildfire) could take up to 300 years across most acres, due to the lag time in reestablishing conifers and the solid establishment of competing vegetation. About 20 to 30 percent of the area could develop LOS structure in 150 to 200 years. This LOS structure would be multi-storied and not a stable, sustainable stand.
- No fuels reduction or effective site preparation would occur on approximately 9,333 acres of planted forested type. The acres of higher mortality forested types that did not receive such treatment would exhibit very heavy fuel loadings. Development of single story, low-density sustainable stands would be difficult and expensive on these acres. The larger fuels could persist for 50 to 100 years. This fuel loading would eliminate the use of prescribed fire without very expensive mechanical pretreatments. It would also create a fuelbed that would support the spread of severe, stand-replacement wildfires. This in turn would increase the potential for soil damage occurring from burning of large, down fuels and the potential for establishment of non-native vegetation and noxious weeds (see Noxious Weeds section). As dead trees fell on these acres, they would damage some of the conifer regeneration. Such damage would limit its ability to develop LOS structure, and provide infection opportunities for insect and disease agents.
- Approximately 11,417 acres will be planted or naturally regenerated, and receive enough fuels treatment so that if maintained by underburning sustainable LOS stands would be expected to develop.
- The roughly 14,000 acres that burned with less than 50 percent vegetative mortality would develop as a mosaic of:
    - Residual overstocked patches,
    - Regenerated overstocked patches.
    - Moderate to heavy fuel loading,
    - Forested stand type that regenerated to shrub/grass vegetation with very few trees. These conditions would not be sustainable over the long term, though they could provide some habitat diversity.
- Plantation noncommercial thinning would occur on approximately 2,214 acres. This would reduce fuel hazard and accelerate development of LOS.
- Prescribed burning would occur on 2,450 acres, reducing fire hazard by reduction of ladder fuel and surface fuel component. This would also reduce costs for future stocking level control treatments.
- Aspen enhancement will occur on 690 acres of riparian aspen and 7 acres of riparian would have deciduous species planting. These treatments would increase habitat diversity within the project area.

Cumulative Effects of the Alternatives

Earlier parts in this section have described past activities that contributed to the creation of current conditions on National Forest System lands. Management on adjacent privately-owned forestlands has also contributed to the creation of current conditions within the Silver Creek and Silver Lake watersheds. Much of the project area is intermingled with these lands.

Timber companies own most of the acres of private land within and surrounding the project area. In recent history (before the 2002 fires), these lands had been intensively managed for timber production. The Toolbox Complex burned over much of these intermingled private lands. Following the fires, any merchantable size trees in areas that burned on these private lands were salvaged in the winter of 2002-2003. Planting has now started on the private land. Planting that has occurred so far on private land is much less dense that that done previously. It appears that at least some of the planting density is 200 trees per acre or less, so the future stands should be much less dense than in the past.

These private land activities are not expected to have an effect on efforts to restore forest vegetation on the adjacent National Forest System lands. Many of the private stands have been harvested to a degree that dead fuel is not the issue

that it is on the National Forest System lands. A few private parcels belonging to non-industrial owners had much denser stands that were burned in 2002, and fuel hazard on those acres would be higher. But acres in that condition are in the minority. Alternative G would provide for a fuels treatment "buffer" around private lands that could address the issue of these adjacent fuels in the long term.

There is little concern that insect populations would build up on private land to a degree that would threaten vegetative communities on National Forest System lands. Most acres on private land do not have enough remaining large trees (that have not been salvaged) for this to be a significant issue.

There are three reasonably foreseeable vegetation management projects that are being planned on National Forest System lands close to the project area. These three projects—the Windmill restoration project, the Triad restoration project, and the West Fork Silver Creek restoration project—all involve a combination of understory thinnings, mechanical fuels treatments, and prescribed burning intended to promote the development of LOS stands by reducing stand densities and reducing the risk of stand-replacement fires. In addition, approximately 1,400 acres of prescribed burning under existing NEPA decisions (Retool North and South) is expected to occur in the Fall of 2003, if weather and other conditions are appropriate to conduct the burn. The predicted cumulative effect of these projects on vegetative conditions, when combined with the alternatives, would be to increase the development of LOS and sustainable forests across the landscape that encompasses the Toolbox project area. Appendix A, page 24, provides specific details by subshed regarding how much treatment is planned within each subshed.

Consistency with the Forest Plan and Other Regulatory Direction

All proposed activities analyzed in this Forested Vegetation section would be consistent with the Fremont National Forest Land and Resource Management Plan, as amended, and other direction listed in the Regulatory Framework for Forested Vegetation.

LOGGING SYSTEMS AND LOGGING ECONOMICS

- Introduction
- Analysis Methods
- Existing Condition
- Environmental Consequences
- Direct and Indirect Effects
- Logging Economics
- Cumulative Effects

Introduction

An overall logging plan for the Toolbox Fire Recovery Project area was made for the commercial forest land remaining after previously reforested units and non-commercial ecotypes were removed. Recommended logging systems were assigned regardless of land status. For example, logging systems were assigned to RHCAs, Old Growth areas, and other resource concern areas, even though the areas may not be considered for harvest. The overall logging plan for the remaining commercial forest land in the project area indicates approximately 90 percent is recommended for ground-based logging and approximately 10 percent is recommended for helicopter logging.

Analysis Methods

Logging system planning was based on local field knowledge, aerial photo interpretation, review of contour maps, and utilization of the GIS slope layer. Logging system boundaries would be further refined during project implementation. Logging system recommendations were primarily based on topography, access, and expected management constraints.

Ground-based logging is generally acceptable on areas with slopes less than 35 percent, with yarding distances of less than 1000 feet, and where management constraints allow ground-based equipment operations. Occasionally during logging system planning, exceptions occurred, such as: 1) areas with minor inclusions of slope greater than 35 percent where the equipment can operate around the inclusions; 2) areas with yarding distances up to ¼ mile instead of constructing new roads; and 3) areas where winch line pulling could remove the timber while keeping equipment out of the areas that exclude ground-based equipment.

Helicopter logging was recommended on areas with continuous slopes greater than 35 percent, where excessive road construction would be required to reach isolated areas, where management requirements were expected to prohibit ground-based equipment, and where winch line pulling would not achieve desired results. Proposed helicopter logging areas may contain some inclusions that meet ground-based characteristics but were too small to identify during project planning.

Logging Systems

Ground-Based Logging—The ground-based logging group includes various machines such as crawler tractors, rubber tired skidders, and forwarders. Also in this generic group are mechanical feller bunchers that fell and bunch trees for skidding by a separate machine. Ground-based machines can be equipped with grapples or winches. Winches hold approximately 75 feet of cable. Operators of equipment with winches can pull line 50 to 70 feet to minimize ground disturbance or to reach logs in equipment exclusion areas. Machines with grapples must back to each log or bunch of logs. One end suspension of logs is be achieved by machines equipped with integrated arches that lift the leading ends of the logs free of the ground. This increases the speed of logging and minimizes ground disturbance. Downhill skidding is preferred over uphill skidding to reduce yarding cycle time and also reduce ground disturbance. The existing classified road system is designed for ground-based logging. Previously used unclassified roads, landings, and skid trails in the project area facilitate ground-based systems. Approximately one landing per ten acres is the historic average for landing density.

Horse Logging—Horse logging was suggested by a member of the public during scoping for logging sensitive areas such as RHCAs. The system has limited application in fire salvage because of low production rates and the limited numbers of horse loggers that are available near the project area. The need to remove fire-killed timber rapidly does not lend itself to horse logging. Therefore, specific areas would not be recommended for horse logging at this time. If credible interest is shown for horse logging, suitable land included as tractor logging ground could be made available during implementation of any of the action alternatives.

Skyline Logging—Skyline logging includes a variety of cable logging systems that employ steel cables operated by a "yarder" equipped with stationary winches. The cables run through a tower to provide lift to the logs being yarded. Compared to basic cable systems that provide limited lift on logs, skyline yarders have an additional cable or "skyline" that is used to lift the logs being yarded. Depending on various factors, especially favorable topography, the logs can be partially or fully suspended above the ground.

Skyline yarding is not a feasible system for the vast majority of the land in the project area. Existing roads were located in the past for tractor logging and most are not conducive to skyline yarding. Many miles of new road construction would be required to place log landings in the proper location for skyline yarding. Steep topography with concave slopes is best to help cable systems provide lift on the logs. Many of the slopes in the project area are relatively flat or are convex slopes that reduce or eliminate log suspension. Finally, suitable stump anchors, lift trees, or both are needed at the far end of the area being logged to support or anchor the cables. Rocky areas, grass flats, or plantations are located where the anchors and lift trees are needed in the few areas where existing roads could provide suitable landing locations. Because the existing road network was constructed to facilitate tractor logging, the topography is usually unfavorable, and adequate anchors and lift trees are not available, skyline yarding systems were not considered during logging system planning.

Helicopter Logging—During helicopter logging, logs are flown fully suspended from the stump to the landing. Adverse effects to resources, such as soil and water, are minimized. Since yarding distances are often longer than ground-based and skyline systems, the need for new road construction is reduced. Larger landings, typically one acre in size, are usually required for efficient log processing and helicopter maintenance and servicing. Where large areas of helicopter logging are proposed, fewer landings are required compared to ground-based and cable systems.

Helicopter logging is sensitive to economic conditions. Helicopter logging is the most expensive system in use in the Pacific Northwest. The economic feasibility of a helicopter logging proposal is primarily affected by three factors: 1) delivered log prices; 2) the ability to maximize the weight of each "turn" (load) of logs by having the log weight approach the load carrying capacity of the helicopter; and 3) minimizing "cycle" (round trip) time by reducing factors such as flight distance, canopy closure over the logs, and search time required to collect a turn of logs.

The Regional Logging Engineer visited the project area early in the planning process. A Boeing 107 Vertol class machine was recommended for the project. The following parameters for logging system planning were provided:

- The minimum volume necessary for a helicopter sale is approximately 1.0 MMbf.
- Units need to contain 6 to 8 Mbf per acre that is available for removal.
- At the altitude of the project, a turn should weigh 6,500 to 7,000 pounds and should consist of no more than seven pieces.
- A turn of logs needs to be available in an area 100 to 150 feet in diameter.
- Average flight distance to log landings should be between ½ to 1 mile. The shorter the distance the better.
- Flight distance to service landings for refueling, inspections, and maintenance should be as short as possible (4 to 5 miles).
- No yarding over high voltage power lines.

Depending on the theme of the alternative, a coarse filter of 7 Mbf per acre would be used before a unit is included in the alternative. Once the potential helicopter volume is calculated a second filter of a minimum volume of 1.0 Mbf would help determine if helicopter logging units would remain in the alternative. Exceptions to the coarse filters may be acceptable but they would be considered on a case-by-case basis. The Helipace computer program will be used to analyze the economic feasibility of alternatives with helicopter logging units that passed through the coarse filters.

Transportation Systems

Transportation system planning for logging projects usually includes temporary roads, unclassified roads, and classified roads. Since the project area contains numerous classified roads and additional classified roads are not expected to be necessary, the planning for logging systems and associated roads concentrated on new temporary and existing unclassified roads. A separate Roads Analysis process was conducted to make recommendations for the long-term management of existing classified roads.

Temporary roads are defined in FSM 7700 as, "Roads authorized by contract, permit, lease, other written authorization, or emergency operation not intended to be a part of the forest transportation system and not necessary for long term resource management (36CFR 212.1).

Unclassified roads are defined in FSM 7700 as, "Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1)."

Mill Capacity

Some concerns were expressed about mill capacity in the local area. The thought was that stumpage prices may be depressed if all of the timber from restoration projects resulting from the large fires of 2002 (Grizzly, Skunk, Winter Rim, Toolbox, and Eyerly) was sold in a short time frame. In reality timber from the 2002 fires, regardless of ownership, would probably become available over a 1 to 3 year time frame (2002 to 2005). Salvage of timber from private land began immediately after the fires were controlled in 2002. Almost all of the private land salvage logging will be completed by the spring of 2003. Forest Service National Environmental Policy Act (NEPA) decisions are scheduled in 2003 to 2004 so Forest Service sales would more than likely be spread out from 2003 to 2005 barring significant delays.

Based on past harvest, the timber salvaged from the 2002 fire areas could be processed at mills in Gilchrist, Prineville, Lakeview, Klamath Falls, Medford, Roseburg, White City, Central Point, Prairie City, and John Day. The mills have ample capacity to process the timber that may be available from the 2002 fires. Because of its proximity to the project area, the Crown Pacific mill at Gilchrist would be the appraisal point.

Logging System Economic Comparison

For ground-based logging, a rough weighted average stump-to-mill cost was determined for each alternative. The rough weighted average costs were based on the total harvestable volume of each volume class in the alternative and the stump-to-mill cost of the harvestable volume in each volume class.

Two adjustments were made to the rough weighted average ground-based stump-to-mill costs. The first was to recognize that Alternative D has a noticeably shorter average yarding distance than the other action alternatives (approximately 370 feet vs. 475 feet). The Mechanized Yarding Appraisal program was used to determine that Alternative D would cost approximately $5.00/MBF less than the other action alternatives. The second adjustment was made to account for the need to hand fall large trees. Commonly used mechanical feller bunchers are limited to trees approximately 21 inches in diameter at the stump. For each alternative the number of trees to hand fell was multiplied by an average experienced cost of $10.00 per tree. The total cost for hand felling was divided by total volume to determine the $/MBF adjustment. Although Alternative E had the highest number of large trees per acre, the $/MBF adjustment was the least due to the higher volume per acre of the units in the alternative. The ground-based stump-to-mill costs are listed in the following table.

To account for volume loss due to the time to complete planning under the requirements do the National Environmental Policy Act (NEPA) and implement sale preparation, small diameter trees and tops of large trees are not included in sawtimber volume estimates. Trees less than 13 inches diameter breast height (dbh) and tops less than 10 inches diameter inside bark (dib) on the small end are not in the volume estimates as sawtimber. To account for assumed value reductions, 35 percent of the green timber value was removed when estimating potential dollar returns.

Helicopter Logging—Helicopter logging stump-to-truck costs were calculated for each unit by the Helipace computer program. The program also calculated a weighted average stump-to-truck cost for each alternative. Factors in the project area that primarily affected the results of the Helipace program calculations include:

- average piece size;
- type of helicopter

- flight distance between units and landings (both log and service)
- equipment move in and move out distance
- the percentage of the helicopter design load available for each turn of logs
- additional flight time to search for logs to maximize payload
- woods and landing crew size, including the number of loaders with operators.

Numerous other factors are considered by the program, but the ones listed above had the greatest affect on costs between the alternatives.

Ground-based Logging—Ground-based stump-to-mill costs for the various harvestable volume classes were calculated during the development of Alternative E. The costs were based on a comparison with a recent appraisal in the Klamath Basin Working Circle. Logging costs per thousand board foot ($/MBF) were separated into stump-to-truck and truck-to mill costs. Stump-to-truck includes costs such as felling, limbing, bucking, skidding, loading, and branding. The costs also include moving equipment to and from the sale area, equipment moves between landings, landing preparation, and landing restoration.

Truck-to-mill costs include log haul, road maintenance, constructing temporary roads, refurbishing unclassified roads, closing both types of road, surface rock replacement, and other miscellaneous costs typical in the working circle. Truck-to-mill costs on a $/MBF basis were assumed to be relatively constant at $64/MBF since the volume classes and units are dispersed throughout the project area. The costs do not include slash disposal and road reconstruction. Those costs are documented elsewhere in the EIS. The primary variable was volume per acre. Low volume per acre results in higher stump-to-truck costs since the timber is more widely scattered than the higher volume per acre stands.

The following table summarizes the ground-based logging costs developed by the comparison appraisal.

Table 3.36 Ground-Based Logging Costs Summary

Harvestable Volume MBF/Acre	Stump-to-truck $/MBF	Truck-to-mill $/MBF	Stump-to-mill Total $/MBF
1	386	64	450
2	251	64	315
4	151	64	215
8	107	64	171
9	95	64	159

Existing Condition

Landings – In the past there has been an average of one landing per 10 acres in the project area. Timber sale contracts required rehabilitation of the landing sites. The Toolbox Complex Fire removed vegetation and residual debris that covered these landings. These landings would be refurbished, used during the implementation of the Toolbox project and then rehabilitated.

Unclassified Roads – The project area contains 59.25 miles of road that met the definition of unclassified prior to the Toolbox Complex Fire in July 2002. On some previously decommissioned roads, the fire consumed barriers, camouflage made of organic material, and the vegetative re-growth that was along and on the road surface. In other situations, inorganic barriers and cross-drains were breached or skirted prior to the fire, during fire suppression, and during post fire activities. Many of the previously decommissioned roads may now function more like unclassified roads than decommissioned roads. Field observations and interpretation of post fire aerial photographs have resulted in the addition of 9.43 miles of previously decommissioned roads to the unclassified road mileage, bringing the total to 68.68 miles of existing unclassified road. Current unclassified road density in the project area is 0.93 miles per square mile.

Environmental Consequences

Direct and Indirect Effects

Common to all Action Alternatives

Ground-based Landings—Landing construction costs are included in stump-to-truck costs. Past experience on the District indicates that ground-based logging averages one landing per ten acres. Since most of the area that was burned is on land that was previously logged, very little new landing construction would be required. Some of the existing landings would

require minor refurbishing. Construction or refurbishing costs plus move in and move out costs are included in the comparison costs that were calculated for typical projects in the local working circle during the development of Alternative E.

The amount of landing activity on or adjacent to a classified road primarily depends on the type of surfacing on the road. For roads with an asphalt or chip-seal surface, logs would be skidded away and landing activity would not typically occur on the road surface. In unusual circumstances, such as hazard tree removal along roads in RHCAs, the logging equipment is likely to be required to remain on the road. Measures would be taken to protect the road surfacing. In visual corridors that coincide with higher standard roads (i.e. roads 27 and 28), the landings would be as far away from the road as possible. However, some situations may require landings adjacent to the roads.

Terrain and the location of existing lower standard roads would be factors in locating landings to meet visual quality objectives. On classified roads with cinder, crushed rock, or both, step landings or landings with short stub spurs would be used, where possible, to keep skidding activities off the road surface. Where roads have a native surface the logs would be decked at the edge of the road. Ground-based machines would often be on the road and activities such as loading logs could also occur on the road. Traffic delays of up to 30 minutes are expected where landings are on or adjacent to roads. Warning signs or flaggers would alert the public to safety hazards. Area closures may be necessary to separate the public from industrial hazards.

Upon completion of logging activities all landings could be scarified or sub-soiled, natural drainage patterns would be restored, and slash accumulations would likely be treated. Depending on the silviculture prescription, landings may be planted along with the rest of the harvest unit.

The following table lists the approximate number of ground-based log landings and the acreage affected by alternative. Landings average ¼ acre in size. Field observations of previously used landings indicate that the proposed mitigation measures successfully return the landings to productive status. In stands with a lodgepole pine component, the landings are often overstocked with reproduction. In ponderosa pine stands, the reproduction is more widely spaced but eh landings are not under-utilized for tree growth.

Table 3.37 Ground-based Log Landings

Alternative	A	C	D	E	G	H
Number of Landings	0	1,400	600	1,120	1,400	1,300
Acres	0	350	150	280	350	325

Unclassified Roads—Unclassified roads were used as often as possible in the overall logging plan to reduce temporary road construction. Approximately 30 miles of existing wheel tracks are included in the overall logging plan for the project. The Toolbox Fire portion has 8 miles and the Silver Fire portion has 21 miles. Approximately 1 mile of the 30 mile total is outside the perimeters of the fires. The roads are needed to connect temporary or unclassified roads inside the fires to classified roads outside of the fires.

The amount of unclassified road proposed for use as temporary road and closure following salvage logging, by alternative, is listed in the following table. Also included in the table is the unclassified road density following decommissioning of unclassified roads that are treated as temporary roads in the Timber Sale Contract. Alternatives C and G accomplish the greatest amount of unclassified road closure following harvest. Alternative A does not accomplish any unclassified road closure.

Table 3.38 Miles of Unclassified Roads to Temporary or Classified Roads.

Alternative	Unclassified to Temporary (Miles)	Unclassified Road Density Following Harvest (Miles per Square Mile)
A	0.00	0.93 – 0.00 = 0.93
C	21.4	0.93 – 0.29 = 0.64
D	5.7	0.93 – 0.08 = 0.85
E	15.8	0.93 – 0.22 = 0.71
G	21.4	0.93 – 0.29 = 0.64
H	19.7	0.93 – 0.27 = 0.66

Unclassified roads can be refurbished at a cost of approximately $75.00 per mile. The fires consumed much of the trees and brush on existing wheel tracks that would have required clearing and grubbing. Unclassified roads not recommended for conversion to classified status following the roads analysis would be treated the same as temporary roads, as per Timber Sale Contract provision B 6.62 (See Chapter 2, "Actions Common to All Fully Analyzed Action Alternatives").

Common to Alternatives C, E, G, and H

Temporary Roads—Temporary roads as they relate to this project are new temporary roads that would be authorized by Timber Sale Contract(s). Proposed temporary roads were planned into land without classified and unclassified roads to reduce tractor logging skid distances and to provide access to helicopter landings to reduce helicopter flight distances. If all of the commercial forest land not in existing plantations in the project area were harvested at one time, approximately 15 miles of new temporary road would be constructed. Approximately 7 miles are in the Silver Fire and 8 miles are in the Toolbox Fire. Temporary road construction and associated activities are governed by Timber Sale Contract provisions B 5.1 and 6.62—Temporary Roads.

Proposed new temporary road locations were planned to avoid stream crossings as much as possible. No Class 1, 2, or 3 stream crossings are proposed. The overall logging plan includes two crossings of Welker Creek (Class 4) in the Toolbox portion of the project.

Temporary road construction is relatively inexpensive because of the dominance of gentle topography in the project area. A crawler tractor could construct one mile of temporary road in average conditions for approximately $100.00. Temporary road construction is an inexpensive method for reducing tractor and helicopter yarding costs. The cost of temporary road construction is relatively insignificant and would be included in the truck-to-mill cost.

Upon completion of harvest activities, all temporary roads would be treated as per Timber Sale Contract provision B 6.62 (See Chapter 2, "Actions Common to All Fully Analyzed Action Alternatives") and returned to Timber Production. The following table lists the number of road segments, mileage, and acreage affected by new temporary roads.

Table 3.39 Temporary Roads

Alternative	A	C	D	E	G	H
Number of Segments	0	59	0	53	59	58
Number of Miles	0	16.0	0	13.3	16.0	14.9
Acreage	0	24	0	20	24	22

Common to Alternatives C, D, E, and G

Helicopter Landings - Helicopter log landings would be located on all of the types of road to reduce average flight distance from the units to ½ mile or less where possible. Helicopter service landings would be located to keep the flight distance from units and log landings for fuel and maintenance to an average of five miles or less. Service landings would be located near main line classified roads to facilitate access by large fuel trucks and maintenance vans. Some of the service landings could perform double-duty as log landings.

Approximately 44 helicopter log landings and 4 service landings are proposed in the overall logging plan to log all of the helicopter ground in the plan. Half of each type is in each fire area. Because of resource restrictions, each alternative would have considerably fewer helicopter landings. For planning purposes, construction of helicopter log landings is estimated to cost about $500.00 each and service landings are estimated at $1000.00 each. Combination service/log landings are estimated to cost $1500.00. A cap of crushed rock is proposed at the service landings to aid in dust abatement and to support fuel and maintenance vehicles.

Upon completion of logging activities all landings could be scarified or sub-soiled, natural drainage patterns would be restored, and slash accumulations would likely be treated. Depending on the silviculture prescription, landings may be planted along with the rest of the harvest unit.

Helicopter log landings are typically one acre in size and service/log landings are two acres or less. As with ground-based log landings, mitigation measures return the landings to productive status. The following table lists the number of landings and acreage by alternative.

Table 3.40 Helicopter Landings

Alternative	A	C	D	E	G	H
Number of Log Landings	0	7	5	1	7	0
Number of Service/Log Landings	0	3	2	1	3	0
Acres	0	13	9	3	13	0

Logging Economics

For Alternatives C, D, and G, the average truck-to-mill cost of $64/MBF was added to determine the stump-to-mill cost. The cost was kept constant since the units are scattered similarly to the ground-based units. The most obvious exception was Alternative E where units are concentrated in the northeast corner of the project area. To account for the shorter haul distance and lower related costs, the truck-to-mill costs were estimated to be $8/MBF less. Alternative H proposes no helicopter yarding. The helicopter stump-to-mill costs are also listed in the next table.

The following table provides comparisons of alternatives based on quantifiable logging system factors.

Table 3.41 Economic Comparison of Logging Systems by Alternative

Comparison Factor	Alt. A	Alt. C	Alt. D	Alt. E	Alt. G	Alt. H
Helicopter Acres	0	470	360	307	449	0
Ground-Based Acres	0	13971	6007	11183	13970	13031
Helicopter Volume (MMBF)	0.0	4.1	3.2	2.7	3.9	0.0
Ground-Based Volume (MMBF)	0.0	69.2	30.5	63.4	69.3	63.8
Helicopter Costs (Stump-to-mill)	$0.00	$253.47	$251.60	$239.36	$252.54	$0.00
Ground-Based Costs (Stump-to-mill)	$0.00	$213.35	$206.05	$203.18	$213.30	$214.19

Delivered Log Price—To determine the delivered log prices to use to compare against projected logging costs, the available stand examination plot data was converted to sample timber cruises. The sample timber cruises were used to determine the volume by species for each stand.

Past experience with fire salvage projects indicates that by the time NEPA compliance and sale preparation is achieved, small trees less than 13 inches diameter breast height and logs (16 foot long) on the tops of larger trees that are less than 10 inches diameter inside the bark on the small end would be dried and blue stained sufficiently to prevent their use as sawlogs. The small diameter material could be chipped but currently there is no local market for chips. Therefore, the volumes by species used later in the Product Quality Adjustment spreadsheet are based on 16 foot saw logs 10 inches diameter inside the bark on the small end and larger. Also, because of normal delays in preparing salvage sales, the delivered log prices in the Oregon Log Market Report, February 25, 2003, were devalued by 35 percent compared to green timber (25 percent for the first year after the fire and 10 percent for the second).

For each sample cruise a Product Quality Adjustment-Oregon Eastside spreadsheet was prepared. The spreadsheets reflected the projected loss in both volume and value from "normal" delays for NEPA compliance and sale preparation time. The weighted average delivered log prices in stands recommended for ground-based logging systems were in all volume classes and ranged from $256 to $318/MBF. The average for ground-based systems was approximately $300/MBF. Helicopter logging areas were in high and very high volume classes and averaged approximately $315/MBF.

Financial Efficiency Comparisons

For the following Financial Efficiency Comparison, the delivered log prices for ground-based and helicopter systems were weighted by the volume of each system in the alternative to produce a $/MBF delivered log price for each alternative. Stump-to-mill costs for each logging system were also weighted by volume to produce a cost for each alternative. As noted previously, slash disposal and road reconstruction costs are not included here. Those costs are documented elsewhere in the EIS.

The following table provides comparisons of alternatives based on delivered log prices, stump-to-mill costs, and potential returns.

Table 3.42 Comparison of Delivered Log Prices, Stump-to-Mill Costs, and Potential Returns, by Alternative

Economic Factor	Alternative A	Alternative C	Alternative D	Alternative E	Alternative G	Alternative H
Delivered Log Price ($ Per MBF)	$0.00	$300.83	$301.41	$300.62	$300.80	$300.00
Stump-to-Mill Cost ($ Per MBF)	$0.00	$215.58	$210.32	$204.67	$215.40	$214.19
Net Stumpage ($ Per MBF)	$0.00	$85.25	$91.09	$95.95	$85.40	$85.81
Volume (MBF)	0	73,276	33,762	66,118	73,157	63,842
Estimated Return* (Total Dollars)**	**$0**	**$6,247,102**	**$3,075,310**	**$6,344,062**	**$6,247,788**	**$5,478,282**

* Without subtractions for slash disposal, road reconstruction, reforestation, etc.
** Math differences in the estimated returns are the result of using spreadsheets that do not round off values during calculations.

Potential Timber Sales

For planning purposes, potential sales were developed by the Timber department at the Silver Lake Ranger District to get an idea about the size of timber sales in each alternative. The potential sales were based on geographic locations, log haul routes, logging systems, expected sale preparation and sale administration budgets, and the need to remove dead timber as quickly as possible. The project area breaks down into eight logical sales. Seven use ground-based logging systems while number eight contains the entire helicopter logging volume in the alternative. As more is learned throughout the NEPA process potential sales are likely to be adjusted. However, sale preparation and sale administration costs tend to increase as the number of sales increase and sale size decreases.

The following table displays the proposed breakdown of sales by alternative and the range of sale sizes within the alternatives.

Table 3.43 Breakdown of Sales and Range of Sale Sizes by Alternative

Sale Number	Alternative A	Alternative C	Alternative D	Alternative E	Alternative G	Alternative H
1 (Ground-based)	0	11.4	3.6	10.0	11.4	10.0
2 (Ground-based)	0	7.6	5.1	6.8	7.6	6.9
3 (Ground-based)	0	8.3	3.5	7.9	8.4	6.8
4 (Ground-based)	0	9.2	3.1	8.4	9.2	9.1
5 (Ground-based)	0	5.2	1.8	3.9	5.2	4.8
6 (Ground-based)	0	16.3	10.0	15.7	16.3	15.4
7 (Ground-based)	0	11.2	3.4	10.7	11.2	10.8
8 (Helicopter)	0	4.1	3.2	2.7	3.9	0.0
Total Volume (MMBF)	**0.0**	**73.3**	**33.7**	**66.1**	**73.2**	**63.8**
Range of Sale Sizes (MMBF)	**n/a**	**4.1 – 16.3**	**1.8 – 10.0**	**2.7 – 15.7**	**3.9 – 16.3**	**4.8 – 15.4**

Cumulative Effects

The cumulative effects of logging systems would be primarily the effects of temporary roads (including existing unclassified roads) and landings. After salvage harvest is complete, for temporary roads, the timber purchaser would be required to remove bridges and culverts, establish cross drains, outslope the roadbed, remove ruts and berms, and effectively block the road to normal vehicular traffic. Landings and skid trails would be scarified or sub-soiled, natural drainage patterns would be restored, and slash accumulations would likely be treated. Depending on the silviculture prescription, landings may be planted along with the rest of the harvest unit. For temporary roads and landings, grass and herbaceous forbs should cover 75-80 percent of the roadbed in the first year after closure, and brush should begin adding to the cover by the second year. Planted landings would appear open in the short term, due to slow seedling growth. After 10 years the landings should contain 10-foot tall trees spaced at 100 trees per acre. No timber sales other than the Toolbox Fire Recovery Project are planned for the project area within the reasonably foreseeable future.

WILDLIFE

- Introduction
- Key Issue
- Purpose and Need
- Regulatory Framework
- Analysis Method
- Area of Analysis
- Fremont National Forest Management Indicator Species Analyzed for the Toolbox Fire Recovery Project, Including Existing Condition, Direct, Indirect, and Cumulative Effects
- Threatened, Endangered, and Sensitive Species Analyzed for the Toolbox Fire Recovery Project, Including Existing Condition, Direct, Indirect, and Cumulative Effects
- Focal Species Analyzed for the Toolbox Fire Recovery Project, Including Existing Condition, Direct, Indirect, and Cumulative Effects
- Other Species, Habitats, and Wildlife Issues of Concern for the Toolbox Fire Recovery Project, Including Existing Condition, Direct, Indirect, and Cumulative Effects

Introduction

This document will include an effects analysis on existing and projected management indicator species likely to be found within the proposed analysis area (Title 2634.1 USFS Manual), and a biological evaluation that discusses and documents the effects of this proposed project on threatened, endangered, and sensitive species (Title 2670.5 USFS Manual). Lastly, focal species identified for the Subprovince Central Oregon/Klamath Basin in the *Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington* (Altman 2000), and other species and habitats of concern will be addressed if they are known to exist within the planning area.

Key Issue: Effects on Wildlife Habitat

Issue Statement: Habitat for snag and down wood dependent species could be negatively impacted by commercial salvage operations through the removal snags. Fuels reduction that includes the use of prescribed fire could negatively impact mule deer habitat by reducing cover.

Measurement Indicator:

The following indicators will be evaluated for each of the alternatives:

- Snag and down wood dependent species habitat retained (acres of identified optimal habitat) from among 1,789 acres of identified optimal black-backed nesting habitat; and 900 acres of identified optimal Lewis' woodpecker nesting habitat)
- Mule deer habitat (Habitat Effectiveness and percent cover)

Purpose and Need

This section analyzes the effects of the alternatives in addressing the purpose and need to maintain sufficient amounts of snag and down wood created by the fire to provide effective habitat for dependent species, while promoting recovery of live forest habitat that was lost as a result of the fire.

Regulatory Framework

As stated in the 36 Code of Federal Regulations 219.19, wildlife habitat shall be managed to maintain viable populations of existing native species by identifying management indicator species whose population changes are believed to indicate the effects of management activities. To meet this CFR, the Land and Resource Management Plan for the Fremont National

Forest (LRMP) identified species whose population changes may indicate impacts on other species found within a specific habitat type. The Endangered Species Act also requires Forests to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the U. S. Fish and Wildlife Service (USFWS) if a proposed activity may affect the population or habitat of a listed or candidate species. The Forest Service manual also directs the Regional Forester to identify sensitive species for each National Forest where species viability may be a concern. The Sensitive Species List for the Fremont National Forest was updated in November of 2000.

Analysis Method

The level of analysis depends on the existing habitat conditions, the intensity of the proposed actions, the magnitude of the actions, and the risk to the resources. Regional and national assessments and conservation strategies were reviewed to determine which species had a likelihood to occur or potential habitats within the Toolbox Fire Recovery Project area. The LRMP, monitoring reports, and district wildlife databases and survey records were reviewed to determine the potential for threatened, endangered, and sensitive species of concern, and management indicator species occurring in the project area. A species was selected for detailed analysis if the species on the list was present within the analysis area or when known habitats for that species had a high likelihood of being affected by the proposed actions. Current field information, post-fire aerial photos, and databases provided the majority of information for detailed assessments of effects.

DecAID, the Decayed Wood Advisor for Managing Snags, Partially Dead Trees, and Down Wood for Biodiversity in Washington and Oregon (Mellen et al., 2003) was used as the primary tool for snag and down wood recommendations for this project because it is a culmination of the most recent science and data available.

Area of Analysis

Effects on wildlife will be assessed for the area within the Toolbox Fire Recovery Project on the Fremont-Winema National Forests. Fire has changed more than 48,000 acres of wildlife habitat and the proposed activities within the project area would affect the trajectory of recovery of the burned area.

Species and Habitats

Fremont-Winema National Forests Management Indicator Species

The Fremont National Forest Land and Resource Management Plan (LRMP) identified species whose population changes may indicate impacts on other species found within a specific habitat type. The following table displays the Management Indicator Species discussed in this Wildlife Section.

Table 3.44 Fremont-Winema National Forest Management Indicator Species

Fremont National Forest Management Indicator Species	Representative of:	Page Number
Goshawk	Overmature/Mature Ponderosa Pine; Mixed Conifer	3-121
Mule Deer	Hunted Species	3-124
Pileated Woodpecker	Overmature/Mature Mixed Conifer	3-130
American Marten	High Elevation Forests; Lodgepole Pine and Mixed Conifer Forests	3-132
Red-naped Sapsucker	Aspen and Deciduous Ecosystems	3-134
Snag and Down Wood Dependent Species	Snag and Down Wood	3-136
Black-backed Woodpecker	Overmature/Mature Lodgepole Pine	3-180

Goshawk

Existing Condition

The northern goshawk is the largest North American accipiter and was chosen as a MIS species due to its association with mature and Late and old Structure (LOS) ponderosa and mixed conifer forest structural stages for nesting. The goshawk's home range encompasses about 6000 acres and is composed of a nest core area, post-fledging area (PFA), and a foraging area. Various forest structural stages are associated with the components of the home range. Nest areas often occur on north aspects, along stream zones or other areas where a dense forest canopy and LOS forest conditions are present. PFAs usually resemble the nest area, but also include a variety of forest types and conditions where hiding cover (for the young) and prey availability is present (Reynolds et al. 1991). Foraging areas may be as closely tied to prey availability as to habitat structure and composition. These areas often contain a mixture of various forest structural stages with snags, downed logs, large trees, and small openings with an herbaceous and/or shrubby understory present.

Fremont National Forest LRMP Standards and Guidelines for goshawks, as amended by the Regional Forester's Amendment #2, are to protect a 30-acre nest core, to delineate a 400-acre post fledging area with an emphasis of maintaining existing LOS stands and enhancing younger stands towards LOS condition, and to protect every known active and historical nest site from disturbance.

Goshawk surveys were conducted in the early summer of 2003, and changes will be incorporated into the alternatives as needed between the Draft Environmental Impact Statement (DEIS) and Final environmental Impact Statement (FEIS). Surveys will be conducted to some degree within all known goshawk post fledging family areas (PFAs) and within areas of suitable habitat that burned light to moderate or less than 50 percent mortality. Due to the variability of vegetation mortality within the fire, viable nesting goshawk habitat remains in areas classified as 0 to 50 percent mortality. In these areas, the fire likely improved stand conditions by burning some of the dense understory, improving snag densities, and enabling flight access for foraging. It is anticipated that the areas classified as greater than 50 percent mortality experienced a high degree of burn and as a result, no longer provide the structure and canopy closure required for nesting.

The fire affected fourteen known PFAs. Each PFA was assessed to determined if is likely to remain functional as a goshawk nesting PFA and this was largely determined by the amount of area that burned in the 0 to 25 percent, 25 to 50 percent, 50 to 85 percent, and greater than 85 percent vegetation mortality category. Other factors were considered including the degree of mortality in and adjacent to the nest stand. The following is a list of known goshawk PFAs within the planning area, the amount of areas burned in each mortality category, and the determination of functionality:

Table 3.45 Assessment of Known Goshawk PFAs Within the Project Area

Goshawk PFA (acres)	Percent of Area 0-25% Mortality	Percent of Area 25-50% Mortality	Percent of Area 50-85% Mortality	Percent of Area >85% Mortality	Percent of Area *not* Burned	Percent of Area Private and Assumed Salvage Harvest	Functionality Determination	Comments
Graham Creek (570 acres)	0	4	8	6	82	0	Functional	Most of area did not burn.
Indian Creek (497 acres)	5	6	0	66	23	0	Non-functional	Majority of PFA including nest stand burned >85%
E. Trough Spring (285 acres)	15	4	0	28	0	53	Non-functional	Majority of PFA either private or >85%
E. Duncan (643 acres)	60	10	3	27	0	0	Non-functional	Nest stand and surrounding area burned >85%
Benny/Hawk (298 acres)	0	54	7	37	0	2	Non-functional	Majority of PFA burned >50%

Table 3.45 Assessment of Known Goshawk PFAs Within the Project Area (continued)

Goshawk PFA (acres)	Percent of Area 0-25% Mortality	Percent of Area 25-50% Mortality	Percent of Area 50-85% Mortality	Percent of Area >85% Mortality	Percent of Area *not* Burned	Percent of Area Private and Assumed Salvage Harvest	Functionality Determination	Comments
Benny Creek (607 acres)	0	15	13	26	46	0	Non-functional	Nest stand and surrounding area burned >85%
Labrie Lake (589 acres)	9	13	1	54	23	0	Non-functional	Nest stand and surrounding area burned >85%
N. Labrie Lake (423 acres)	26	43	5	26	0	0	Functional	Majority of PFA burned <50% mortality
Buckaroo (107 acres)	0	0	13	87	0	0	Non-functional	All of PFA burned >50% mortality
Foster (300 acres)	0	29	3	68	0	0	Non-functional	Majority of PFA, including nest stand, burned >85% mortality
S. Hager Mountain (734 acres)	12	2	0	0	86	0	Functional	Majority of PFA, including the nest stand, did not burn
Frog Ponds (838 acres)	1	30	3	66	0	0	Non-functional	Majority of PFA, including nest stand, burned >85% mortality
N. Duncan Creek (269 acres)	0	38	14	48	0	0	Non-functional	Majority of PFA, including nest stand, burned >85% mortality
C/B (1244 acres)	43	11	0	5	41	0	Functional	Majority of PFA burned <50% mortality and nest stands did not burn

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

No salvage harvest would result in a substantial increase in foraging habitat within and adjacent to any existing nesting habitat that remains within the fire. Bird species richness will increase as snag and down wood habitat increases, which should contribute to greater diversity of prey species.

Although goshawk foraging habitat may flourish in the short term, no fuels treatment or planting would be detrimental to goshawk habitat in the long term. This alternative has no proposed fuels treatment. Therefore areas that naturally regenerate and the remaining habitat that burned light to moderate have fuels conditions that would contribute to future high intensity fires. No proposed planting would also result in a delayed advancement of future goshawk nesting and foraging habitat.

Conclusions for Alternative A

This alternative is expected to have the most beneficial effect on goshawk populations and habitat in the short term. It is anticipated that existing goshawk populations would not be affected directly or indirectly by this alternative.

Alternative C, D, E, G, and H

Salvage harvest would reduce the short-term foraging habitat within and adjacent to any existing nesting habitat that remains within the fire. Overall however, it is expected that snag levels retained within all harvest units, as described in the Snag and Down Wood Dependent Species section, should provide for the levels needed to maintain the foraging base necessary for nesting success. Harvest levels would vary within the four PFAs that are expected to remain functional post-fire (see preceding table). Alternative C proposes 196 acres, Alternative D proposes 111 acres, Alternative E proposes 148 acres, Alternative G proposes 196 acres, and Alternative H proposes 189 acres of harvest within the four PFAs identified in the preceding table as remaining functional. No harvest units are located within ½ mile of known nest sites. Mitigation measures to ensure snag retention levels needed to maintain the goshawk foraging base necessary for nesting success are listed in the Mitigation and Resource Protection Measures section of Chapter 2.

As recommended by Reynolds and others, the proposed prescribed fire in ponderosa pine and mixed-species forests would perpetuate northern goshawk habitat and reduce fuel loading (1992). Alternatives C and G propose 3,572 acres of prescribed fire, and Alternative D and H propose 2,450 acres of prescribed fire. Alternative E proposes 0 acres of prescribed fire and therefore does not offer the opportunity to improve goshawk habitat and reduce fuel loadings. Any aspen enhancement treatments located near goshawk habitat may improve foraging habitat by increasing bird species richness as the condition of aspen improves. Alternatives C, D, G, and H propose 690 acres of aspen protection and Alternative E proposes 0 acres of aspen protection.

Although goshawk foraging habitat may be reduced in the short term (as discussed above), this would result in many acres receiving fuels reduction treatments, planting, and plantation thinning. This is expected to reduce the likelihood of fuels conditions that would contribute to future high intensity fires and would accelerate development of future foraging and nesting habitat. Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire. Planting would produce goshawk habitat much more quickly into the future than natural regeneration under Alternative A. The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting. All action alternatives proposed, except Alternative E, propose 2,214 acres of plantation thinning.

Surveys were conducted in the early summer of 2003 and mitigations would be incorporated into this project as needed. Also measures listed in Chapter 2 should mitigate any direct effects associated with unknown nests.

Conclusions for Alternatives C, D, E, G, and H

With no considerable change in existing and potential nesting habitat within the project area due to the maintenance of snags within and outside harvest units, and, with the mitigations in place, it is anticipated that existing goshawk populations would not be greatly affected by any of these alternatives in the short term. In the long term, goshawk habitat would be perpetuated and maintained with planting and fuel treatments, the greatest with Alternative G, and to a lesser degree with Alternatives C, H, E, and D respectively.

Mitigations

Mitigation measures regarding active raptor nests can be found in Chapter 2, Mitigation and Resource Protection Measures – Wildlife.

Cumulative Effects Common To All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on goshawks and the following activities have the potential to produce a cumulative effect. Past management activities have likely decreased the potential

habitat available for goshawks within the project area. Fire suppression and wildfires, as described in Table A-1 of Appendix A, have changed stand conditions, providing more dense understories. This has reduced goshawk habitat overall by creating continuous dense ponderosa pine stands, instead of stands that provide a mosaic of thickets and openings preferred by goshawks for flight access and foraging. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, have changed overall stand conditions on National Forest System and private lands. The management practices that include overstory removal and partial removal of ponderosa pine have converted many stands previously dominated by open large diameter pine to stands now characterized as multi-storied stands with white fire and pine in the understory.

Fuels reduction projects, as described in Table A-3 of Appendix A, have likely improved goshawk habitat by reducing understory stand densities and creating more of a diversity in habitat that includes openings for flight access and foraging. Recreation activities, as described in Table A-5 of Appendix A, may have some effect on goshawk productivity if nest sites are located near campgrounds or other recreational sites. Grazing, as described in Table A-8 of Appendix A, has had little effect on goshawk habitat or productivity. Wildlife and watershed improvement projects, as described in Table A-9 of Appendix A, include aspen enhance projects. Aspen stands that were treated near goshawk habitat may improve foraging habitat by increasing bird species richness as the condition of aspen improves. Snag and down wood loss through personal use firewood cutting, as described in Table A-12 of Appendix A, and through past timber management activities including salvage and hazard removal, as described in Table A-2 of Appendix A, have decreased snag and down wood levels. This has likely decreased overall foraging habitat for goshawks. Salvage harvest has occurred on several acres of private land as described in Table A-13 of Appendix A. This would likely reduce foraging habitat for goshawks by removing prey habitat.

Reasonably foreseeable future activities include treatments within the Bridge Creek Subshed and treatments displayed in Table A-16 of Appendix A within the project area subsheds. Silvicultural activities include restoration thinning and harvest that would promote open understory sustainable ponderosa pine stands. These activities in conjunction with prescribed fire are expected to improve habitat for goshawks. Prescribed fire would thin out understories in a mosaic fashion providing diversity in structure and increasing replacement snag and down wood numbers. Silvicultural treatments designed to promote open and variable ponderosa pine stands would likely increase the abundance and distribution of goshawks. Cumulatively, it is expected that goshawk populations would increase in the long term.

Mule Deer

Existing Condition

Desired habitat conditions for mule deer will not necessarily reflect optimum conditions but should be within a range between LRMP Standards and Guidelines, which, generally, are stated as minimums, and optimal habitat conditions. Optimal mule deer habitat is generally described as a mix of hiding, thermal, fawning cover, and foraging habitat. The optimum mix of cover should be 40 to 50 percent of the available habitat with 20 percent in hiding cover, 10 percent in thermal cover, 5 percent in fawning cover, and the remaining 5 to 15 percent in either hiding, thermal, or fawning cover. LRMP Standards and Guidelines require a minimum of 30 percent cover on summer range, 30 percent cover on transition range, and 50 percent cover on winter range.

A number of factors, including road density, distance between sources of water, forage utilization by cattle, and the amount and arrangement of cover and forage patches will effect habitat use by mule deer. Optimal conditions for these factors are those values as defined in Bienz, et al. (1985), Thomas (1979), and others, where no effect on habitat use is anticipated. These include: road density – 1.4 mi/sq. mi; distance between water sources - 2.8 mi; forage utilization by cattle – 10 to 24 percent; cover – 40 to 50 percent; arrangement of cover and forage – optimal use within 600’ of a cover or forage patch. These factors are used to determine a Habitat Effectiveness (HE) value in which the LRMP standard is 50 percent on summer range, 60 percent on transition range, and 80 percent on winter range.

Mule Deer in Central Oregon are a migratory group of animals that roam a vast mountainous summer range and crowd into relatively small winter ranges (Dealy 1971). Mule deer are not believed to have been abundant prior to 1850 in this region, and remained at low numbers through the early 1900s (Peek et al. 1999). Mule deer began to increase around 1915, probably because of increased shrublands (Salwasser 1979, Peek et al. 1999). Shrublands have since continued to mature across the western ranges (Urness 1990, Peek et al. 1999) and this is the case throughout much of the planning area. Public interest and use have initiated management of mule deer populations that are higher than historical numbers.

The following mule deer habitat factors remain important within the project area:

1) Cover

Thermal cover is described as overstories that shelter an animal from microclimatic extremes (Black et al. 1976, Demarchi and Bunnell 1993). Individuals can find lower ambient temperatures under thermal cover in hot weather and warmer temperatures in cold weather (Peek et al. 1982). Wind velocity is greatly reduced, and snow depth and condition are more favorable to animal movement in cover stands (Peek et al. 1982). All these factors combined can reduce energy loss by mule deer (Peek, et al. 1982). In harsh winters, animals lacking sufficient energy reserves are more vulnerable to winter-spring mortality (Demarchi and Bunnel 1993). Summer thermal cover minimizes metabolic and time costs associated with heat dissipation (Demarchi and Bunnel 1993). Lost foraging time or the energetic costs of increasing metabolism can translate into decreased summer weight gains (Demarchi and Bunnell 1993). Thermal cover can also be provided by shrubs, juniper woodlands, or physical objects such as boulders and ledges (Peek et al. 1982). Gay (1998) also found that animals are as likely to bed in the shade of a single conifer, rock outcrop, or cut-bank in the midday, as in high canopy closures.

Hiding cover habitat is used for escape and protection from predators and humans. Black et al. has suggested security or hiding cover is required even in the absence of humans and predators, implying a psychological need (1976, Peek et al. 1982). It has been observed that mule deer tend to bed down in hiding cover along ridgetops where they can view approaching predators. Although under current management, optimal habitat is defined as that which is within 600 feet (183m) of cover, Gay did not find concentrated deer use within 600 feet of hiding cover (1998). In fact, fewer than 20 percent of study animals concentrated habitat within 600 feet of hiding cover. Although the LRMP requires that mule deer habitat is managed by using the current definition of cover (a stand in which greater than 60 percent of the area can hide 90 percent of a deer at 200 feet), this omits less dense vegetation types which deer also recognize as cover (Gay 1998).

2) Grass and Forbs

Actual usage of grass and forbs by mule deer is difficult to determine because microhistological analysis is not credible due to nearly complete digestion of new and rapidly growing grasses and forbs (Zyzner and Urness 1969, Gay 1998). Grasses and forbs compose the bulk of spring diets. Gay's studies found that in April and May of 1995, when there was no snow cover and an abundance of new grasses and forbs, deer were seldom seen feeding on anything other then new herbaceous growth (1998). Forbs especially showed high use with 25 to 44 percent in June and July and 15 to 57 percent in August and September (Gay 1998).

Fire may affect the forage resource by changing both forage quality and quantity. Forage characteristics that may be affected by fire include: protein, phosphorus and fiber content, and subsequent changes in digestibility (Bunting 1998). Cook found substantial increases in crude protein of herbs after burning (1994). Fire-stimulated flowering is another phenomenon which increases seedling abundance in burned areas, as Walstad found increased flowering and seed vigor following fire for grasses in the pine forests and high desert regions east of the Cascades (1990). Small burned areas may also be more heavily utilized by herbivores than large areas because of the concentration of palatable regrowing forage (Bunting 1998).

3.) Mountain Mahogany

Mountain mahogany regeneration post fire can be variable. A curlleaf mountain-mahogany stand near MacKay, Idaho, had burned around 1900. In 1968, it contained plants ranging from 8 to 54 years of age (Scheldt and Tisdale, 1970). A stand that burned in 1965 showed no signs of regeneration by 1968. However, Collins described excellent seedling emergence in post fire year 1 of a 1979 wildfire in the Salmon National Forest, possibly due to an unusually wet growing season (1980).

Wintering deer in 2003 for the Silver Lake Unit were estimated at about 69 percent of a management objective of 10,300 animals. In general, the mule deer population appears to be stable to slightly increasing (M.J. Hedrick, personal communication).

The project area lies within mule deer winter, transition, and summer ranges. There are approximately 3,736 acres of winter range, 14,879 acres of transition range, and 29,102 acres of summer range. Due to the degree of vegetation mortality within the fire, the area has been reduced to a condition of little cover, but grass and forb forage response is expected to greatly increase. The fire burned in a mosaic pattern, which modified the pre-existing cover and forage habitat conditions. Currently, plantations, riparian areas, and dense stands that burned with light intensity are continuing to provide hiding, thermal, and fawning cover where they provided them pre-fire. Areas that burned with a moderate or high intensity likely do not provide hiding cover, if they did pre-fire. Some extensive stands of curlleaf mountain mahogany, a highly palatable

forage for big game and important source of hiding cover (Gruell et al. 1984), burned severely. Mule deer populations may increase as a result of the extensive amount of increased forage within the fire. Anecdotal evidence in local wildfires including the Alder Ridge Fire and Lone Pine Fire shows that mule deer use increases within wildfire areas.

Currently, LRMP standards for HE are not being met in any range on any of the subsheds, and percent cover standards are being met on the transition range of the Middle Silver Creek Subshed (30.4 percent), summer range of the Thompson Reservoir Subshed (37.7 percent), and summer range of the West Fork Subshed (47.6 percent).

Habitat mapping was performed within the mule deer winter range on both U.S. forest Service (USFS) and Bureau of Land Management (BLM) within the fire perimeter to indicate shrub loss (conducted by Hedrick, Oregon Department of Fish and Wildlife, 2002). Areas were mapped into 5 categories: 1. mix of live and dead shrubs with generally green trees in the overstory (5 percent), 2. shrubs and overstory trees burned (26 percent), 3. shrubs burned with generally green trees in the overstory (7 percent), 4. shrubs burned with live and dead trees in the overstory (41 percent), 5. shrubs burned in open scabflat (15 percent), and no burn (6 percent). Approximately 89 percent of the winter range within the fire perimeter on USFS and BLM land lost the majority of the shrub component. As a result, in years with heavy snow loadings on the winter range, mule deer populations may decline until the bitterbrush becomes reestablished. Bitterbrush is not expected to become established to the height of effectiveness on the winter/transition range for 20 or more years.

Environmental Consequences

Direct and Indirect Effects

Mule deer cover/forage information was mapped during the fall of 2002. As currently directed by the LRMP, analysis of mule deer habitat was performed by using habitat effectiveness (HE) calculations based in the Southcentral Oregon mule deer habitat suitability index model. This is based on the principle that areas within 600 feet of an edge of cover are the most well-used and effective habitat within cover and forage areas. This habitat is mapped and acreages calculated to obtain a percent of the planning area that is effective from a forage/cover juxtaposition standpoint. Modifiers to this percent including road density, water availability, forage utilization by domestic livestock, and cover/forage to arrive at a final HE value.

Percent cover and HE were analyzed on USFS and other private lands within the portions of the Benny Creek, East Duncan Creek, Lower Duncan Creek, Middle Silver Creek, Thompson Reservoir, Upper Duncan Creek, Upper Silver Creek, and West Fork Silver Creek Subsheds that are within the Silver Lake Ranger District boundaries only. It was assumed that areas of scabflats and open meadows were not capable of producing cover and thus would not be considered cover deficient in this analysis.

Mule Deer Analysis by Range

The following table displays the amount of mule deer summer, transition, and winter range within the project area and the habitat effectiveness of each alternative.

Table 3.46 Percent Cover and Habitat Effectiveness for Entire Project Area (Summer Range, Transition Range and Winter Range)

Alternative	Percent Cover			Habitat Effectiveness		
	Summer	**Transition**	**Winter**	**Summer**	**Transition**	**Winter**
A	29.8%	10.5%	18.8%	34.0%	6.3%	5.4%
C	29.7%	10.5%	18.8%	40.3%	8.0%	10.0%
D	29.8%	10.5%	18.8%	41.5%	8.0%	10.0%
E	29.8%	10.5%	18.8%	38.6%	7.3%	7.7%
G	29.7%	10.5%	18.8%	38.6%	7.3%	7.7%
H	29.8%	10.5%	18.8%	40.3%	8.0%	10.0%
Standard & Guideline	30%	30%	40-50%	50%	60%	80%

Mule Deer Analysis By Range Within Each Subshed

The following tables display the amount of summer, transition, and winter range within each subshed of the Toolbox project area and habitat effectiveness by alternative.

Table 3.47 Percent Cover by Subwatershed (S=Summer Range, T=Transition Range and W=Winter Range

Alt.	Benny Cr		East Duncan			Lower Duncan			Middle Silver			Thompson		Upper Duncan			Upper Silver			West Fork Silver		
	S	**T**	**S**	**T**	**W**	**S**	**T**	**W**	**S**	**T**	**W**	**S**	**T**	**S**	**T**	**W**	**S**	**T**	**W**	**S**	**T**	**W**
A	29.0	13.3	11.0	5.9	0	5.4	0.9	1.9	0	30.4	28.9	37.7	12.5	19.8	5.5	0	20.1	8.7	11.2	47.6	9.6	20.6
C	29.0	13.3	9.4	5.6	0	4.4	0.9	1.9	0	30.4	28.9	37.7	12.5	19.6	5.5	0	20.1	8.7	11.2	47.6	9.6	20.6
D	29.0	13.3	11.0	5.9	0	5.4	0.9	1.9	0	30.4	28.9	37.7	12.5	19.8	5.5	0	20.1	8.7	11.2	47.6	9.6	20.6
E	29.0	13.3	11.0	5.9	0	5.4	0.9	1.9	0	30.4	28.9	37.7	12.5	19.8	5.5	0	20.1	8.7	11.2	47.6	9.6	20.6
G	29.0	13.3	9.4	5.6	0	4.4	0.9	1.9	0	30.4	28.9	37.7	12.5	19.6	5.5	0	20.1	8.7	11.2	47.6	9.6	20.6
H	29.0	13.3	11.0	5.9	0	5.4	0.9	1.9	0	30.4	28.9	37.7	12.5	19.8	5.5	0	20.1	8.7	11.2	47.6	9.6	20.6
S&G	30	30	30	30	40-50	30	30	40-50	30	30	40-50	30	30	30	30	40-50	30	30	40-50	30	30	40-50

No winter range in Benny Creek and Thompson Subwatersheds

Table 3.48 Habitat Effectiveness (Percent) by Subwatershed (S=Summer Range, T=Transition Range and W=Winter Range

Alt.	Benny Cr		East Duncan			Lower Duncan			Middle Silver			Thompson		Upper Duncan			Upper Silver			West Fork Silver		
	S	**T**	**S**	**T**	**W**	**S**	**T**	**W**	**S**	**T**	**W**	**S**	**T**	**S**	**T**	**W**	**S**	**T**	**W**	**S**	**T**	**W**
A	40.0	5.3	2.3	1.9	0	1.8	0.3	0.4	0	35.0	0	42.6	8.1	7.3	1.2	0	9.4	3.3	1.1	40.5	4.1	3.7
C	44.0	5.3	2.7	4.1	0	1.7	0.4	0.5	0	36.2	0	48.5	8.1	9.0	1.9	0	10.1	3.9	3.4	49.5	5.0	8.7
D	44.0	5.3	3.1	4.1	0	3.1	0.4	0.5	0	36.2	0	50.0	8.1	9.0	1.9	0	10.1	3.9	3.4	49.5	5.0	8.7
E	40.6	5.3	2.9	3.7	0	1.9	0.3	0.4	0	36.2	0	46.3	8.1	8.1	1.7	0	9.7	3.7	2.2	47.3	4.7	8.7
G	40.6	5.3	2.5	3.7	0	1.5	0.3	0.4	0	36.2	0	46.3	8.1	8.1	1.7	0	9.7	3.7	2.2	47.3	4.7	8.7
H	44.0	5.3	3.1	4.1	0	2.1	0.4	0.5	0	36.2	0	48.5	8.1	9.0	1.9	0	10.1	3.9	3.4	49.5	5.0	8.7
S&G	50	60	50	60	80	50	60	80	50	60	80	50	60	50	60	80	50	60	80	50	60	80

No winter range in Benny Creek and Thompson Subwatersheds

Effects Common to all Alternatives

Overall, percent cover is extremely low in all alternatives. Cover for mule deer will be minimal for many years until conifers are re-established through natural regeneration (Alternative A) or planting (Alternatives C, D, E, G, and H). The few small patches of cover that remain in the fire are likely to get heavy use from mule deer. Forage production in the form of grasses, forbs, and snowbrush ceanothus is expected to increase. Although forage may improve, cover may be limited to the point of ineffectiveness in much of the interior of the burn. Increased down wood levels in the future is expected to improve fawning habitat by increasing fawn protection.

Mountain mahogany stands that burned severely would be monitored for natural regeneration. If it appears that natural regeneration is not occurring within the next 5 to 10 years, mountain mahogany planting or seeding may be considered under another National Environmental Policy Act (NEPA) decision.

Alternative A (No Action)

No harvest would allow the burned area to recover at a natural rate. This would result in a more delayed return of cover than with Alternatives C, D, E, G, and H. This alternative does not offer the opportunity to close or decommission any existing roads, which would increase mule deer security.

Conclusions for Alternative A

Although population numbers are expected to remain stable with this alternative, distribution and use as a result of the project activities may change.

Alternatives C and G

Although cover would remain limited for many years, planting under these alternatives is expected to provide cover at a much faster rate (approximately 10 to 15 years) than Alternative A. To provide long-term cover in conjunction with shrub development, planting is not planned at a rate to develop cover in the immediate future. With a diversity in planting with variable spacing and trees per acre, some areas would recover as hiding cover much more quickly while some areas would remain open for forage longer. This treatment is expected to provide a distribution of cover to forage in the long term that is favorable to mule deer. The few small patches of cover that remain in the fire are likely to get heavy use from mule deer. Forage should remain plentiful within the plantations until the stands begin to close in (30 to 40 years). Planting at lower densities of 130 to 250 trees per acre would provide foraging habitat longer into the future. The silvicultural prescription for the plantation thinning would be designed to maintain cover. This should open up plantations and improve forage production, thereby producing a mix of cover and forage that is optimal for mule deer.

These alternatives would have a slight effect on cover. It is estimated that the proposed prescribed burning may reduce cover within existing cover stands by 35 percent. This drops the overall percent cover calculation slightly for the summer range in Lower Duncan Creek, Upper Duncan Creek and East Duncan Creek subwatersheds and transition range in East Duncan Creek subwatershed and the overall Habitat Effectiveness calculation slightly for the summer range in the Lower Duncan subwatershed (see the following table).

The table below displays the effects of cover loss in Alternatives C and G. Although the result in acreage and percent cover is marginal, overall cover loss due to the fire was significant and further loss may have a negative effect on mule deer habitat.

Table 3.49 Effects of Cover Loss in Alternatives C and G

	Lower Duncan Creek Subshed Summer Range	Upper Duncan Creek Subshed Summer Range	East Duncan Creek Subshed Summer Range	East Duncan Creek Subshed Transition Range
Acres of existing cover stands proposed for prescribed fire	96 acres	100 acres	231 acres	33 acres
Existing percent cover	5.4%	19.8%	11.0%	5.9%
Percent cover as a result of prescribed fire	4.4%	19.6%	9.4%	5.6%

Alternative C has a greater impact on mule deer security than Alternative G by closing 141.9 miles of road versus 82 miles of road in alternative G. Road closures and percent cover are the primary reasons for the difference in HE between Alternative C and G. Overall, HE remains very low due to the lack of cover within the project area. With the exception of a slight decrease in HE in the Lower Duncan subwatershed, HE increases slightly in these alternatives due to road closures. Salvage alternatives may result in a delayed or slower rate of response for some forage species. For example, studies show that naturally regenerated bitterbrush growth is 41percent lower on salvaged sites (Sexton 1998). However, it is recognized that this study began salvage logging in the first winter post-fire, which may lead to different effects in the bitterbrush response than if salvage logging begins the second year post-fire when plants may have a better opportunity to become established. This would produce the largest impact where harvest is proposed on the winter range.

Conclusions for Alternatives C and G

Although population numbers are expected to remain stable with these alternatives, distribution and use as a result of the project activities in the local area may change.

Alternatives D, E, and H

Although cover would remain limited for many years, planting under these alternatives is expected to provide cover at a much quicker rate (approximately 10 to 15 years) than Alternative A. To provide long-term cover in conjunction with shr1ub development, planting is not planned at a rate to develop cover in the immediate future. With a diversity in planting with variable spacing and trees per acre, some areas would recover as hiding cover more quickly while some areas would remain open for forage longer. This treatment is expected to provide a distribution of cover to forage in the long term that is favorable to mule deer. The few small patches of cover that remain in the fire are likely to get heavy use from mule deer. Forage should remain plentiful within the plantations until the stands begin to close in (30 to 40 years). Planting at lower densities of 130 to 250 trees per acres would provide foraging habitat longer into the future. The silvicultural prescription for the plantation thinning would be designed to maintain cover. This should open up plantations and improve forage production, thereby producing a mix of cover and forage that is optimal for mule deer.

Alternatives D and H have a greater impact on mule deer security than Alternative E by closing 147.1 and 144.5 miles of road respectively, versus 82 miles of road in Alternative E. The difference in road closures generates the difference in HE between Alternatives D, E, and H. Overall, HE remains very low due to the lack of cover within the project area, but increases slightly in these alternatives due to road closures. Salvage alternatives may result in a delayed or slower rate of response for some forage species. For example, studies show that naturally regenerated bitterbrush growth is 41 percent lower on salvaged sites (Sexton 1998). However, it is recognized that this study began salvage logging in the first winter post-fire which may lead to different effects in the bitterbrush response than if salvage logging begins the second year post-fire when plants may have a better opportunity to become established. This would produce the largest impact where harvest is proposed on the winter range.

Conclusions for Alternatives D, E, and H

Although population numbers are expected to remain stable with these alternatives, distribution and use as a result of the project activities in the local area may change.

Mitigation Measures

Mitigation measures that apply to mule deer can be found in Chapter 2, Mitigation and Resource Protection Measures – Wildlife.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on mule deer and the following activities have the potential to produce a cumulative effect. Past management activities have likely increased the potential habitat for mule deer within the project area. Fire suppression and wildfires, as described in Table A-1 of Appendix A, and timber harvest activities, as described in Table A-2 and A-13 of Appendix A, have changed overall stand conditions on National Forest System and private lands. Commercial harvest that included overstory removal and fire suppression significantly increased desirable shrub species above historical levels. Over the long term, this has also led to a condition of decadent, less nutrient-rich browse species and overstocked dense stands of timber in which forage is becoming limited.

Fuels reduction projects, as described in Table A-3 of Appendix A, have likely improved mule deer habitat by burning some of the decadent shrubs and creating more of a mosaic of grass, forbs, and shrubs. Recreation activities, as described in Table A-5 of Appendix A, may have some effect on mule deer security near campgrounds or other recreational sites.

Grazing, as described in Table A-8 of Appendix A, has created competition with mule deer for early green-ups, forbs, and winter browse. However, the management plans and operating plans currently in place appear to be adequate to maintain shrubs and grass/forbs in the project area. Noxious weed treatments, as described in Table A-4 of Appendix A, have reduced the spread of noxious weeds that maintains native vegetation for mule deer forage.

Wildlife and watershed improvement projects, as described in Table A-9 of Appendix A, include aspen enhancement and juniper thinning projects. Aspen enhancement increases regeneration and valuable forage for mule deer. Juniper thinning increases forage and shrub production in areas where the juniper is out-competing the native vegetation. Down wood loss through personal use firewood cutting, as described in Table A-12 of Appendix A, and through past timber management activities, as described in Table A-2 of Appendix A, have decreased fawning habitat and protection. Road construction, as displayed in Table A-6 of Appendix A, has reduced mule deer security, although efforts to close and decommission roads (approximately 60 miles in the West Fork Silver Creek, Upper Silver Creek, Thompson Reservoir, and Benny Creek Subsheds), as displayed in Table A-9 of Appendix A, is reducing this effect. Although mule deer populations have increased from pre-settlement times, populations have declined from the high numbers experienced during the middle 1900s.

Reasonably foreseeable future activities include treatments within the Bridge Creek Subshed and treatments displayed in Table A-16 of Appendix A within the project area subsheds. Silvicultural activities including restoration thinning and harvest are expected to improve mule deer habitat if a landscape level approach is applied to the planned distribution of cover to forage placement that is desirable to mule deer. It is anticipated that prescribed fire and silvicultural treatments that move dense stands to a more open condition would increase forage. Prescribed fire frequencies and placement need to be considered if shrub establishment, most notably bitterbrush, is to be maintained. Cover needs to remain distributed across the subshed, but the current definition (hiding 90 percent of a deer at 200 feet) and size of cover patches may need to be reconsidered. Riparian improvements including the large woody debris placement projects in the West Fork Silver Creek (Table A-16 of Appendix A) and in the Bridge Creek Subshed would likely increase riparian vegetation and likely improve fawning habitat and success. Grazing, as displayed in Table A-17 of Appendix A, would continue to occur, and would continue to allow competition with deer for forage resources habitat. Dispersed recreation and hunting would continue to occur, and would directly affect mule deer. Also increases during hunting season contribute to altering movement patterns and habitat use. Cumulatively, all present and future cumulative activities including the activities proposed with this project, would likely maintain local mule deer populations and habitat.

Pileated Woodpecker

Existing Condition

Highly suitable pileated woodpecker habitat, characterized by Bull and Holthausen 1993, Aney and McClelland 1985, Schroeder 1982, and others, includes large trees and snags greater than 20” diameter breast height (dbh) for nesting and roosting, snags and downed logs greater than 15” dbh for foraging, relatively high canopy closure (greater than 60 percent), except in ponderosa pine (greater than 30 percent), and the presence of carpenter or other species of ants for feeding. The number of downed logs recommended by Bull and Holthausen 1993 (40.5/acre) exceeds, by far, current LRMP Standards and Guidelines.

Pileated woodpeckers are the largest woodpeckers in North America and were chosen as a MIS species because of their close association with old growth conifer forests. Of the woodpeckers, the pileated is the most likely to be affected by timber management practices due to its large size and resultant need for large dead trees for nesting, large hollow trees for roosting, and dead woody material for foraging (Bull et al. 1986). The pileated is also responsible for creating nest holes for numerous larger secondary cavity nesters. Approximately 90 percent of the diet of these birds consists of carpenter ants, which are associated with large standing and downed wood.

There are no specific standards and guidelines related to the pileated woodpecker or its habitat. There is a requirement to provide sufficient habitat quality, quantity, and diversity to maintain self-sustaining populations across the Forest. There are no known pileated woodpecker nests within or adjacent to the project area. General reconnaissance following the Toolbox and Silver Fires resulted in one pileated woodpecker sighting within the project area.

The habitat components necessary to attract pileated woodpeckers are not present in much of the burned area. Where the fire resulted in moderate to high vegetation mortality all the live trees were killed. Although many woodpecker species are found within burned areas, none of the literature about species presence mentions the pileated as a species found among dead trees. In the areas that experienced low vegetation mortality, where most of the canopy is alive with occasional

individual or small patches of dead trees, the habitat for pileated woodpeckers may be ideal. Pileated woodpeckers occupying the mosaic of low vegetation mortality areas may forage into the edges of the higher vegetation mortality areas as the insect population increase. Foraging habitat was more greatly impacted, and has been reduced in the short term, as a result of the fire, by reducing pre-existing down wood and snags, and creating a larger number of hardened snags and hardened future down wood, which reduces the likelihood of carpenter ants colonizing the area. No formal pileated woodpecker surveys have been conducted in the area of the Toolbox and Silver Fires.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

In the long term, as snags and down wood begin to decay and desirable insects including carpenter ants are available, adjacent populations of pileated woodpeckers may forage within the planning area. Within the mixed conifer stands that burned light to moderate, potential habitat may improve with increased snag and down wood levels and use may increase in the long term.

No fuels treatment or planting could be detrimental to pileated woodpecker habitat in the long term. This alternative has no proposed fuels treatment. Therefore areas that naturally regenerate and the remaining habitat that burned light to moderate have fuels conditions that would contribute to future high intensity fires. No proposed planting would also result in a delayed advancement of future pileated woodpecker habitat.

Conclusions for Alternative A

Minimal impacts to pileated woodpecker habitat or their populations are anticipated under this alternative.

Alternative C, D, E, G, H

Minimal impacts to pileated woodpecker habitat or their populations are anticipated under these alternatives. In the long term, as snags and down wood begin to decay and desirable insects including carpenter ants are available, adjacent populations of pileated woodpeckers may forage within the Toolbox Fire Recovery Project area. Within the mixed conifer stands that burned light to moderate, potential habitat may improve with increased snag and down wood levels and use may increase in the long term. It is expected that snags levels retained within the harvest units should provide for the levels needed to maintain pileated woodpecker foraging and nesting habitat. Snag levels overall would be the greatest with Alternative D, which proposes the least amount of harvest and the least with Alternative C, which proposes the greatest amount of harvest. Alternative C proposes 14,441 acres of salvage, Alternative G proposes 14,419 acres of salvage, Alternative H proposes 13,031 acres of salvage, Alternative E proposes 11,490 acres of salvage, and Alternative D proposes 6,367 acres of salvage. Any harvest or activity during the breeding season may have a direct effect on nesting.

Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire. The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. Planting is expected to accelerate development of future foraging and nesting habitat and produce pileated woodpecker habitat much more quickly into the future than natural regeneration under Alternative A. The advantages of planting would be the greatest with alternative C, which proposes the greatest amount of planting, and the least with alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting.

Conclusions for Alternatives C, D, E, G, and H

Although pileated woodpecker habitat would remain stable under all alternatives, populations have the greatest potential to increase with the alternatives that provide for the greatest amount of snag habitat for nesting and foraging. This is directly related to salvage and therefore, Alternative D has the greatest potential for pileated woodpecker populations to increase followed by Alternatives E, H, C, and G respectively.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on pileated woodpeckers and the following activities have the potential to produce a cumulative effect. Past management activities have likely decreased the potential habitat available for pileated woodpeckers within the project area. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, have changed overall stand conditions on National Forest System and private lands. These activities have removed large diameter trees, snags and down wood, reduced patch sizes and connectivity, and diminished the amount of high quality LOS interior habitat and overstory canopy cover all required for pileated woodpecker habitat. Fire suppression, as described in Table A-1 of Appendix A, has changed stand conditions providing more dense understories and has converted many stands previously dominated by open large diameter pine to stands now characterized as multi-storied stands with white fire and pine in the understory. The succession of true ponderosa pine sites towards a mixed conifer composition as a result of fire suppression has likely increased habitat for pileated woodpecker across the landscape.

Fuels reduction projects, as described in Table A-3 of Appendix A, have increased habitat slightly in areas where small patches of heavy fire mortality have occurred within pileated woodpecker habitat, such as on Hager Mountain. Recreation activities, as described in Table A-5 of Appendix A, may have some effect on pileated woodpecker productivity if nest sites are located near campgrounds or other recreational sites. Grazing, as described in Table A-8 of Appendix A, has had little effect on pileated woodpecker habitat or productivity. Snag and down wood loss through personal use firewood cutting, as described in Table A-12 of Appendix A, and through past timber management activities including salvage and hazard removal, as described in Table A-2 of Appendix A, and through salvage harvest on several acres of private land as described in Table A-13 of Appendix A, have decreased snag and down wood levels. This has likely decreased overall nesting and foraging habitat for pileated woodpeckers.

Reasonably foreseeable future activities include treatments within the Bridge Creek Subshed and treatments displayed in Table A-16 of Appendix A within the project area subsheds. Silvicultural activities include restoration thinning and harvest that would promote open understory sustainable ponderosa pine stands. These activities, in conjunction with prescribed fire, are expected to decrease habitat for pileated woodpeckers by reducing the encroaching white fir and density of ponderosa pine stands. It is expected that the true ponderosa pine stands that have moved toward a mixed conifer composition would be converted back to true ponderosa pine forests thereby decreasing what may have been future habitat for pileated woodpeckers. Cumulatively, it is expected that pileated woodpecker populations would return to historical levels in the long term (150 to 200 years) as snag and down wood levels increase and continuous mixed conifer LOS habitat develops across the landscape.

American Marten

Existing Condition

Preferred habitat as described in Freel, 1991 is characterized by dense (60 –100 percent canopy closure), multi-storied, multi-species late seral coniferous forests with a high number of large (greater than 24” dbh) snags and down logs. Habitat is generally within ½ mile of dense riparian corridors used as travelways and has an interspersion of small (less than 1 to 2 acres) openings for foraging.

The American marten was chosen as a MIS species due to its close association with late successional mixed conifer and lodgepole pine forests. Dense, multistoried, multi-species climax coniferous forests characterize preferred habitat with a high number of large snags and down wood. These areas also include close proximity to dense riparian corridors used as travelways, and an interspersion of small openings with good ground cover used for foraging. They also require forested travel corridors for maintaining links among individuals and populations (Witmer 1998). Martens particularly prefer forests with complex physical structure near the ground (Ruggiero et al. 1994) that provides thermoneutral (stable temperatures) resting sites and access to subnivian (beneath the snow) prey (Chapin, 1997). Diets include shrews, deer mice, red squirrels, heather voles, northern flying squirrels, and Douglas squirrels (Witmer et al. 1998). Large openings are avoided due to the lack of forest structure for maintenance of prey species and the susceptibility of marten to predators.

Optimal habitat includes a home range of 1900 acres which includes mature stands that are greater than 120 acres, greater than 70 percent canopy closure, greater than three snags per acre in resting/denning and foraging habitat, greater than nine live tree snag replacements, and greater than 20 down logs per acre. Travel corridors should provide 60 to 80 percent canopy closure and greater than 300 feet within mature stands or greater than 600 feet when there are adjacent openings.

There are no known marten sightings within the proposed project area. The nearest sightings of pine marten are located approximately 3 miles west of the project area within the Yamsey Semi-primitive Non-motorized Recreation Area discovered during winter track surveys. There are no specific standards and guides related to the marten or its habitat. There is a requirement to provide sufficient habitat quality, quantity, and diversity to maintain self-sustaining populations across the Forest. General reconnaissance following the Toolbox and Silver Fires resulted in no pine marten sightings. No formal surveys were conducted for this project. Marginal habitat does exist within the Toolbox and Silver Fires on National Forest System lands.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

It is anticipated that within the interior of the fire in large patches of high vegetation mortality, pine marten use is not expected due to the entire loss of LOS character and because pine marten tend to avoid very large openings. Pine marten use may continue on the edges between areas of high vegetation mortality and low to moderate vegetation mortality, and foraging opportunities may become optimal on these edges when down wood becomes abundant in 20 to 30 years. Research has shown they are unlikely to be present in burned areas for 20 or more years post-fire (Strickland and Douglas 1987). Large numbers of jackstraw down wood would provide for the complex physical structure near the ground needed for nesting sites and access to subnivian prey. Although habitat quality may increase, other factors may preclude the future use of this habitat by pine martens, including the lack of connectivity for travel corridors, most notably within the area of the fire. No proposed planting would result in a delayed advancement of future pine marten habitat.

Conclusions for Alternative A

Pine marten use is expected to continue at current levels.

Alternative C, D, E, G, and H

Salvage harvest would not affect marten habitat in the short term because burned over areas are not likely to be used by marten before forest cover is re-established. In the long term, salvage activities proposed under these alternatives may reduce the likelihood of pine marten use within the planning area due to decreased future down wood levels. The effects would be the greatest with Alternative C, which proposes the greatest amount of salvage and the least with Alternative D, which proposes the least amount of salvage. Alternative C proposes 14,441 acres of salvage, Alternative G proposes 14,419 acres of salvage, Alternative H proposes 13,031 acres of salvage, Alternative E proposes 11,490 acres of salvage, and Alternative D proposes 6,367 acres of salvage.

Units proposed for fuels treatment would likely diminish pine marten habitat due to the loss of all non-commercial down wood that would provide the complex structure needed for nesting sites and access to subnivian prey. This would have the greatest effect where fuels treatment is proposed along the edges of high vegetation mortality areas and low to moderate vegetation mortality areas. However, reducing fuel loadings should sustain the habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire, and 10 to 30 percent of the slash piles would be retained for pine marten habitat. The effects of fuels treatment would be the greatest with Alternative G, which proposes the greatest amount of fuels treatment and the least with Alternative D, which proposes the least amount of fuels treatment. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment.

It is anticipated that within the interior of large patches where the vegetation mortality was very high, pine marten use is not expected due to the entire loss of LOS character and because pine marten tend to avoid very large openings. Pine marten use may continue along the edges of lightly burned and severely burned stands. Foraging opportunities may increase within riparian corridors where salvage is not proposed. Although foraging quality may slightly increase within the riparian corridors, other factors may preclude the future use of this habitat by pine martens, including the lack of connectivity for travel corridors, most notably within the area of the fire.

Planting is expected to accelerate development of future pine marten much more quickly than natural regeneration under Alternative A. The advantages of planting would be the greatest with alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of

planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting.

Conclusions for Alternatives C, D, E, G, and H

Although pine marten habitat would remain stable under all alternatives, populations have the greatest potential to increase with the alternatives that provide for the greatest amount of down wood habitat for denning and nesting. This is directly related to salvage and, therefore, Alternative D has the greatest potential for pine marten populations to increase followed by Alternatives E, H, C, and G respectively.

Mitigation Measures

Mitigation measures that apply to pine marten can be found in Chapter 2, Mitigation and Resource Protection Measures – Wildlife.

Cumulative Effects of Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on pine marten and the following activities have the potential to produce a cumulative effect. Past management activities have likely decreased the potential habitat available for pine marten within the project area. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, have changed overall stand conditions on National Forest System and private lands. These activities have removed large diameter trees, snags and down wood, reduced patch sizes and connectivity, and diminished the amount of high quality LOS interior habitat and overstory canopy cover all required for pine marten habitat.

Fire suppression, as described in Table A-1 of Appendix A, have changed stand conditions, providing more dense understories, and have converted many stands previously dominated by open large diameter pine to stands now characterized as multi-storied stands with white fire and pine in the understory. Recreation activities, as described in Table A-5 of Appendix A, and grazing, as described in Table A-8 of Appendix A, likely have had little affect on pine marten. Snag and down wood loss through personal use firewood cutting, as described in Table A-12 of Appendix A, and through past timber management activities, including salvage and hazard removal, as described in Table A-2 of Appendix A, and through salvage harvest on several acres of private land, as described in Table A-13 of Appendix A, have decreased snag and down wood levels. This has likely decreased overall denning and foraging habitat for pine marten.

Reasonably foreseeable future activities include treatments within the Bridge Creek Subshed and treatments displayed in Table A-16 of Appendix A within the project area subsheds. Silvicultural activities include restoration thinning and harvest that would promote open understory sustainable ponderosa pine stands. These activities, in conjunction with prescribed fire, are expected to increase habitat for pine marten by creating more contiguous future LOS. Cumulatively, it is expected that pine marten populations would return to historical levels in the long term (150 to 200 years) as down wood and snag levels increase and continuous mixed conifer LOS habitat develops across the landscape.

Red-naped Sapsuckers

In addition to being listed on this Fremont National Forest Management Indicator Species list, the red-naped sapsucker is also listed on the Subprovince Central Oregon/Klamath Basin Focal Species list. All of the analysis for this species will be presented in this section.

Existing Condition

Red-naped sapsuckers are closely associated with aspen and deciduous riparian or forested stands. Sapsucker species require older trees with heart rot for nesting as well as adjacent conifers or mountain mahogany for sapwell feeding. Habitat recommendations include greater than 10 percent cover of aspen saplings in the understory to provide adequate representation of younger seral stages for replacement, greater than 14 trees and greater than 4 snags per 1.5 acres that are greater than 39 feet in height and 10 inches DBH, and a mean canopy closure of 40 to 80 percent (Altman and Holmes 2000).

The conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are (Altman 2000):

1. Lack of recruitment of aspen due to livestock grazing, big game browsing, and fire suppression.

2. Reduced presence of large aspen trees and snags due to limited replacement.

3. The encroachment of conifer trees in aspen stands (shading contributes to lack of recruitment).

Red-naped sapsuckers are primary excavators, providing cavities for many other bird species (Neel 1999). The Breeding Bird Survey trend analysis has reported a 13 percent decline for red-naped sapsuckers in the Basin and Range Province between 1966 and 1996 (Neel 1999). Other species that benefit from large aspen trees and snags are the house wren, mountain bluebird, Williamson's sapsucker, tree swallow, and northern flicker.

Aspen stands provide ecological, as well as aesthetic, diversity to the landscape, forage and cover for ungulates, nesting, feeding and migratory habitat for a variety of avian species, and habitat for a wide variety of small mammals. Generally, aspen stands are declining throughout the western U.S. and may be currently at only 5 percent of pre-settlement occurrence (Wall et al. 1999).

There are no specific standards and guides related to the red-naped sapsucker or its habitat. There is a requirement to provide sufficient habitat quality, quantity, and diversity to maintain self-sustaining populations across the Forest. Sapsucker surveys have not been conducted within the project area. Aspen stands experienced a variation in burning from partially burned stands resulting in a mix of live and dead aspen, to stand replacement burns.

No specific red-naped sapsucker surveys were conducted for this project. Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Red-naped sapsuckers were only detected at Graham Creek and West Fork Silver Creek. Below is the total number of detections of red-naped sapsuckers at Graham Creek and West Fork Silver Creek from 1994 to 2001:

The following table displays the total number of detections of red-naped sapsuckers at Graham Creek and West Fork Silver Creek from 1994 to 2001.

Table 3.50 Red-naped Sapsucker Detections – 1994 to 2001

Location	1994	1995	1996	1997	1998	1999	2000	2001
Graham Creek	2	0	0	0	1	0	0	1
West Fork Silver Creek	0	0	0	0	0	1	0	1

Environmental Consequences

Direct and Indirect Effects

Effects Common to All Alternatives

It is expected that aspen would respond positively to the effects of the fire with an increase in regeneration. Distribution of livestock is expected to improve as new foraging areas are created due to fire-created open and favorable conditions. This would relieve grazing pressure on riparian areas and other areas of concern. Aspen stands that experienced stand replacement fire, may experience browsing from livestock and big game.

Alternative A (no action)

Conclusions for Alternative A

There would be no effect on mature aspen for current red-naped sapsucker habitat, therefore, it is expected there would be no effects on existing red-naped sapsuckers within the project area.

Alternative E

Conclusions for alternative E

There would be no effect on mature aspen for current red-naped sapsucker habitat; therefore, it is expected there would be no effects on existing red-naped sapsuckers within the project area. Any harvest or activity during the breeding season may have a direct effect on nesting.

Alternative C, D, G, H

There would be no effect on mature aspen for current red-naped sapsucker habitat. Aspen treatments of 690 acres are designed to protect aspen regeneration are incorporated into Alternatives C, D, G, and H. These treatments would be designed to protect aspen from browsing by felling live and dead conifers and junipers within the stand to deter livestock and big game. This would help to mitigate the effects of grazing on young regenerating aspen and to protect future red-naped sapsucker habitat.

Conclusions for Alternatives C, D, G, and H

With little to no affect on mature aspen in these alternatives, it expected there would be no effects on existing red-naped sapsuckers within the project area. Any harvest or activity during the breeding season may have a direct effect on nesting.

Mitigation Measures

Mitigation measures that apply to red-naped sapsuckers and aspen can be found in Chapter 2, Mitigation and Resource Protection Measures – Wildlife.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on red-naped sapsuckers and aspen, and the following activities have the potential to produce a cumulative effect. Within the project area, aspen has gradually been replaced by conifers over time as a result of the change in forest structure, leading to dense conifer stands from fire suppression and timber management. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, and fire suppression, as described in Table A-1 of Appendix A, have changed overall stand conditions on National Forest System and private lands providing more dense understories. These past activities have converted many aspen stands previously dominated by mature aspen with scattered large ponderosa pine, to stands now characterized as multi-storied stands with juniper, white fir, and ponderosa pine in the understory. Aspen stands historically were fire dependent systems that relied on fire for periodic thinning and regeneration. Grazing, as displayed in Table A-8 of Appendix A, has likely reduced aspen regeneration, especially in allotments that receive late season grazing. The aspen enhancement treatments, as displayed in Table A-9 of Appendix A, have likely improved the long-term health of the aspen that has been treated.

Reasonably foreseeable future activities include treatments within the Bridge Creek Subshed and treatments displayed in Table A-16 of Appendix A within the project area subsheds. Silvicultural activities include restoration thinning and conifer harvest within aspen stands to promote the aspen component. These activities, in conjunction with prescribed fire, are expected to improve aspen health and regeneration, thereby increasing red-naped sapsucker habitat. Projects designed to thin encroaching conifers within aspen would open up stands and allow for expansion and growth, prescribed fire would stimulate regeneration, and improved riparian conditions would eventually improve water tables. Grazing, as displayed in Table A-17 of Appendix A, may some effect on aspen regeneration post fire. Total AUMs are being reduced from traditional levels due to the fire in the allotments that burned with high severity, and these allotments would not experience late season grazing when there tends to be heavy browsing on aspen. Large scale prescribed burning in the Bridge Creek Subshed is also likely to improve the distribution of cattle and big game with increased foraging opportunities. Cumulatively, it is expected that red-naped sapsucker populations would increase in the long term as aspen is protected and treated in the future.

Snag and Down Wood Dependent Species (including Black-backed Woodpeckers and Lewis' Woodpeckers)

This group of species was divided into four separate categories for analysis purposes, as follows:

- Snag dependent species
- Black-backed woodpecker
- Lewis' woodpecker
- Down wood dependent species

The black-backed woodpecker is listed separately on the Fremont National Forest Management Indicator Species list and on the Subprovince Central Oregon/Klamath Basin Focal Species list, which also lists the Lewis' woodpecker. However, all of the analysis for these species will be covered in this Snag and Down Wood Dependent Species section.

Snag Retention Strategy Within Harvest Units

The data in DecAID was used extensively to design snag retention guidelines for this project. DecAID is an advisory tool to help managers evaluate the effects of forest conditions and existing or proposed management activities on wildlife that use snags and down wood. DecAID also can help managers decide on snag and down wood sizes and levels needed to help meet wildlife management objectives for a particular project or area (Mellen et al. 2002). DecAID is a summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, expert judgment, and experience. DecAID presents information on wildlife use of snag diameter, snag density, down wood diameter, and down wood percent cover, and on the range of "natural conditions" (unharvested) and current (all) conditions of snag density and down wood percent cover by diameter classes. It is, for the most part, a statistical summary of published research data on wildlife and forest inventory data (Mellen et al. 2003).

DecAID Definitions of Terminology and Sources of Data

The following is a definition of the terminology and the three sources of data provided in DecAID that were used to develop recommendations for this project (*Throughout this document the three sources of data,* wildlife data, inventory data, and distribution data*, would appear in bold to allow for the reader to return to the descriptions below for definitions of what the data means and how is can be applied):*

1. Tolerance Level

The information in DecAID is presented at three statistical tolerance levels that may be interpreted as three levels of "assurance:" 30 percent tolerance level, 50 percent tolerance level, and 80 percent tolerance level. For example, if a 30 percent tolerance level of snag dbh used by wildlife species in a specific vegetation condition is 20 inches dbh, this means that 30 percent of all individuals of the wildlife populations used less than or equal to that size snag. An 80 percent tolerance level would correspond to 80 percent of the individuals using that corresponding size snag. A 100 percent tolerance level means all of the individuals would use that size snag (100 percent tolerance intervals correspond to the maximum observed values, such as the largest dbh snag observed to be used by a wildlife species) (Mellen et al. 2003).

2. Down Wood Percent Cover

Down wood percent cover is the total percent of any given area that is covered by down wood. Down wood measured include all down wood that is 5 inches dbh on the small end, at least 10 feet long, and includes down wood in all decay classes. For DecAID, this method of measure was used because it best describes the abundance of down wood as it relates to wildlife use (Carey 1995), percent cover was the most common measure used in studies showing wildlife selection of areas with higher amounts of down wood, and percent cover is one of the most precise and efficient means of recording down wood. As an example, 1.1 percent down wood cover on an acre would equal one 30-inch dbh ponderosa pine tree, two 20-inch dbh ponderosa pine trees, two 15-inch dbh ponderosa pine trees, and eight 10-inch dbh ponderosa pine trees.

3. Wildlife Data

For the **wildlife data** provided in DecAID, "tolerance level" means that either 30 percent, 50 percent, or 80 percent of the population were found under certain conditions such as snag density, diameter, or down wood percent cover at a nest site. For example, a post-fire research study in Idaho which provided a sample size of 35 black-backed woodpeckers nests, discovered that 30 percent of the nest sites had 62.2 snags/acre greater than 10 in. dbh, 50 percent of the nest sites had 88.3 snags/acre greater than 10 in. dbh, and 80 percent of the nest sites had 126.1 snags/acre greater than 10 in. dbh (Mellen et al. 2003). It is important to consider that the wildlife data provided in DecAID for post-fire habitats is from one wildlife study located in Idaho. The vegetative conditions and the habitat selected by cavity-nesters may be different in this project area.

4. Inventory Data

For the **inventory data** provided in DecAID, the sample is the set of inventory plots, and the population from which those plots are taken is the total landscape represented by the sample of plots. Forest inventory plots include: the Current Vegetation Survey (CVS), conducted by USDA Forest Service, Pacific Northwest Region, on National Forest lands; the Forest Inventory and Analysis (FIA), conducted by USDA Forest Service, Pacific Northwest Research Station, on non - National Forest System lands; and the Natural Resource Inventory (NRI), conducted by USDI Bureau of Land Management (BLM) on BLM lands in western Oregon (Mellen et al. 2003). The inventory data is summarized by data for unharvested inventory plots only, and by data for all the plots under current conditions including those that have been harvested. Furthermore, the data is summarized by data that contained, for example, measurable snags, and by data for all plots including the plots that contained measurable snags and the plots that did not contain measurable snags.

The inventory tolerance levels describe sizes and amounts of dead wood at the population level or the total landscape, not just for the inventory plot sample. In other words, the tolerance levels describe dead wood conditions across the total area within the vegetation condition. It is important to consider that the estimates represent average conditions within a vegetation condition at the regional level, rather than conditions around specific nest sites (Mellen et al. 2003). Therefore, it is important to consider vegetation conditions that are present in your local project area. A map of harvested and unharvested plot locations can be found on the following website: http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf.

The **inventory data** tolerance levels describe proportions of the area within a given vegetation condition that have specific sizes or amounts of dead wood (Mellen et al. 2003). The 50 percent tolerance level more closely represents the median value (the middle value in a distribution, above and below which lie an equal number of values), than the mean (average) (Mellen et al. 2003). For example at the 80 percent tolerance level, 80 percent of the plots in the *Ponderosa Pine/Douglas-fir Forest, Larger Trees Vegetation Condition that are unharvested and contain measurable snags* have less than 13.3 snags/acre; 20 percent of the plots have greater than 13.2 snags/acre.

It is very important to recognize that the unharvested inventory data is represented as vegetation conditions from plots measured at a single point in time and the current conditions express events that have occurred over the past decades to centuries (Mellen et al.2002). Johnson and O'Neil recommend that caution must be exercised in using this regional plot data or **inventory data** to describe the estimated historical range of conditions in dead wood because it is a sample of only current conditions and lack data on site history (2001). Even if the plots in a "natural" forest could be identified, snags and down wood have been altered to an unknown degree by fire suppression and other human influences. On the eastside in particular, current levels of snags and down wood may be elevated above historical conditions due to fire suppression and increased mortality, and may be depleted below historical levels in local areas burned by intense fire or subjected to repeated salvage and firewood cutting (Johnson and O'Neil 2001).

5. Distribution Data

DecAID also provides inventory **distribution data** on the percent of the plot-sized areas of a given vegetation condition that have various amounts of dead wood, density of snags, or percent cover of down wood. The density of snags, down wood, or percent cover of down wood corresponds to a percent of the area (Mellen et al. 2003).

How the Data in DecAID Was Applied to This Project

The Toolbox and Silver Fires are extremely variable, ranging from a low-intensity underburn to a high-intensity stand replacement burn. Vegetation mortality mapping was conducted using aerial photos followed by some ground verification. Vegetation mortality was mapped by four categories: 0 to 25 percent, 26 to 51 percent, 51 to 85 percent, and greater than 85 percent, and is largely characteristic of the overstory vegetation because of the limitations involved in using aerial photos.

Areas mapped as less than 50 percent mortality are considered to be intact functional forests including a mosaic of unburned or lightly burned patches within or possibly above, the historic range for stocking levels, interspersed with small patches of localized mortality greater than a few acres in size. Areas mapped as greater than 50 percent mortality are areas in which the fire was predominately stand replacing and, therefore, are well below the historic range for stocking levels. Studies show that cavity-nesting birds require higher densities of snags in post-fire conditions versus green conditions for nesting. This is likely due to the fact that in post-fire conditions, cavity-nesting birds require more snags for foraging, cover, and protection from predators. Therefore, different snag retention prescriptions were developed for areas less than 50 percent mortality (green stand conditions) versus areas of greater than 50 percent mortality (post-fire conditions).

1. Snag Retention in Areas Mapped as Less Than 50 Percent Mortality:

For the areas mapped as less than 50 percent mortality, the **unharvested inventory data** provided in DecAID was utilized to develop prescriptions that mimic the landscape distribution and quantity of snags in "natural conditions" for the *Ponderosa Pine/Douglas-fir Forest, Larger Trees Vegetation Condition* (Mellen et al. 2003). It is assumed that the unharvested inventory data provides the best picture available of "natural conditions." However, it is recognized that the unharvested inventory data is represented as vegetation conditions from plots measured at a single point in time and the current conditions express events that have occurred over the past decades to centuries (Mellen et al.2002). Snag levels do not provide true estimated historical conditions; however, this is the best data available in attempting to discover an appropriate level and distribution of snags across a landscape in green stand conditions or less than 50 percent mortality areas. **Inventory data and distribution data** for the *Ponderosa Pine/Douglas-fir Forest, Larger Trees Vegetation Condition* (Mellen et al. 2003) were used to develop snag retention guidelines within harvest units that are less than 50 percent mortality.

The Toolbox and Silver Fires are primarily dry ponderosa pine communities. The average rainfall is low and the overall productivity of the area is low. The low elevation sites are adjacent to the desert fringe and are often mixed with juniper, open sagebrush flats, and mountain mahogany vegetation types. Overall, these sites have very low productivity and historically averaged 5 to 20 large trees per acre. These areas can be classified as either:

1. less than 5000' elevation
2. 5000-5500' elevation and Hopkins ecoclass CP-S2-11 - Ponderosa Pine/bitterbrush/fescue communities (1979)

The higher elevation ponderosa pine communities become more productive and generally receive more moisture. These sites historically averaged of 15 to 25 large trees per acre. These areas can be classified as either:

1. greater than 5500' elevation
2. 5000-5500' elevation and *not* Hopkins ecoclass CP-S2-11 - Ponderosa Pine/bitterbrush/fescue communities (1979)

As stated in DecAID, it is important to consider that the estimates of snag densities, snag diameters, and down wood percent cover represent average conditions within a vegetation condition at the regional level, rather than conditions around specific nest sites (Mellen et al. 2003). The inventory plots represent a range of habitat types from low elevation ponderosa pine communities with lower snag densities and overall stocking levels, to higher elevation ponderosa pine communities with higher snag densities and overall stocking levels. **Therefore, it was determined that the 50 percent tolerance level was appropriate for the low elevation ponderosa pine/less than 50 percent mortality communities in the project area, and the 80 percent tolerance level was appropriate for the higher elevation ponderosa pine/less than 50 percent mortality communities in project area.**

With the data available in DecAID for the *Ponderosa Pine/Douglas-fir Forest, Larger Trees Vegetation Condition* (Mellen et al. 2003), the average number of snags per acre recommended for harvest units was developed following this process:

Low Elevation Ponderosa Pine / Less Than 50 Percent Mortality Communities - Snags

1. The 50 percent tolerance level for unharvested **inventory plots** that contained measurable snags is 6.3 snags/ac greater than 10"dbh. This is data for only those unharvested inventory plots that contained measurable snags.

2. Considering that 6.3 snags/acre greater than 10" dbh is for only those plots that contained measurable snags, it is likely not appropriate to manage for this level across the landscape because not all plots contained measurable snags. This is consistent with Johnson and O'Neil's prediction that clumping of snags may be a natural pattern in the ponderosa pine communities (2001). Therefore, the **distribution data** was used as a guide to determine how snags were distributed under "natural condition" and to determine what approximate percentage of the landscape provide measurable snags and what approximate percent of the landscape did not provide measurable snags. The **distribution data** demonstrates that of all the unharvested inventory plots, 54 percent contained no snags and 46 percent had measurable snags greater than 10" dbh.

3. Averaging 6.3 snags across the landscape with 54 percent of the landscape containing no snags and 46 percent of the landscape containing measurable snags, the average number of snags across the total landscape is approximately **2.9 snags/acre**.

4. The **distribution data** of snag sizes on all unharvested inventory plots demonstrates that 66 percent of snags measured are 10 to 19.9" dbh, 27 percent are 20 to 29.9" dbh, and 7 percent are greater than 30"dbh. Therefore, if 2.9 snags are retained on the average across a landscape, 66 percent or 1.9 snags are 10 to 19.9" dbh, 27 percent or 0.8 snags are 20 to 29.9" dbh, and 7 percent or 0.2 snags are greater than 30" dbh.

In addition to the 2.9 snags per acre within harvest units, some areas less than 50 percent mortality would receive no harvest (43 to 81 percent of the project area, depending upon alternative), and would provide the opportunity to provide for higher levels of snags across the landscape.

The following table displays the average number of snags per acre within harvest units that are low elevation ponderosa pine with less than 50 percent mortality.

Table 3.51 Average Snags per Acre / Low Elevation Ponderosa Pine Less Than 50 Percent Mortality

Snag Size	Average # snags/acre 1. < 5000' elevation 2. 5000-5500' elevation and ecoclass CP-S2-11
10-14.9"	0.9
15-19.9"	1.0
20-29.9"	0.8
>30"	0.2
Total Snags/Acre	**2.9**

Low Elevation Ponderosa Pine / Less Than 50 Percent Mortality Communities – Percent Down Wood

1. The 50 percent tolerance level for unharvested **inventory plots** that contained measurable down wood is 1.8 down wood percent cover. This is data for only those unharvested inventory plots that contained measurable down wood.

2. Considering that 1.8 down wood percent cover is for only those plots that contained measurable percent down wood, it is likely not appropriate to manage for this level across the landscape because not all plots contained measurable down wood. This is consistent with Johnson and O'Neil's prediction that clumping of down wood may be a natural pattern in the ponderosa pine communities (2001). Therefore, the **distribution data** was used as a guide to determine how down wood were distributed under "natural conditions" and to determine what approximate percentage of the landscape provide measurable down wood and what approximate percent of the landscape did not provide measurable down wood. The **distribution data** demonstrates that of all the unharvested inventory plots, 38 percent contained no down wood and 62 percent had measurable down wood.

3. Averaging 1.8 down wood percent cover across the landscape with 38 percent of the landscape containing no down wood and 62 percent of the landscape containing measurable down wood, the average down wood percent cover across the total landscape is approximately **1.1 down wood percent cover**.

In addition to the 1.1 down wood percent cover within harvest units, some areas less than 50 percent mortality would receive no harvest (43 to 81 percent of the project area, depending upon alternative), and would provide the opportunity to provide for a higher down wood percent cover across the landscape.

High Elevation Ponderosa Pine / Less Than 50 Percent Mortality Communities - Snags

1. The 80 percent tolerance level for unharvested **inventory plots** that contained measurable snags is 13.3 snags/ac greater than 10"dbh. This is data for only those unharvested inventory plots that contained measurable snags.

2. Considering that 13.3 snags/acre greater than 10" dbh is for only those plots that contained measurable snags, it is likely not appropriate to manage for this level across the landscape because not all plots contained measurable snags. This is consistent with Johnson and O'Neil's prediction that clumping of snags may be a natural pattern in the ponderosa pine communities (2001). Therefore, the **distribution data** was used as a guide to determine how snags were distributed under "natural condition" and to determine what approximate percentage of the landscape provide measurable snags and what approximate percent of the landscape did not provide measurable snags. The **distribution data** demonstrates that of all the unharvested inventory plots, 54 percent contained no snags and 46 percent had measurable snags greater than 10" dbh.

3. Averaging 13.3 snags across the landscape with 54 percent of the landscape containing no snags and 46 percent of the landscape containing measurable snags, the average number of snags across the total landscape is approximately **6.1 snags/acre**.

4. The **distribution data** of snag sizes on all unharvested inventory plots demonstrates that 66 percent of snags measured are 10 to 19.9" dbh, 27 percent are 20 to 29.9" dbh, and 7 percent are greater than 30"dbh. Therefore, if 6.1 snags are retained on the average across a landscape, 66 percent or 4.0 snags are 10 to 19.9" dbh, 27 percent or 1.7 snags are 20 to 29.9" dbh, and 7 percent or 0.4 snags are greater than 30" dbh.

In addition to the 6.1 snags per acre within harvest units, some areas less than 50 percent mortality would receive no harvest (43 to 81 percent of the project area, depending upon alternative), and would provide the opportunity to provide for higher levels of snags across the landscape.

The following table displays the average number of snags per acre within harvest units that are high elevation ponderosa pine with less than 50 percent mortality.

Table 3.52 Average Snags per Acre / High Elevation Ponderosa Pine Less Than 50 Percent Mortality

Snag Size	Average # of snags/acre 1. > 5500' elevation 2. 5000-5500' elevation and *not* ecoclass CP-S2-11
10-14.9"	2.0
15-19.9"	2.0
20-29.9"	1.7
>30"	0.4
Total Snags/Acre	**6.1**

High Elevation Ponderosa Pine / Less Than 50 Percent Mortality Communities – Percent Down Wood

1. The 80 percent tolerance level for unharvested **inventory plots** that contained measurable down wood is 4.1 down wood percent cover. This is data for only those unharvested inventory plots that contained measurable down wood.

2. Considering that 4.1 down wood percent cover is for only those plots that contained measurable down wood, it is likely not appropriate to manage for this level across the landscape because not all plots contained measurable down wood. This is consistent with Johnson and O'Neil's prediction that clumping of down wood may be a natural pattern in the ponderosa pine communities (2001). Therefore, the **distribution data** was used as a guide to determine how down wood were distributed under "natural conditions" and to determine what approximate percentage of the landscape provide measurable down wood and what approximate percent of the landscape did not provide measurable down wood. The **distribution data** demonstrates that of all the unharvested inventory plots, 38 percent contained no down wood and 62 percent had measurable down wood.

3. Averaging 4.1 down wood percent cover across the landscape with 38 percent of the landscape containing no down wood and 62 percent of the landscape containing measurable down wood, the average down wood percent cover across the total landscape is approximately **2.5 down wood percent cover**.

In addition to the 2.5 down wood percent cover within harvest units, some areas less than 50 percent mortality would receive no harvest (43 to 81 percent of the project area, depending upon alternative), and would provide the opportunity to provide for a higher down wood percent cover across the landscape.

Clumping and distribution would vary within harvest units to manage for the clump size, snag requirements, and distribution required for different cavity-dependent species. Within a 10-acre area, a *minimum* of 1 snag clump of 20 snags is required, with the exception of narrow units or portions of units (see Project Implementation in this Wildlife section). Snag clumps would range from 2 to 30 snags per clump. In areas where snags are intermixed within a green overstory, smaller clumps are encouraged to provide for a better distribution of snags across the unit. In areas of localized mortality greater than 5 acres, larger snag clumps are encouraged. Pre-fire snags would be protected to the extent possible. Groups of snags should be focused in the area around pre-fire snags where the opportunity exists. Clumps would be located as least 200 feet from any road. If snag clumps are located within 200 feet from a road to mitigate visual qualities, snags would be selectively marked to ensure they are not tall enough to fall the road.

The snag levels recommended for this project in the less than 50 percent mortality areas, are within the range estimated in research conducted by Harrod et al. (1998) and Agee (2002) and described in DecAID (Mellen et al. 2003). Harrod et al. (1998) estimated historical snags densities in ponderosa pine-dominated, dry forests. They estimated that densities of snags greater than 6 inches dbh ranged from 5.9 to 14.1/acre in pre-European settlement landscapes. Their estimates were derived by calculating growth in basal area from pre-1930 growth rates, holding forest stand structure relatively constant (i.e. as a new live tree is recruited another one becomes a mortality), and applying published snag fall rates (Bull 1983, Keen 1929,

Raphael and Morrison 1987, Schmid et al. 1985) to calculate basal area of snags every 10 years. They assumed the historic frequent, low-intensity fires did not accelerate snag fall rates.

Agee (2002) estimated lower snag densities than Harrod et al. for the ponderosa pine/Douglas-fir forest series by estimating number of trees in 0.1ha clumps of 16 age classes and assuming that the oldest patch is killed by insects every 25 years. He assumed fire helped to decompose snag patches and that after 5 fires at 10-year intervals the snags would be completely consumed. His estimated historical snag density was 2 per acre. Agee (2002) compares his estimates to Harrod et al. (1998) but states a different assumption about dbh of snags; Agee assumes and average snag dbh of 75 cm (30 in) when calculating biomass, while Harrod et al. estimated densities for size classes as small as 15 cm (6 in) dbh.

2. Snag Retention in Areas Mapped as Greater Than 50 Percent Mortality:

For areas mapped as greater than 50 percent mortality, the wildlife data in DecAID was utilized to develop snag retention guidelines within harvest units for post-fire habitats for the *Ponderosa Pine/Douglas-fir, Open Canopy Condition* (Mellen et al. 2003). The **wildlife data** was used to assure that the Toolbox project would provide the habitat necessary for nesting habitat for cavity dependent species in post-fire conditions.

The data in DecAID indicates that:

> "the best available **wildlife data** indicate that to maintain snag densities in this vegetation condition at the 30 percent tolerance level in post-fire habitats, manage for a variety of snag densities across the burned area. The highest density clumps of snags, when extrapolated to a per acre basis, should average up to 61/acre greater than 10 in dbh with about 2/acre of those snags greater than 20 in dbh. Some snag clumps should be of lower density averaging 10/acre greater than 10 in dbh, with about 2/acre of those snags greater than 20 in dbh. The zero values in the wildlife data for larger snags are a result of variability in the data; actual nest sites for these species consist of at least the nest snag." (Mellen et al. 2003)

In summary, the wildlife data in DecAID suggests retaining a variation in snag densities ranging from 10 snags/acres greater than 10 inches dbh to 61 snags/acre greater than10 inches dbh. According to the data in DecAID, 10 snags/acre greater than 10 inches dbh would be to manage for the 30 percent tolerance level for Lewis' woodpeckers and 61 snags/acre greater than 10 in dbh would be to manage for the 30 percent tolerance level for black-backed woodpeckers. Black-backed woodpeckers have consistently selected unlogged conditions of high snag densities for both nesting and foraging habitat in burned forests (Caton 1996, Hitchcox 1996, Hoffman 1997, Hutto 1995, Kreisel and Stein 1999, Saab et al. 2002), and Lewis' woodpeckers were most abundant in partially logged burned forests and relatively rare in unlogged units of western Idaho (Saab and Dudley 1998). **Because Lewis' woodpeckers were most abundant in harvested conditions and because a large part of the project area will remain unharvested (42 to 70 percent of the project area, depending upon alternative), it was determined that the 30 percent tolerance level for Lewis' woodpeckers (10 snags/acre greater than 10 in dbh) was appropriate for harvest units that are greater than 50 percent mortality.**

Table 3.53 Average Number of Snags/Acre in Harvest Units With Greater Than 50 Percent Mortality

Snag Size	Average # snags/acre
10-14.9"	6.0
15-19.9"	2.0
20-29.9"	1.6
>30"	0.4
Total Snags/Acre	**10.0**

Clumping and distribution would vary within harvest units to manage for the clump size, snag requirements, and distribution required for different cavity-dependent species. Within a 10-acre area, a *minimum* of one snag clump is required, with the exception of narrow units or portions of units (see Project Implementation on the following page). Pre-fire snags would be protected to the extent possible. Groups of snags should be focused in the area around pre-fire snags where the opportunity exists. Snag clumps would range from 50-100 snags per clump, and clumps would be distributed every 5 to 10 acres. Clumps would be located as least 200 feet from any road. If snag clumps are located within 200 feet from a road to mitigate visual qualities, snags would be selectively marked to ensure they are not tall enough to fall the road.

Project Implementation

The level of mortality within the project area is expected to increase through time in response to both the direct effects of fire or the effects of insects. Eventual implementation and layout of units would be based on the mortality at the time of layout. Although the acreage outputs discussed in this wildlife section may change, this does not change the type of effect on cavity-nesting birds because the snag retention guidelines, as described above, are based on the expected biological needs of cavity-nesters under green stand conditions versus post-fire conditions. Because units include a combination of all three vegetation types (low elevation ponderosa pine/less than 50 percent mortality, high elevation ponderosa pine/less than 50 percent mortality, and greater than 50 percent mortality), the percent of the unit in each type will determine the total number of snags required per unit. A snag is defined as a dead or fire damaged tree meeting the criteria described in Chapter 2, "Actions Common to All Fully Analyzed Action Alternatives" "Commercial Salvage."

Snag clumps would be retained every 5 to 10 acres. The category of mortality would be based on the overstory mortality within a 5 to 10 acre area. This would be used to determine the total number of snags that would be needed to comprise a clump. Within a 10-acre area, a minimum of one snag clump would be required, with the exception of narrow units or narrow portions of units (see below). It is recognized that the snag diameter classes, as described in the preceding tables, may not be present in all snag clumps due to the variation within a stand. For example, in a pure lodgepole stand, trees greater than 15 in dbh may not be available. To account for this, snag clumps would be representative of the area for which they are retained, while retaining the largest available snags. If larger snags are not available within a snag clump, they would be made up for in other snag clumps, where possible. All snags counted as retention would be 10 inches dbh or greater. Snag clumps would not exceed 2 acres. If the needed snag numbers cannot be achieved within a 2-acre area, the numbers will be made up within another snag clump within the same harvest unit. See wildlife mitigation measures in Chapter 2 for further information on snag retention within harvest units. In some cases, snag clumps may need to be retained on the edge of a unit, or in strips, preferably near an area that is devoid of snags (i.e. scabflats or green stands without snags).

To ensure implementation of fuels treatment and reforestation, work areas for contract workers must meet Oregon Occupational Safety and Health Administration (OSHA) standards. Workers cannot work within 1.5 tree lengths of high hazard trees. Snags retained within the project area may be considered high hazard trees at some time during implementation. This can present logistical problems in particularity narrow portions of salvage units. Snag retention in salvage units or parts of salvage units that are less than 500 feet wide would apply a specific exception to the snag clumping strategy described above. In these narrow units, or parts of units, dead trees that are adjacent to, but outside of, the unit will "count" toward meeting snag retention within the unit or parts of the unit, if the adjacent stand is not proposed for salvage and if at least 50 percent of the larger than 10 inch dbh trees are dead. In this case, snags would not be retained within the narrow portion of the unit. See wildlife mitigation measures in Chapter 2 for further information on snag retention within harvest units.

Selection of Areas for No Harvest

Black-backed woodpecker habitat areas were identified by selecting areas meeting the habitat qualities for which black-backed woodpeckers select (Saab et al., 2002). Using GIS and ground verification, areas were identified that had high pre-fire crown closure and experienced high mortality from the fire. These stands are between 67 and 287 acres totaling approximately 1,789 acres of *identified* optimal black-backed nesting habitat in 12 locations distributed across the project area. Six are located in the Silver Fire and six are located in the Toolbox Fire. Some subsheds did not provide *identified* optimal habitat. Black-backed woodpecker habitat available within the project area is not limited to these areas only. See "Existing Condition for Black-backed Woodpeckers" in this section for more information.

Lewis' woodpecker areas were also identified by selecting areas meeting the habitat qualities for which Lewis' woodpeckers select (Saab et al., 2002). Using GIS, stand data, and ground verification, areas were located that had low to moderate crown closure pre-fire and had high densities of large ponderosa pine. These stands are between 5 and 43 acres in size, totaling approximately 900 acres of *identified* optimal Lewis' woodpecker nesting habitat in approximately 50 different locations well distributed across the Toolbox and Silver Fires. Lewis' woodpecker habitat available within the project area is not limited to these areas only. See "Existing Condition for Lewis' Woodpeckers" in this section for more information.

In addition, some areas were recommend for no harvest within a 500m buffer of the black-backed areas for a monitoring study that will be conducted from 2003 to 2007. This study will monitor the effectiveness of salvage logging prescriptions designed to maintain habitat for sensitive woodpecker species. To determine if there is a landscape influence of the salvage

harvest, some areas within the 500m buffer were recommended for no harvest. Total wildlife leave areas identified for this project is 3690 acres.

Existing Condition for Snag Dependent species

LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2, require that "all sale activities (including regeneration, select cutting, thinning, or salvage) will maintain snag and green tree replacement/roost trees greater than 15 inches dbh at 100 percent population potential levels of primary cavity excavators, and this should be determined using the best available data on species requirements as applied through current snag models or other documented procedures." The best available science at the time determined this to be 4 snags per acre; 3 snags greater than 15 inches dbh (greater than 20 inches dbh preferred) and 1 snag greater than 10 inches dbh (12 inches dbh preferred). Down wood requirements are to manage for 80 lineal feet of down wood in ponderosa pine communities, and 120 lineal feet of down wood in mixed conifer communities. In keeping with the direction to use the best available information on species requirements, the data available in DecAID, or "the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in Washington and Oregon" (Mellen et al. 2003) was used as the primary tool for snag and down wood recommendations for this project.

As stated in Johnson and O'Neil, several major lessons have been learned in the period 1979 to 1999 that have tested critical assumptions of earlier management advisory models (2001), including some of the assumptions used to develop the current recommendations in the LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2. Some assumptions include:

- calculation of numbers of snags required by woodpeckers based on assessing their "biological (population) potential" is a flawed technique (Johnson and O'Neil 2001). Empirical studies are suggesting that snag numbers in areas used and selected by some wildlife species are far higher that those calculated by this technique (Johnson and O'Neil 2001).
- numbers and sizes (dbh) of snags used and selected by secondary cavity nesters often exceed those of primary excavators (Johnson and O'Neil 2001).

This suggests the current direction of managing for 100 percent population potential levels of primary excavators may not represent the most meaningful measure of managing for cavity-nesters and that these snag levels, under certain conditions, may not be adequate for some species. In addition, the current direction provides recommendations for green stand conditions only when studies show that cavity-nesting birds require higher densities of snags in post-fire condition versus green stand conditions for nesting and productivity. This is likely due to the fact that in post-fire conditions, cavity-nesting birds require more snags for foraging, cover, and protection from predators.

The use of DecAID is a culmination of the most recent science and data available. As stated by Johnson and O'Neil (2001), DecAID is based on a thorough review of the literature, available research and inventory data, and expert judgment. These recommendations will be compared to the current LRMP standard and guidelines, as Amended by the Regional Forester's Amendment #2, for this project.

Primary excavators, such as woodpeckers and nuthatches, are forest dwelling birds that are specialized for foraging on and nesting in decaying wood. They require trees with rotted heartwood for excavating nest holes and for a foraging substrate (Jackman 1974). This foraging substrate consists of insects such as bark and wood boring beetles on the surface of trees. Their impact is sometimes great enough to prevent insect outbreaks (Jackman 1974). The most significant role primary excavators play in the forest community is the provision of nest holes for small mammals or for cavity nesting birds that do not excavate their own holes (Jackman 1974). Approximately 31 percent of the total bird fauna use snags for nesting and denning, foraging, roosting, communicating, and as hunting and resting perches (Raphael and White 1984). Rose et al. identifies 96 wildlife species associated with snags and 86 species associated with down wood (2001). Most snag using wildlife species are associated with snags greater than 14.2" dbh with about a third of these using snags greater than 29.1" dbh.

Morrison and Raphael found that snags created by fire decayed rapidly and fell more quickly than those on unburned forests, and that larger snags had greater longevity than smaller snags (1993). Bull found that the average rate of fall of ponderosa pine snags 10 to 20" dbh was 23 percent and of snags greater than 20" dbh was 3 percent (1980). Raphael and White estimated that 4.2 suitable soft snags per acre were required to support maximum burned densities on burned forests, and that taking into account fall rates, 4 hard snags were required to produce one soft snag (1984). To achieve a density of 4.2 soft snags per acre at year 15, if only hard snags were marked, would require 16 to 17.2 snags per acre depending on

forest type to support maximum bird densities limited by territorial behavior. This closely agrees with Saab and Dudley who found that seven species of cavity nesters using burned stands just 2 to 4 years after a wildfire selected nest sites with more than 20 snags per acre where snags were distributed in clumps (1997). Another finding of Raphael and White (1984) and Saab (1997) was that birds preferred to nest in patches of snags. Their foraging studies suggested that closely spaced large trees allowed maximum energy intake, partly by reducing inter-tree flight time. They recommended snags be managed as dispersed clumps rather than as isolated individuals to meet both nesting and feeding requirements.

Several authors suggest that the presence of unlogged, severely burned forests in forested landscapes, may be critical for maintaining populations of certain cavity-nesting birds (Hutto 1995, Caton 1996, Saab and Dudley 1998). Many cavity-nesting birds exhibit marked increases in abundance after the occurrence of stand-replacement fires (Blackford 1955, Koplin 1969, Taylor and Barmore 1980, Harris 1982, Raphael and White 1984, Hutto 1995, Caton 1996, Hitchcox 1996, Hoffman 1997, Murphy and Lehnhausen 1988, Saab and Dudley 1998). The most dramatic increases are for species that are timber drillers and aerial foragers. Cavity-nesters likely respond positively to stand-replacement burns for a number of reasons. Bark beetles (Amman and Ryan 1991) and wood-boring beetles (Zhang et al. 1993, Hart 1998) often colonize fire-killed or injured trees in high densities. Subsequently, this is followed by an increase in the abundance of *Picoides* woodpeckers, which are strongly associated with dying or recently killed trees. Bark- and wood-boring insects form the prey base for certain woodpeckers. Indeed, the appearance of *Picoides* woodpeckers in stand-replacement burns typically coincides with the emergence of adult wood-borers (Harris 1982, Hoffman 1997, Murphy and Lehnhausen 1998). Also, stand-replacement fires create large expanses of standing dead trees in an open setting, which is important for secondary cavity-nesters that are aerial foragers (Taylor and Barmore 1980, Hutto 1995, Sallabanks 1995, Johnson and Wauer 1996). Finally, stand-replacement fires provide a multitude of potential nesting sites as snags soften with decay introduced by the multitude of insects (Raphael and White 1984, Hughes 2000). Although temporary, stand-replacement fires create a rich and concentrated foraging resource in areas where nest site potential also increases. It is thought that many cavity-nesting species are dependent upon both the spatial and temporal occurrence of severe burns to maintain their populations (Hutto 1995, Caton 1996, Hoffman 1997, Machmer 2000).

As indicated in DecAID, the work of Saab and Dudley (1998) and Saab et al. (2002) should be consulted when planning management activities in post-fire habitats (Mellen et al. 2003). This research recommends that managing for a range of post-fire habitat conditions, characteristic of black-backed and Lewis' woodpeckers, would likely incorporate habitat features necessary for nest occurrence of other cavity-nesting birds (Saab et al. 2002). In addition, habitat should be managed at multiple spatial scales to incorporate the continuum of habitat used by black-backed and Lewis's woodpeckers (Johnson, et al. 2000, Saab et al. 2002). This suggests that developing salvage logging prescriptions that maintain habitat characteristics for both black-backed and Lewis' woodpeckers, while considering both the microhabitat and landscape scale, would likely retain habitat for the entire assemblage of cavity-nesting birds.

Less Than 50 Percent Mortality:

Although formal surveys have not been conducted within the project area, it can be assumed that the areas mapped as less than 50 percent mortality are likely well above snag levels in "natural conditions" for the ponderosa pine communities found within the project area and well above LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2.

Greater Than 50 Percent Mortality

Although formal surveys have not been conducted within the project area, it can be assumed that the areas mapped as greater than 50 percent mortality are likely well above snag levels in "natural conditions" for the ponderosa pine communities found within the project area and well above LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2.

The **wildlife data** in DecAID for post fire habitats provides snag densities for the 30 percent, 50 percent, and 80 percent tolerance levels for seven cavity nesting species studied in Idaho. According to the District Silviculturist, with limited data available across all areas for this project, snag size classes and densities can best be determined through volume estimates that were developed using the best available data from stand exams, post fire stand exam plots, aerial photo interpretation, and past silvicultural activities information. The following data will be used to determine the approximate tolerance level for each species in each alternative.

***The approximate tolerance levels are intended to be a comparative measure between alternatives*. It is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may**

select for areas with lower snags densities than what was selected for in Idaho, and, therefore, the tolerance levels overall would be lower.

The approximate number of trees greater than 10 inches dbh and greater than 20 inches dbh found in the low, moderate, high, and very high volume categories are displayed in the following table. Using these estimates, the tolerance level for each species based upon the snag densities around nest sites as displayed in DecAID can be determined.

Table 3.54 Estimated Snag Density Numbers Based on Volume in the Greater Than 50 Percent Mortality Areas

Estimated Volume	Approximate number of trees >10 inches dbh	Approximate number of trees >20 inches dbh
Low (L)	<35	0-3
Moderate (M)	36-70	4-5
High (H)	71-99	6-10
Very High (VH)	100+	11+

The wildlife data in DecAID demonstrates the following snags densities for seven different cavity nesting species at the 30 percent, 50 percent, and 80 percent tolerance level (Mellen et al. 2003):

Table 3.55 Snag Densities for Seven Cavity Nesting Species at 30, 50, and 80 Percent Tolerance Level

Species	30% Tolerance level (#snags/acre) based on wildlife data in DecAID		Estimated volume that provide these snag densities	50% Tolerance level (#snags/acre) based on wildlife data in DecAID		Estimated volume that provide these snag densities	80% Tolerance level (#snags/acre) based on wildlife data in DecAID		Estimated volume that provide these snag densities
	>10" dbh	>20" dbh		>10" dbh	>20" dbh		>10" dbh	>20" dbh	
Black-backed Woodpecker	62.2	0	M	88.3	0	H	126.1	0	VH
Hairy Woodpecker	12.7	0	L	41.8	0	M	85.3	0	H,VH
Lewis' Woodpecker	9.5	0	L,M	24.8	6.2	H	48.1	16.1	VH
Mountain Bluebird	6.8	0	L,M,H	29.7	12.4	VH	63.9	38.0	**
Northern Flicker	5.4	2.2	L,M,H	29.8	17.4	VH	66.4	39.6	**
Western Bluebird	9.2	0		32.1	0	L,M	66.5	0	H,VH
White-headed Woodpecker	20.0	0	L	51.4	0	M	95.5	0	H,VH

** 80 percent tolerance level for mountain bluebird and northern flicker cannot be achieved on this District. The ponderosa pine types on the Fremont are generally drier sites than found in Idaho, and stand densities of large trees greater than 20" dbh do not reach these densities.

Based on the wildlife data in DecAID and the total acres of low, moderate, high, and very high volume levels in the project area, the average tolerance level for each of the cavity-nesting species can be determined.

1. The percent of the project area at each tolerance level for each species is calculated by:

$$\frac{\text{Total acres of the L, M, H, and/or VH volume that meet the snag densities for each species as displayed in the table above}}{\text{Total Acres greater than 50 percent mortality}}$$

2. The approximate average tolerance level across the project area for each individual cavity-nesting species is calculated by:

(percent of area at 30 %)(30) + (percent of area at 50 %)(50) + (percent of area at 80 %)(80)

Total acres greater than 50 percent mortality = 14,897 acres
1. **Total acres of greater than 50 percent mortality and low volume (L)** = 2,318 acres
2. **Total acres of greater than 50 percent mortality and moderate volume (M)** = 4,336 acres
3. **Total acres of greater than 50 percent mortality and high volume (H)** = 5,724 acres
4. **Total acres of greater than 50 percent mortality and very high volume (VH)** = 2,519 acres

Table 3.56 Existing Tolerance Level for Cavity Nesting Species Within the Project Area*

		Percent of Total Project Area at Less than 30% Tolerance Level	Percent of Total Project Area at the 30% Tolerance Level	Percent of Total Project Area at the 50% Tolerance Level	Percent of Total Project Area at the 80% Tolerance Level		Approximate Average Tolerance Level Across the Project Area
Black-backed Woodpecker		16%	29%	38%	17%		41%
Hairy Woodpecker		0%	16%	29%	55%		63%
Lewis' Woodpecker		0%	45%	38%	17%		46%
Mountain Bluebird		0%	83%	17%	0%		33%
Northern Flicker		0%	83%	17%	0%		33%
Western Bluebird		0%	0%	16%	84%		75%
White-headed Woodpecker		0%	16%	29%	55%		67%

*The approximate tolerance levels are intended to be a comparative measure between alternatives. **It is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and therefore the tolerance levels overall would be lower.**

Existing Condition for Black-backed Woodpeckers

Numerous authors have associated black-backed woodpeckers with disturbances that provide for a large number of dead and dying trees such as fire or insect outbreaks (Bock and Bock, 1974; Marshall 1992; Raphael and White 1984). Black-backed woodpeckers are associated with mature and overmature forested stands that have a high incidence of disease, decay, and mortality (Goggans et al. 1988). They are an eruptive species, meaning they respond to local, temporary, abundance of food as a result of wind, fire, or insect-killed timber that support bark beetles in above normal numbers (Marshall 1992). Black-backed woodpeckers are often dependent upon stand-replacement wildfires occurring on the landscape, despite the fact that their use of a recently burned forest may be short term (1 to 4 years) (Sallabanks and McIver 1998). Although fires are an ephemeral source of habitat for black-backed woodpeckers, nesting success and productivity is higher in burned areas and, therefore, burned areas are critical for their long term persistence.

Black-backed woodpeckers forage on trees that generally have been dead for less then three years by "scaling" or prying off layers of bark to get at the insects. Goggans et al. (1988) has suggested that a reproductive pair of black-backed woodpeckers require a minimum of 956 acres of continuous or interconnected pine in a mature to overmature condition. They excavate a new cavity for nesting each year and it can often be identified by bark that has been peeled from the entrance hole (Marshall 1992). Little use of downed material has been observed, although Goggans, et al. (1987) observed that black-backed woodpeckers used logs 4 percent of the time in central Oregon. It is assumed that these logs had retained at least some bark. This is a relatively rare species because of the removal of mature and insect-infested timber from otherwise suitable habitat and from the conversion of mature and old growth forests to young fast growing stands that are relatively free of heartrot and bark beetles (Marshall 1992).

Black-backed woodpeckers have consistently selected unlogged conditions of high snag densities for both nesting and foraging habitat in burned forests (Caton 1996, Hitchcox 1996, Hoffman 1997, Hutto 1995, Kreisel and Stein 1999, Saab et al. 2002). High snag densities most likely provide greater foraging opportunities for black-backed woodpeckers, which

feed primarily on bark and wood-boring beetles (Dixon and Saab 1998). In a burned ponderosa pine forest of western Idaho, the highest probability of nest occurrence for black-backed woodpeckers was found in Douglas-fir cover types with pre-fire crown closures of greater than 70 percent and where stand size averaged 30 to 50 hectares or 74 to 124 acres (Saab et al. 2002). Additionally, black-backed woodpeckers selected landscapes where large stands of Douglas-fir/high crown closure occurred in closer proximity than at random points within the surrounding landscapes.

Figure 3.23 Example of Black-Backed Woodpecker Habitat Within the Project Area

There are no specific Standards and Guidelines related to the black-backed woodpecker or its habitat. There is a requirement to provide sufficient habitat quality, quantity, and diversity to maintain self-sustaining populations across the Forest. The project area currently provides optimal foraging and nesting habitat for black-backed woodpeckers. Although specific surveys have not been conducted for black-backed woodpeckers within the planning area, several sighting have been documented during field reconnaissance.

The Toolbox and Silver Fires have created optimal habitat for black-backed woodpeckers in areas of high canopy closure pre-fire with high densities of smaller trees. Due to past harvest and the local ponderosa pine communities being dry sites with generally lower canopy closures, the average existing tolerance level for black-backed woodpeckers within the project area is approximately 41 percent.

On the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower canopy closure than found at the study site in Idaho where the wildlife data and recommendations were developed for DecAID. Therefore for this project, areas greater than 40 percent pre-fire canopy closure were estimated to be suitable habitat for black-backed woodpeckers. Based on this criteria, 12 areas were located that were greater than 40 percent canopy closure, with the largest amount of greater than 56 percent canopy within the area available, and that experienced heavy mortality. Although there is approximately 4,147 total acres of greater than 40 percent canopy closure that is also greater than 50 percent mortality within the fire, only 1,789 acres were selected as *identified* optimal habitat based on the contiguous size of area, the amount within the areas greater than 56 percent canopy closure, and the amount of area greater than 50 percent mortality (see the following tables). These areas make up 12 separate and well-distributed black-backed areas within the project area, six located in the Silver Fire and six located in the Toolbox Fire.

Table 3.57 Total Acres of I*dentified* Optimal Black-backed Woodpecker Habitat by Subshed

Subshed	Total Acres of Identified Optimal Black-backed Woodpecker Habitat
Benny Creek	325
East Duncan Creek	5
Lower Duncan Creek	123
Thompson Reservoir	555
Upper Duncan Creek	250
Upper Silver Creek	0
Middle Silver Creek	0
West Fork Silver Creek	531
Total Acres	**1,789**

In addition to the *identified* optimal habitat listed in the table above, areas of high canopy closure, or greater than 40 percent canopy closure and greater than 50 percent mortality, within the project area may provide for limited black-backed woodpecker habitat within the project area. Although much of these acres do not meet the contiguous size as defined in the literature by Saab et al. (2002) (74 to 124 acres), they likely do provide the high densities of trees for which black-backed woodpeckers select. Within the project area, there are only 36 acres of habitat available greater than 70 percent canopy closure and greater than 50 percent mortality, 864 acres of habitat available 56 to 70 percent canopy closure and greater than 50 percent mortality, and 3,247 acres of habitat available 40 to 56 percent canopy closure and greater than 50 percent mortality.

The following table displays total acres within the project area that are high canopy closure (greater than 40 percent canopy closure) and greater than 50 percent mortality by subshed (These acres overlap with the acres in the above table).

Table 3.58 Acres of Greater than 40 Percent Canopy Closure and Greater Than 50 Percent Mortality by Subshed

Subshed	Total Acres		
	>70% Canopy Closure	56-70% Canopy Closure	40-56% Canopy closure
Benny Creek	0	238	655
East Duncan Creek	0	131	211
Lower Duncan Creek	0	146	569
Thompson Reservoir	1	105	645
Upper Duncan Creek	11	114	551
Upper Silver Creek	1	8	113
Middle Silver Creek	0	0	35
West Fork Silver Creek	23	122	468
Total Acres	**36**	**864**	**3,247**
Total Acres	**4,147**		

No specific black-backed woodpecker surveys were conducted for this project. Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Black-backed woodpeckers were not detected at any of these locations.

Existing Condition for Lewis' Woodpeckers

A common characteristic of Lewis' woodpecker habitat is openness due to their foraging method of aerial insect feeding and, in some instances, brushy undergrowth is necessary to support insect populations (Sousa 1983). Burned old ponderosa pine forests created by stand replacement fires are highly productive source habitats compared to unburned ponderosa pine forests (Tobalski 1997). Lewis' woodpeckers also require large snags in an advanced state of decay or trees with soft sapwood for ease of cavity excavation (Bock 1970, Rapheal and White 1984, Saab and Dudley 1995).

The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically and socially appropriate, through natural events or management, to maintain greater than 1 percent of the landscape as post-fire old ponderosa pine forest habitat or greater than 50 percent of a post-fire landscape unsalvaged (Altman 2000). Where salvage logging is occurring in post-fire old ponderosa pine forests, maintain or provide in burns greater than 100 acres, greater than 50 percent of the standing and down wood, and, in all burns, retain all snags greater than 20 inches and greater than 50 percent of those 12 to 20 inches dbh. In addition, snags should be clumped rather than evenly spaced, with both hard and soft decay classes, to lengthen the period that stands are suitable nesting habitat (Altman 2000). Where ecologically appropriate, initiate actions in old forest habitat to maintain or provide approximately 24 snags/acre greater than 9 inches dbh of which seven should be greater than 20 inches, provide recruitment snags particularly in areas with high risk of stand-replacement fires, and provide shrub understory with greater than 13 percent cover (Altman 2000).

Some of the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000) are:

1. Fire suppression policies that have reduced the extent of this habitat condition across the landscape.
2. Salvage logging of burned ponderosa pine forests.
3. Extensive high-grade harvest of individual old ponderosa pine trees before decay and snag formation occur.

The Lewis' woodpecker is listed by the US Fish and Wildlife Service as a bird of conservation concern, meaning that, without additional conservation actions, it is likely to become a candidate for listing under the Endangered Species Act of 1973 (2002).

Lewis's woodpeckers were most abundant in partially logged burned forests and relatively rare in unlogged units of western Idaho (Saab and Dudley 1998). This species favors open woodlands, especially burned pine forests (Tonasket 1997, Saab and Vierling 2001). Lewis's woodpeckers are primarily aerial flycatchers during the breeding season (Saab and Vierling 2001) and post-fire conditions likely provide source habitats for Lewis's Woodpeckers because of increases in shrubby understories and associated arthropods, open canopies, and snags for nesting (Saab and Vierling 2001). In western Idaho, ponderosa pine/Douglas-fir cover type with moderate pre-fire crown closure (40 to 70 percent) was the best landscape predictor of nest occurrence for Lewis's woodpecker (Saab et al. 2002). Stands were smaller (0 = 6.63 hectares $\pm$ 0.16 or 16 to 17 acres) and in closer proximity than those stands surrounding random locations (Saab et al. 2002).

Figure 3.24 Example of Lewis' Woodpecker Habitat Within the Project Area

The Toolbox and Silver Fires have created optimal habitat for Lewis' woodpeckers in areas with high densities of large ponderosa pine. There have been several sightings of Lewis' woodpeckers on the Silver Lake Ranger District; however, Lewis' woodpeckers were not detected during field reconnaissance for this project. Due to past overstory harvest of large ponderosa pine and generally low densities of large ponderosa pine in the dry fringe communities, the average existing tolerance level for Lewis' woodpeckers within the project area is approximately 46 percent.

Lewis' woodpecker areas were also identified as indicated by the research conducted by Saab et al. (2002). On the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower canopy closure than found at the study site in Idaho, where the wildlife data and recommendations were developed for DecAID. Therefore, for this project, areas that are 11 to 40 percent pre-fire canopy closure with high densities of large ponderosa pine snags were estimated to be suitable habitat for Lewis' woodpeckers. Based on this criteria, areas were identified using GIS, stand data, and ground verification (see the following table). This totals approximately 900 acres of *identified* optimal Lewis' woodpecker nesting habitat in approximately 50 different locations well distributed across the Toolbox and Silver Fires.

Table 3.59 Total Acres of *Identified* Optimal Lewis' Woodpecker Habitat by Subshed

Subshed	Total Acres of Identified Optimal Lewis' Woodpecker Habitat
Benny Creek	78
East Duncan Creek	128
Lower Duncan Creek	20
Thompson Reservoir	169
Upper Duncan Creek	226
Upper Silver Creek	58
Middle Silver Creek	39
West Fork Silver Creek	182
Total Acres	**900**

Although 900 acres have been identified as optimal Lewis' woodpecker habitat, Lewis' woodpecker habitat is not limited to these areas within the project area. According to the District Silviculturist, volume can be an indicator of areas that likely provide high densities of large ponderosa pine. Areas mapped as high or very high volume likely provide high densities of large ponderosa pine. Volume, in addition to mortality, ecoclass, and canopy closure can assist in identifying potential Lewis' woodpecker habitat. Although much of these acres do not meet the contiguous size as defined in the literature by Saab et al. (2002) (16 to 17 acres), they likely do provide the high densities of large ponderosa pine for which Lewis' woodpeckers select.

The following total acres within the project area that are low to moderate canopy closure (11 to 40 percent), greater than 50 percent mortality, ponderosa pine or ponderosa pine dominated mixed conifer communities, and high or very high volume by subshed (these acres overlap with the acres in the preceding table).

Table 3.60 Acres of 11 to 40 Percent Canopy Closure in Greater than 50 Percent Mortality Ponderosa Pine or Ponderosa Pine Dominated Mixed Conifer

Subshed	Total Acres
Benny Creek	379
East Duncan Creek	253
Lower Duncan Creek	285
Thompson Reservoir	1,064
Upper Duncan Creek	854
Upper Silver Creek	298
Middle Silver Creek	207
West Fork Silver Creek	1,598
Total Acres	**4,938**

No specific Lewis' woodpecker surveys were conducted for this project. Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project

area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Lewis' woodpeckers were only detected at Bottle Springs. Below is the total number of detections of Lewis' woodpeckers at Bottle Springs from 1994 to 2001:

Table 3.61 Detections of Lewis' Woodpeckers at Bottle Springs - 1994 to 2001

Location	1994	1995	1996	1997	1998	1999	2000	2001
Bottle Springs	0	0	0	0	1	0	0	0

Existing Condition for Down Wood Dependent Species

Dead wood is also a fundamental feature of healthy forests. Logs contribute to the hydrology of a site and provide microhabitats that protect wood-dwelling organisms with moist, thermally stable, predator-protected niches in which to live (Torgersen, unpublished). Logs can be considered either places in which animals such as the pine marten forage, or places in which animals such as fawns or black bear use for hiding cover and protection. Down wood provides physically complex structures where animals find stable temperatures and moisture for denning, nesting, feeding, and food storage (Torgersen unpublished).

Although formal down wood surveys have not been completed for the project area, it is expected based on field reconnaissance that down wood levels are currently deficient due to consumption during the fire. There may be localized areas within the project area that meet down wood levels; however, overall across the landscape, levels are likely below LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2, and the down wood percent cover recommendations developed using the data in DecAID (1.1-2.5 down wood percent cover).

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Snag Dependent Species

This alternative would provide for the greatest number of snags for primary and secondary excavators and for the highest tolerance level or assurance for all cavity dependent species. All existing snags would be available in several size classes with differing densities. This alternative will provide for the maintenance of existing condition in the short-term as described earlier in this report and displayed in Tables 3.56 through 3.60. Some opportunistic birds, such as hairy woodpeckers, are capable of excavating nests in harder snags (Raphael and White 1984) and it is expected that they would rapidly invade the fire. Other species, such as the Lewis' woodpecker or the northern flicker, require softer snags for excavating nest sites (Raphael and White 1984) and would expand into the fire as snags begin to decay. The likelihood of meeting snag levels into the future with increased snag longevity and retention would be the greatest under this alternative, with large diameter snags expected to last 20 to 30 years. Snag recruitment is forgone for many years until natural regeneration occurs and trees develop into functioning mature stands in which natural snag recruitment occurs. However, in the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase as the beetles move into these areas. Snag levels would greatly exceed LRMP Standards and Guidelines as amended by the Regional Forester's Amendment #2, and the recommendation described above developed using the data in DecAID (see Tables 3.51, 3.53, and 3.53).

Black-backed Woodpeckers

This alternative provides for optimal conditions and the highest tolerance level or assurance for black-backed woodpeckers. With increased nesting opportunities and foraging habitat as bark beetles populations increase, an eruption in the black-blacked woodpecker population within the burned areas is expected. Of four studies conducted on the effects of post-fire salvage on bird species, only the black-backed woodpecker showed a consistent response to logging with significantly more nests found on unlogged sites (McIver 2000). As the insect population declines in the high mortality areas (within 1 to 3 years), woodpecker numbers would show a corresponding decrease back to pre-fire numbers. However, after the beetle population decreases in the stands that experienced high vegetation mortality in 2 to 4 years, it is expected that the beetles would begin to enter the stands that experienced low to moderate vegetation mortality, and black-backed woodpeckers would follow the foraging source.

Lewis' Woodpeckers

This alternative provides optimal conditions and the highest tolerance level or assurance for Lewis' woodpeckers. With increased nesting opportunities as snags begin to soften and foraging opportunities as the aerial insect population increase, an increase in Lewis' woodpecker population within the burned area is expected until the large trees begin to fall (20 to 30 years). Lewis' woodpeckers are found to be most abundant in partially logged burned forests (Saab and Dudley 1998). With no salvage logging to make for more open favorable conditions, the increase may not occur until the smaller trees begin to fall in 1 to 10 years.

Down Wood Dependent Species

As snags begin to fall, down wood levels would significantly increase, thereby increasing denning, nesting, and feeding habitat for down wood dependent species.

Conclusions for Alternative A

Snag Dependent Species - This alternative provides the greatest opportunity to provide snag numbers that would likely lead to increases in populations in the short term and the persistence of populations in the long term (15 or more years).

Black-backed Woodpecker - Black-backed woodpecker populations and viability are expected to show the greatest increase under this alternative.

Lewis' Woodpecker - Lewis' woodpecker populations and viability are expected to show the greatest decrease under this alternative in the short term (1 to 10 years) due to dense snag conditions, but the greatest increase in the long term (10 to 30 years) due to the maintenance of all large ponderosa pine snags.

Down Wood Dependent Species - Down wood levels would greatly exceed LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2, and the down wood percent cover recommendations developed using the data in DecAID (1.1-2.5 down wood percent cover).

Effects Common to All Action Alternatives

Areas Less Than 50 Percent Mortality

All action alternatives propose the same set of activities; however, what would vary among the alternatives is the level of treatments prescribed. Salvage harvest would occur in all action alternatives. Seven percent of the snags retained would be larger snags (30 or more inches) to provide for the long term persistence of snag habitat. Snags would be retained in clumps that would be well distributed across the harvest units. Snag clumps would range from 2 to 30 snags per clump, which should be within the size range that Agee estimates for historical conditions (2002). Agee predicts that in forests dominated by ponderosa pine, mature clumps of trees occur in patches ranging from 0.05 to 0.87 acres in size (Agee 2002). Snag densities and diameter requirements are designed to mimic estimated historical levels, or "natural conditions," and, therefore, should be adequate for the species dependent upon this type of vegetation type under estimated historical conditions. Harvest would not occur on acres where snag levels are likely above estimated historical conditions.

Snag Dependent Species

All alternatives provide for cavity-nesting habitat in the short term. In the long term (10-30 years), snags are expected to fall and cavity-nesting habitat would not be available. Most cavity-nesters show consistent patterns of decrease after logging, including the mountain bluebird, black-backed woodpecker, hairy woodpecker, and three-toed woodpecker (McIver 2000). Snags would all be retained in clumps and, if possible, would be located around pre-existing snags to provide for diversity in decay classes. Clump sizes were designed to be large enough that they provide effective nesting habitat for cavity-nesters, but small enough that the area would retain a good distribution of snags across the harvest units. Studies show that bird species selected nest sites with higher tree densities, and cavity nesters, as a group, selected clumps of snags as opposed to snags retained in uniform, evenly spaced distribution (Johnson and O'Neil 2001). Larger snags (30 or more inches) would be retained to provide for the long term persistence of snag habitat. Any harvest or activity during the breeding season may have a direct effect on nesting.

Due to safety (site prep for reforestation) and fuels hazard concerns, many acres of harvest would require the felling and treatment of fuels (all trees less than 13 inches dbh or whatever merchantability cut-off size is decided upon) through various methods including lop and scatter, jackpot burning, crushing, etc. This treatment is proposed in varying levels by alternative in harvest units and would occur outside of designated snag clumps. The use of snag clumps by cavity-nesting species could be reduced due to the loss of foraging habitat in the surrounding landscape. Use for some species,

particularly timber-drilling woodpeckers and bark gleaners, may be limited due to the large amount of foraging habitat lost around the snag clumps. Bates (2001) summarized this as follows:

> "Most studies on cavity-nesters that have focused on nest site availability have suggested that cavity-nesters increase in burned habitats as nest site potential also increases (Taylor and Barmore 1980, Raphael and White 1984). In a five-year study that looked at both nesting and foraging use of cavity-nesters in both a stand-replacement burn and adjacent unburned forests in Montana, Caton (1996) concluded 'differences in abundances of most species were probably due to differences in foraging opportunities rather than differences in nest-site availability.' She observed, 'nests were placed in sites with characteristics that corresponded to bird species' foraging habits (pg. 78).' That is, timber-drilling woodpeckers and bark gleaners placed their nests in areas with greater basal area, mean dbh, and live canopy compared to ground or aerial foragers."

Black-backed Woodpecker

In the first year after the fire (2003), no logging would occur and all potential existing habitat would be available for black-backed nesting and foraging. After the beetle population decreases in the stands that experienced high vegetation mortality in 2 to 4 years, it is expected that the beetles would begin to enter the stands that experienced low to moderate vegetation mortality, and black-backed woodpeckers would follow the foraging source. The acres of harvest within the greater than 50 percent mortality category would likely not provide nesting habitat for black-backed woodpeckers in both the short and long term. Any harvest or activity during the breeding season may have a direct effect on nesting.

Lewis' Woodpecker

Lewis's woodpeckers are most abundant in partially logged burned forests and relatively rare in unlogged units of western Idaho (Saab and Dudley 1998). Within the harvest units greater than 50 percent mortality, snags would be retained at the 30 percent tolerance level or assurance for Lewis' woodpeckers and should provide for suitable nesting habitat. The areas considered to be the most optimal *identified* habitat selected for Lewis' woodpeckers within the project area are based on the following criteria: 1) areas of low to moderate canopy closure pre-fire ranging generally between 16 to 17 acres and 2) high densities of large ponderosa pine trees.

Lewis' woodpecker habitat may also be identified by selecting areas of low to moderate canopy closure (11-40 percent), high mortality (greater than 50 percent), ponderosa pine or ponderosa pine dominated mixed conifer communities, and areas of high or very high volume (see the following table). Although much of these acres do not meet the contiguous size as defined in the literature by Saab et al. (2002) (16 to 17 acres), they likely do provide the high densities of large ponderosa pine for which Lewis' woodpeckers select. Any harvest or activity during the breeding season may have a direct effect on nesting.

Down Wood Dependent Species

It is expected that as snags begin to fall, down wood levels would increase, thereby increasing denning, nesting, and feeding habitat for down wood dependent species. Levels would vary across the landscape due to the variation in snag retention and fuels treatments prescribed. Some areas of no harvest would greatly exceed the recommendations, while areas of harvest and fuels treatments may be at or below the recommendations.

Alternative C

Areas less than 50 percent Mortality

Harvest would occur on approximately 5,801 acres. Approximately 1,125 acres are low elevation ponderosa pine type in which an average of 2.9 snags per area would be retained within harvest units (see Table 3.51). Approximately 4,676 acres are high elevation ponderosa pine type in which an average of 6.1 snags per area would be retained within harvest units (see Table 3.52). Harvest would not occur on approximately 4,381 acres where snag levels are likely above estimated historical conditions.

Areas Greater Than 50 Percent Mortality

1. **Total acres greater than 50 percent mortality** = 14,897 acres
2. **No harvest acres**
    1. Total acres of greater than 50 percent mortality and low volume (L) = 947 acres
    2. Total acres of greater than 50 percent mortality and moderate volume (M) = 1,481 acres
    3. Total acres of greater than 50 percent mortality and high volume (H) = 2,460 acres
    4. Total acres of greater than 50 percent mortality and very high volume (VH) = 1,368 acres

3. Total acres of harvest greater than 50 percent mortality retaining 8 trees/acre 10 to 20" dbh and 2 trees/acre greater than 20" dbh = 8,641 acres.

Within harvest units, 30 percent tolerance level would be provided for Lewis' woodpeckers, mountain bluebirds, northern flickers, and western bluebirds.

Table 3.62 Alternative C Tolerance Level for Cavity Nesting Species Within the Project Area*

		Percent of Total Project Area at Less than 30% Tolerance Level	Percent of Total Project Area at the 30% Tolerance Level	Percent of Total Project Area at the 50% Tolerance Level	Percent of Total Project Area at the 80% Tolerance Level		Approximate Average Tolerance Level Across the Project Area
Black-backed Woodpecker		64%	10%	17%	9%		19%
Hairy Woodpecker		58%	6%	10%	26%		28%
Lewis' Woodpecker		0%	74%	17%	9%		38%
Mountain Bluebird		0%	91%	9%	0%		32%
Northern Flicker		0%	91%	9%	0%		32%
Western Bluebird		0%	58%	16%	26%		46%
White-headed Woodpecker		58%	6%	10%	26%		28%

*The approximate tolerance levels are intended to be a comparative measure between alternatives. **It is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and therefore the tolerance levels overall would be lower.**

Snag Dependent Species

This alternative proposes to salvage 8,642 acres of dead material within the areas mapped as greater than 50 percent mortality. This would result in a lower tolerance level or assurance for all cavity-nesting species as displayed in the preceding table.

Due to safety (site prep for reforestation) and fuels hazard concerns, many acres of harvest would require the felling and treatment of fuels (all trees less than 13 inches dbh) through various methods, including lop and scatter, jackpot burning, crushing, etc. This treatment is proposed within approximately 8,642 acres of harvest units and would occur outside of designated snag clumps.

Approximately 5,816 acres of harvest units would not require this type of treatment within the first 3 to 4 years. The unmerchantable material would be retained providing ample amounts of foraging habitat around the snag clumps. These areas are expected to receive greater use overall by cavity-nesters than the areas that would receive site-prep and fuels reduction treatments. If site prep is required within these 5,816 acres, it would occur in year 4 or 5 when the snags have begun to fall and the foraging habitat is less effective.

Outside of the areas proposed for salvage, approximately 4,301 acres would require site prep. These areas can be described as areas that have received heavy amounts of past harvest and are now post and pole stands, or generally do not contain enough material to be considered an economically viable salvage area. Therefore, these areas likely contain low levels of cavity-nesting habitat. These areas are likely providing foraging habitat due to the smaller overall tree size. Within these areas, a 1-acre snag clump would be retained every 5 acres to retain some foraging habitat and continuity in snags, all snags outside of the leave clumps would likely be felled in 2004 or 2005, and, therefore, would decrease foraging habitat for cavity nesting species. Snag recruitment is foregone for many years until planted trees develop into functioning mature stands in which natural snag recruitment occurs. Planting of approximately 20,906 acres under this alternative would accelerate this process.

Black-backed Woodpeckers

For this alternative, the tolerance level, or assurance of retaining habitat for black-backed woodpeckers, is reduced from an average of 41 percent to 19 percent across the landscape. However, of the 12 areas considered to be the most optimal *identified* habitat selected for black-backed woodpeckers within the project area based on the following criteria: 1) areas of high canopy closure pre-fire ranging generally between 75 to 120 acres, and 2) high densities of smaller trees, at least part of all 12 areas are being retained under this alternative and would remain large enough that they would be effective habitat. Although the total amount of acres of *identified* optimal black-backed habitat is reduced from 1,789 acres to 1,620 acres, all 12 areas would still meet the criteria as described in the literature by Saab et al. (2002). Therefore, the majority of the most optimal *identified* habitat would be retained within the project area (see the following table).

In addition to the *identified* optimal habitat displayed in the following table, areas of high canopy closure within the project area may provide for limited black-backed woodpecker habitat within the project area. Although much of these acres do not meet the contiguous size as defined in the literature by Saab, et al. (2002) (74 to 124 acres), they likely do provide the high densities of trees for which black-backed woodpeckers select (see the following table). Approximately 2,349 acres or 57 percent of areas would remain unharvested.

The 8,642 acres of harvest within the greater than 50 percent mortality category would likely not provide nesting habitat for black-backed woodpeckers in both the short and long term.

Table 3.63 Alternative C Total Acres of *Identified* Optimal Black-backed Woodpecker Habitat and Acres Within the Project That Are High Canopy Closure and Greater than 50 Percent Mortality by Subshed

	***Identified* Optimal Black-backed Woodpecker Habitat**		**Suitable Black-backed Woodpecker Habitat**					
Subshed	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**	**Total Acres Proposed for Harvest**			**Total Acres *Not* Proposed for Harvest**		
			>70% Canopy Closure	**56-70% Canopy Closure**	**40-56% Canopy Closure**	**>70% Canopy closure**	**56-70% Canopy Closure**	**40-56% Canopy closure**
Benny Creek	39	286	0	84	424	0	154	231
East Duncan Creek	0	5	0	60	153	0	71	58
Lower Duncan Creek	0	123	0	57	328	0	89	241
Thompson Reservoir	95	460	0	28	206	1	77	439
Upper Duncan Creek	13	238	7	28	107	4	86	444
Upper Silver Creek	0	0	1	2	32	0	6	81
Middle Silver Creek	0	0	0	0	32	0	0	3
West Fork Silver Creek	22	508	1	9	239	22	113	229
Subtotal Acres			9	268	1,521	27	596	1,726
Total Acres	**169**	**1,620**	**1,798**			**2,349**		

The project acres shown overlap with the acres of *identified* optimal black-backed woodpecker habitat.

Lewis' Woodpeckers

In this alternative, the tolerance level, or assurance of retaining habitat for Lewis' woodpeckers is reduced from an average of 46 percent to 38 percent across the landscape. Of the areas considered to be the most optimal *identified* habitat selected for Lewis' woodpeckers, 683 acres would be retained as unlogged leave areas distributed across the project area (see the following table).

The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington* are, where ecologically and socially appropriate, through natural events or management, to maintain greater than 50 percent of a post-fire landscape unsalvaged (Altman 2000). Under this alternative, including all acres in all mortality classes, 42 percent of the areas proposed for salvage would remain unlogged. In addition, 1,974 acres or 40 percent of the total acres that are greater than 50 percent mortality, with low to moderate canopy closure, and high to very high volume would remain unharvested (see the following table).

Table 3.64 Alternative C Total Acres of *Identified* Optimal Lewis' Woodpecker Habitat by Subshed and Acres of 11 to 40 Percent Canopy Closure and Greater Than 50 Percent Mortality in Ponderosa Pine or Ponderosa Pine-Dominated Mixed Conifer by Subshed

	***Identified* Optimal Lewis' Woodpecker Habitat by Subshed**		**Suitable Lewis' Woodpecker Habitat**	
Subshed	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**
Benny Creek	27	51	272	107
East Duncan Creek	18	109	99	154
Lower Duncan Creek	11	9	193	93
Thompson Reservoir	57	111	829	235
Upper Duncan Creek	64	163	511	344
Upper Silver Creek	17	41	177	122
Middle Silver Creek	1	38	158	49
West Fork Silver Creek	22	161	728	870
Total Acres	**217**	**683**	**2,967**	**1,974**

The project acres shown overlap with the acres of *identified* optimal Lewis' woodpecker habitat

Down Wood Dependent Species

Within all harvest units under this alternative, the snags alone, retained as described in Tables 3.51, 3.52, and 3.53, would equal a minimum of 0.70 down wood percent cover. Therefore it is estimated that:

1. Down wood levels would be slightly below 1.1 – 2.5 percent down wood cover within approximately 8,642 acres of harvest units that would receive site prep and fuels treatment. down wood levels would be a minimum of 0.70 percent down wood cover.
2. Down wood levels would be at or above 1.1 – 2.5 percent down wood cover on approximately 5,816 acres of harvest units that would not receive site prep and fuels reductions. Down wood levels would be a minimum of 0.70 percent down wood cover **plus** all snags less than 13 inches dbh.
3. Down wood levels would greatly exceed 1.1 – 2.5 percent down wood cover on approximately 10,637 acres that would receive no harvest.

Conclusion for Alternative C

Areas Less Than 50 Percent Mortality - Overall across the landscape, snag levels are likely well above estimated historical conditions and provide sufficient habitat for cavity dependent species. In addition, in the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase, even post salvage, as the beetles move into these areas.

Areas Greater Than 50 Percent Mortality:

- **Snag Dependent Species** - All action alternatives provide for cavity-nesting habitat in the short term. In the long term (10 to 30 years), snags are expected to fall and cavity-nesting habitat would not be available. This would result in a lower tolerance level or assurance for all cavity-nesting species as displayed in Table 3.62.

- **Black-backed Woodpecker** - Although the tolerance level for black-backed woodpeckers would be reduced, it is likely that sufficient habitat is being retained to provide for viable populations of black-backed woodpeckers under this alternative.
- **Lewis' Woodpecker** - Although this is the least desirable alternative for Lewis' woodpecker habitat, it is likely that sufficient habitat is being retained to provide for viable populations of Lewis' woodpeckers.
- **Down wood Dependent Species** - In the long term, down wood levels should exceed the levels recommended to meet estimated historical or "natural conditions" as developed with the data in DecAID of 1.1 – 2.5 percent cover *across the landscape,* and should greatly exceed LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2.

Table 3.65 Alternative C Summary of Harvest and No Harvest, Site Prep and Fuel Reduction (Felling of All Material Less Than 13 inches dbh) and Reforestation, Total Acres of *Identified* and Suitable Habitat and Tolerance Levels for Black-backed Woodpeckers and Lewis' Woodpeckers

Harvest and No Harvest			Site Prep and Fuel Reduction (Felling of All Material Less Than 13 inches dbh) and Reforestation		Total Acres of Identified and Suitable Habitat for Black-backed Woodpeckers and Lewis' Woodpeckers		
	Total Acres of Harvest	**Total Acres of No Harvest**		**Total Acres**		**Total Acres of Harvest**	**Total Acres of No Harvest**
<50% Mortality Low Elevation Ponderosa Pine	1,125	4,381	**Total acres** of harvest with site-prep and fuels reduction	8,642	**Total acres** of *identified* optimal black-backed woodpecker habitat	169	1,620
<50% Mortality High Elevation Ponderosa Pine	4,676		**Total acres** of harvest without site-prep and fuels reduction	5,816	**Total acres** of suitable black-backed woodpecker habitat	1,798	2,349
>50% Mortality	8,641	6,256	**Total acres** of site-prep in areas outside of harvest	4,301	**Total acres** of *identified* optimal Lewis' woodpecker habitat	217	683
Total	**14,442**	**10,637**	**Total acres** of reforestation	20,906	**Total acres** of suitable Lewis' woodpecker habitat	2,697	1,974

Tolerance Levels for Black-backed and Lewis' Woodpeckers		
	Existing Condition	**Alternative C**
Tolerance level for black-backed woodpeckers	41%	19%
Tolerance level for Lewis' woodpeckers	46%	38%

Although the tolerance level would be reduced for all cavity nesters including a reduction from 41 percent to 19 percent for black-backed woodpeckers and from 46 percent to 38 percent for Lewis' woodpeckers, it is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and therefore the tolerance levels overall would be lower. In addition, 91 percent of the *identified* optimal habitat and 57 percent of the total suitable habitat for black-backed woodpecker habitat would remain unharvested, and 76 percent of the *identified* optimal habitat and 40 percent of the total suitable habitat for Lewis' woodpeckers would remain unharvested. And overall, 42 percent of the project area would remain unharvested.

Based on the most recent science and information available in DecAID, habitat would be retained under this alternative to provide for viable populations of all cavity nesting and down wood dependent species. Snag retention was based on the

snag levels needed for cavity nesting species in: 1) green stand conditions (less than 50 percent mortality) based on the **inventory data and distribution data** available in DecAID, and 2) post-fire conditions (greater than 50 percent mortality) based on the **wildlife data** available in DecAID, most notably for black-backed woodpeckers and Lewis' woodpeckers. By taking the approach of managing for estimated historical or "natural conditions" in the green stands, and for both black-backed woodpeckers and Lewis' woodpecker that require the opposite extremes for snag densities and size requirements in the post-fire conditions, this alternative would likely provide habitat for the entire assemblage of woodpecker species.

Overall, snag levels across the landscape, including both harvest and unharvested areas, are well above LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2, and well above levels suggested by Agee (2002) and Harrod et al. (1998) for estimated historical levels. Within all harvest units or 58 percent of the project area, snags would be retained at an average of approximately 8.2 snags per acre, and 42 percent of the project area would remain unharvested and likely contain high levels of snags. In the areas that require site-prep and fuels reduction, use may be limited to the aerial insect feeders as the foraging habitat would largely be lost for the timber-drilling and bark gleaner woodpeckers. However, ample habitat should be provided within the unharvested areas and within the harvested areas that would not require site-prep in which all snags less than 13 inches dbh would be retained.

Alternative D

Areas Less Than 50 Percent Mortality

Under this alternative, harvest would occur on approximately 1,947 acres. Approximately 195 acres are low elevation ponderosa pine type in which an average of 2.9 snags per area would be retained within harvest units (see Table 3.51). Approximately 1,752 acres are high elevation ponderosa pine type in which an average of 6.1 snags per area would be retained within harvest units (see Table 3.52). Harvest would not occur on approximately 8,164 acres where snag levels are likely above estimated historical conditions.

Areas Greater Than 50 Percent Mortality

1. **Total acres greater than 50 percent mortality** = 14,897 acres
2. **No Harvest Acres**
    1. Total acres of greater than 50 percent mortality and low volume (L) = 1,552 acres
    2. Total acres of greater than 50 percent mortality and moderate volume (M) = 2,907 acres
    3. Total acres of greater than 50 percent mortality and high volume (H) = 4,116 acres
    4. Total acres of greater than 50 percent mortality and very high volume (VH) = 1,892 acres
3. **Total acres of Harvest greater than 50 percent mortality retaining 8 trees/acre 10 to 20" dbh and 2 trees/acre greater than 20" dbh =** 4430 acres.

Within harvest units, 30 percent tolerance level would be provided for Lewis' woodpeckers, mountain bluebirds, northern flickers, and western bluebirds.

Table 3.66 Alternative D Tolerance Level for Cavity Nesting Species Within the Project Area*

		Percent of Total Project Area at Less than 30% Tolerance Level	Percent of Total Project Area at the 30% Tolerance Level	Percent of Total Project Area at the 50% Tolerance Level	Percent of Total Project Area at the 80% Tolerance Level		Approximate Average Tolerance Level Across the Project Area
Black-backed Woodpecker		39%	20%	28%	13%		30%
Hairy Woodpecker		29%	10%	20%	41%		46%
Lewis' Woodpecker		0%	59%	28%	13%		42%
Mountain Bluebird		0%	87%	13%	0%		33%
Northern Flicker		0%	87%	13%	0%		32%

Table 3.66 Alternative D Tolerance Level for Cavity Nesting Species Within the Project Area* (continued)

		Percent of Total Project Area at Less than 30% Tolerance Level	Percent of Total Project Area at the 30% Tolerance Level	Percent of Total Project Area at the 50% Tolerance Level	Percent of Total Project Area at the 80% Tolerance Level		Approximate Average Tolerance Level Across the Project Area
Western Bluebird		0%	29%	30%	41%		57%
White-headed Woodpecker		29%	10%	20%	41%		46%

*The approximate tolerance levels are intended to be a comparative measure between alternatives. **It is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and therefore the tolerance levels overall would be lower.**

Snag Dependent Species

This alternative proposes to salvage 4,430 acres of dead material within the areas mapped as greater than 50 percent mortality. This would result in a lower tolerance level or assurance for all cavity-nesting species as displayed in the preceding table.

Due to safety (site prep for reforestation) and fuels hazard concerns, many acres of harvest would require the felling and treatment of fuels (all trees less than 13 inches dbh) through various methods, including lop and scatter, jackpot burning, crushing, etc. This treatment is proposed within approximately 4,776 acres of harvest units and would occur outside of designated snag clumps.

Approximately 1,598 acres of harvest units would not require this type of treatment within the first 3 to 4 years. The unmerchantable material would be retained providing ample amounts of foraging habitat around the snag clumps. These areas are expected to receive greater use overall by cavity-nesters than the areas that would receive site-prep and fuels reduction treatments. If site prep is required within these 1,598 acres, it would occur in year 4 or 5 when the snags have begun to fall and the foraging habitat is less effective.

Outside of the areas proposed for salvage, approximately 9,603 acres would require site prep. These areas can be described as areas that have received heavy amounts of past harvest and are now post and pole stands, or generally do not contain enough material to be considered an economically viable salvage area. Therefore, these areas likely contain low levels of cavity-nesting habitat. These areas are likely providing foraging habitat due to the smaller overall tree size. Within these areas, a 1-acre snag clump would be retained every 5 acres to retain some foraging habitat and continuity in snags, all snags outside of the leave clumps would likely be felled on approximately 1,500 acres in 2004, 3,000 acres in 2005, 2,500 acres in 2006, and 2,603 acres in 2007 and, therefore, would decrease foraging habitat for cavity nesting species. The areas receiving site prep in 2006 and 2007 would have a lesser effect because the small tree component that would provide the foraging habitat would have already begun to fall. Snag recruitment is foregone for many years until planted trees develop into functioning mature stands in which natural snag recruitment occurs. Planting of approximately 20,743 acres under this alternative would accelerate this process.

Black-backed Woodpeckers

For this alternative, the tolerance level, or assurance of retaining habitat for black-backed woodpeckers, is reduced from an average of 41 percent to 30 percent across the landscape. However, of the 12 areas considered to be the most optimal *identified* habitat selected for black-backed woodpeckers within the project area based on the following criteria: 1) areas of high canopy closure pre-fire ranging generally between 75 to 120 acres, and 2) high densities of smaller trees, at least part of all 12 areas are being retained under this alternative and would remain large enough that they would be effective habitat. Although the total amount of acres of *identified* optimal black-backed habitat is reduced from 1,789 acres to 1,712 acres, all 12 areas would still meet the criteria as described in the literature by Saab et al. (2002). Therefore, the majority of the most optimal *identified* habitat would be retained within the project area (see the following table).

In addition to the *identified* optimal habitat displayed in the following table, areas of high canopy closure within the project area may provide for limited black-backed woodpecker habitat within the project area. Although much of these acres do not meet the contiguous size as defined in the literature by Saab, et al. (2002), they likely do provide the high densities of

trees for which black-backed woodpeckers select (see the following table). Approximately 3,354 acres or 81 percent of areas would remain unharvested.

Table 3.67 Alternative D Total Acres of *Identified* Optimal Black-backed Woodpecker Habitat by Subshed and Acres with Greater Than 40 Percent Canopy closure and Greater Than 50 Percent Mortality by Subshed

	***Identified* Optimal Black-backed Woodpecker Habitat**		**Suitable Black-backed Woodpecker Habitat**					
Subshed	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**	**Total Acres Proposed for Harvest**			**Total Acres *Not* Proposed for Harvest**		
			>70% Canopy Closure	**56-70% Canopy Closure**	**40-56% Canopy closure**	**>70% Canopy Closure**	**56-70% Canopy Closure**	**40-56% Canopy closure**
Benny Creek	23	301	0	4	112	0	234	544
East Duncan Creek	0	5	0	27	79	0	103	131
Lower Duncan Creek	0	123	0	37	182	0	109	388
Thompson Reservoir	21	534	0	4	67	1	101	578
Upper Duncan Creek	11	239	6	26	80	4	89	471
Upper Silver Creek	0	0	0	0	19	1	8	96
Middle Silver Creek	0	0	0	0	0	0	0	36
West Fork Silver Creek	22	510	1	8	142	22	113	325
Subtotal			7	106	681	28	757	2,569
Total Acres	**77**	**1,712**	**794**			**3,354**		

The project acres shown overlap with the acres of *identified* optimal black-backed woodpecker habitat.

Lewis' Woodpeckers

In this alternative, the tolerance level, or assurance of retaining habitat for Lewis' woodpeckers is reduced from an average of 46 percent to 42 percent across the landscape. Of the areas considered to be the most optimal *identified* habitat selected for Lewis' woodpeckers within the project area, 770 acres would be retained as unlogged leave areas under this alternative distributed across the project area (see the following table).

The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington* are, where ecologically and socially appropriate, through natural events or management, to maintain greater than 50 percent of a post-fire landscape unsalvaged (Altman 2000). Under this alternative, including all acres in all mortality classes, 75 percent of the areas proposed for salvage would remain unlogged. In addition, 3,313 acres or 67 percent of the total acres that are greater than 50 percent mortality, with low to moderate canopy closure, and high to very high volume would remain unharvested (see the following table).

Table 3.68 Alternative D Total Acres of *Identified* Optimal Lewis' Woodpecker Habitat by Subshed and Acres with 11 to 40 Percent Canopy Closure and Greater Than 50 Percent Mortality in Ponderosa Pine or Ponderosa Pine-Dominated Mixed Conifer

	***Identified* Optimal Lewis' Woodpecker Habitat**		**Suitable Lewis' Woodpecker Habitat**	
Subshed	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**
Benny Creek	1	77	184	194
East Duncan Creek	0	127	50	203
Lower Duncan Creek	10	10	160	125
Thompson Reservoir	36	133	344	720
Upper Duncan Creek	51	176	364	490
Upper Silver Creek	13	46	49	249
Middle Silver Creek	1	38	46	161
West Fork Silver Creek	18	163	427	1,171
Total Acres	**130**	**770**	**1,624**	**3,313**

The project acres shown overlap with the acres of *identified* optimal Lewis' woodpecker habitat.

Down Wood Dependent Species

Within all harvest units under this alternative, the snags alone, retained as described in Tables 3.51, 3.52, and 3.53, would equal a minimum of 0.70 down wood percent cover. Therefore it is estimated that:

1. Down wood levels would be slightly below 1.1 – 2.5 percent down wood cover within approximately 4,776 acres of harvest units that would receive site-prep and fuels treatment. Down wood levels would be a minimum of 0.73 percent down wood cover.

2. Down wood levels would be at or above 1.1 – 2.5 percent down wood cover on approximately 1598 acres of harvest units would not receive site-prep and fuels reductions. Down wood levels would be a minimum of 0.73 percent down wood cover **plus** all snags less than 13 inches dbh.

3. Down wood levels would greatly exceed 1.1 – 2.5 percent down wood cover on approximately 18,631 acres that would receive no harvest.

Conclusion for Alternative D

Areas Less Than 50 Percent Mortality - Overall across the landscape, snag levels are likely well above estimated historical conditions and provide sufficient habitat for cavity dependent species. In addition, in the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase, even post salvage, as the beetles move into these areas.

Areas Greater Than 50 Percent Mortality:

- **Snag Dependent Species** - All action alternatives provide for cavity-nesting habitat in the short term. In the long term (10 to 30 years), snags are expected to fall and cavity-nesting habitat would not be available. This would result in a lower tolerance level or assurance for all cavity-nesting species as displayed in Table 3.66.

- **Black-backed Woodpecker** - Although the tolerance level for black-backed woodpeckers would be reduced, it is likely that sufficient habitat is being retained to provide for viable populations of black-backed woodpeckers under this alternative.

- **Lewis' Woodpecker** - Although this is the least desirable alternative for Lewis' woodpecker habitat, it is likely that sufficient habitat is being retained to provide for viable populations of Lewis' woodpeckers.

- **Down wood Dependent Species** - In the long term, down wood levels should exceed the levels recommended to meet estimated historical or "natural conditions" as developed with the data in DecAID of 1.1 – 2.5 percent cover *across the landscape,* and should greatly exceed LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2.

Table 3.69 Alternative D Summary of Harvest and No Harvest, Site Prep and Fuel Reduction (Felling of All Material Less Than 13 inches dbh) and Reforestation, Total Acres of *Identified* and Suitable Habitat and Tolerance Levels for Black-backed Woodpeckers and Lewis' Woodpeckers

Harvest and No Harvest			Site Prep and Fuel Reduction (Felling of All Material Less Than 13 inches dbh) and Reforestation		Total Acres of Identified and Suitable Habitat for Black-backed Woodpeckers and Lewis' Woodpeckers		
	Total Acres of Harvest	**Total Acres of No Harvest**		**Total Acres**		**Total Acres of Harvest**	**Total Acres of No Harvest**
<50% Mortality Low Elevation Ponderosa Pine	195	8,164	**Total acres** of harvest with site-prep and fuels reduction	4,776	**Total acres** of *identified* optimal black-backed woodpecker habitat	77	1,712
<50% Mortality High Elevation Ponderosa Pine	1,752		**Total acres** of harvest without site-prep and fuels reduction	1,598	**Total acres** of suitable black-backed woodpecker habitat	794	3,354
>50% Mortality	4,430	10,467	**Total acres** of site-prep in areas outside of harvest	9,603	**Total acres** of *identified* optimal Lewis' woodpecker habitat	130	770
Total	**6,377**	**18,631**	**Total acres** of reforestation	20,743	**Total acres** of suitable Lewis' woodpecker habitat	1,624	3,313

Tolerance Levels for Black-backed and Lewis' Woodpeckers		
	Existing Condition	**Alternative D**
Tolerance level for black-backed woodpeckers	41%	30%
Tolerance level for Lewis' woodpeckers	46%	42%

Although the tolerance level would be reduced for all cavity nesters, including a reduction from 41 percent to 30 percent for black-backed woodpeckers and from 46 percent to 42 percent for Lewis' woodpeckers, it is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and therefore the tolerance levels overall would be lower. Also, 96 percent of the *identified* optimal habitat and 81 percent of the total suitable habitat for black-backed woodpecker habitat would remain unharvested, and 86 percent of the *identified* optimal habitat and 67 percent of the total suitable habitat for Lewis' woodpeckers would remain unharvested. Overall, 75 percent of the project area would remain unharvested.

Based on the most recent science and information available in DecAID, habitat would be retained under this alternative to provide for viable populations of all cavity nesting and down wood dependent species. Snag retention was based on the snag levels needed for cavity nesting species in: 1) green stand conditions (less than 50 percent mortality) based on the **inventory data and distribution data** available in DecAID, and 2) post-fire conditions (greater than 50 percent mortality) based on the **wildlife data** available in DecAID most notably for black-backed woodpeckers and Lewis' woodpeckers. By taking the approach of managing for estimated historical or "natural conditions" in the green stands, and for both black-backed woodpeckers and Lewis' woodpecker that require the opposite extremes for snag densities and size requirements in the post-fire conditions, this alternative would likely provide habitat for the entire assemblage of woodpecker species.

Overall, snag levels across the landscape, including both harvest and unharvested areas, are well above LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2, and well above levels suggested by Agee (2002) and Harrod et al. (1998) for estimated historical levels. Within all harvest units or 25 percent of the project area, snags would be retained at an average of approximately 8.7 snags per acre, and 75 percent of the project area would remain unharvested and likely contain high levels of snags. In the areas that require site-prep and fuels reduction, use may be limited to the aerial insect feeders as the foraging habitat would largely be lost for the timber-drilling and bark gleaner woodpeckers. However, ample habitat should be provided within the unharvested areas and within the harvested areas that would not require site-prep in which all snags less than 13 inches dbh would be retained.

Alternative E

Areas Less Than 50 Percent Mortality

Under this alternative, harvest would occur on approximately 3,991 acres. Approximately 592 acres are low elevation ponderosa pine type in which an average of 2.9 snags per area would be retained within harvest units (see Table 3.51). Approximately 3,399 acres are high elevation ponderosa pine type in which an average of 6.1 snags per area would be retained within harvest units (see Table 3.52). Harvest would not occur on approximately 6169 acres where snag levels are likely above estimated historical conditions.

Areas Greater Than 50 Percent Mortality

1. **Total acres greater than 50 percent mortality** = 14,897 acres
2. **No Harvest Acres**
    1. Total acres of greater than 50 percent mortality and low volume (L) = 1,890 acres
    2. Total acres of greater than 50 percent mortality and moderate volume (M) = 1,519 acres
    3. Total acres of greater than 50 percent mortality and high volume (H) = 2,537 acres
    4. Total acres of greater than 50 percent mortality and very high volume (VH) = 1,448 acres
3. **Total acres of Harvest greater than 50 percent mortality retaining 8 trees/acre 10 to 20" dbh and 2 trees/acre greater than 20" dbh =** 7,503 acres.
   Within harvest units, 30 percent tolerance level would be provided for Lewis' woodpeckers, mountain bluebirds, northern flickers, and western bluebirds.

Table 3.70 Alternative E Tolerance Level for Cavity Nesting Species Within the Project Area*

		Percent of Total Project Area at Less than 30% Tolerance Level	Percent of Total Project Area at the 30% Tolerance Level	Percent of Total Project Area at the 50% Tolerance Level	Percent of Total Project Area at the 80% Tolerance Level		Approximate Average Tolerance Level Across the Project Area
Black-backed Woodpecker		63%	10%	17%	10%		20%
Hairy Woodpecker		50%	13%	10%	27%		69%
Lewis' Woodpecker		0%	73%	17%	10%		38%
Mountain Bluebird		0%	90%	10%	0%		32%
Northern Flicker		0%	90%	10%	0%		32%
Western Bluebird		0%	50%	23%	27%		48%
White-headed Woodpecker		50%	13%	10%	27%		31%

*The approximate tolerance levels are intended to be a comparative measure between alternatives. **It is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and therefore the tolerance levels overall would be lower.**

Snag Dependent Species

This alternative proposes to salvage 7,503 acres of dead material within the areas mapped as greater than 50 percent mortality. This would result in a lower tolerance level or assurance for all cavity-nesting species as displayed in the preceding table.

Due to safety (site prep for reforestation) and fuels hazard concerns, many acres of harvest would require the felling and treatment of fuels (all trees less than 13 inches dbh) through various methods, including lop and scatter, jackpot burning, crushing, etc. This treatment is proposed within approximately 5,759 acres of harvest units and would occur outside of designated snag clumps.

Approximately 5,734 acres of harvest units would not require this type of treatment within the first 3 to 4 years. The unmerchantable material would be retained providing ample amounts of foraging habitat around the snag clumps. These areas are expected to receive greater use overall by cavity-nesters than the areas that would receive site-prep and fuels reduction treatments. If site prep is required within these 5,734 acres, it would occur in year 4 or 5 when the snags have begun to fall and the foraging habitat is less effective.

Outside of the areas proposed for salvage, approximately 4,330 acres would require site prep. These areas can be described as areas that have received heavy amounts of past harvest and are now post and pole stands, or generally do not contain enough material to be considered an economically viable salvage area. Therefore, these areas likely contain low levels of cavity-nesting habitat. These areas are likely providing foraging habitat due to the smaller overall tree size. Within these areas, a 1-acre snag clump would be retained every 5 acres to retain some foraging habitat and continuity in snags, all snags outside of the leave clumps would likely be felled on approximately 1,000 acres in 2004, 1,530 acres in 2005, and 1,800 acres in 2006, and, therefore, would decrease foraging habitat for cavity nesting species. The areas receiving site prep in 2006 would have a lesser effect because the small tree component that would provide the foraging habitat would have already begun to fall.

Snag recruitment is foregone for many years until planted trees develop into functioning mature stands in which natural snag recruitment occurs. Planting of approximately 20,753 acres under this alternative would accelerate this process.

Black-backed Woodpeckers

Under this alternative, the tolerance level, or assurance of retaining habitat for black-backed woodpeckers is reduced from an average of 41 percent to 20 percent across the landscape. However, of the 12 areas considered to be the most optimal *identified* habitat selected for black-backed woodpeckers within the project area based on the following criteria: 1) areas of high canopy closure pre-fire ranging generally between 75 to 120 acres and 2) high densities of smaller trees, at least part of all twelve areas are being retained under this alternative and would remain large enough that they would be effective habitat. Although the total amount of acres of *identified* optimal black-backed habitat is reduced from 1,789 acres to 1,651 acres, all 12 areas would still meet the criteria as described in the literature by Saab et al. (2002). Therefore, the majority of the most optimal *identified* habitat would be retained within the project area (see the following table).

In addition to the *identified* optimal habitat listed in the following table, areas of high canopy closure within the project area may provide for limited black-backed woodpecker habitat within the project area. Although much of these acres do not meet the contiguous size as defined in the literature by Saab et al. (2002), they likely do provide the high densities of trees that black-backed woodpeckers select for (see the following table). Approximately 2,509 acres or 61 percent of these areas would remain unharvested.

Table 3.71 Alternative E Total Acres of *Identified* Optimal Black-backed Woodpecker Habitat by Subshed and Acres with Greater Than 40 Percent Canopy Closure and Greater Than 50 Percent Mortality by Subshed

	***Identified* Optimal Black-backed Woodpecker Habitat**		**Suitable Black-backed Woodpecker Habitat**					
Subshed	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**	**Total Acres Proposed for Harvest**			**Total Acres *Not* Proposed for Harvest**		
			>70% Canopy Closure	**56-70% Canopy Closure**	**40-56% Canopy closure**	**>70% Canopy Closure**	**56-70% Canopy Closure**	**40-56% Canopy closure**
Benny Creek	39	286	0	67	357	0	171	298
East Duncan Creek	0	5	0	59	151	0	72	60
Lower Duncan Creek	0	123	0	46	295	0	100	275
Thompson Reservoir	65	490	0	28	206	1	77	439
Upper Duncan Creek	13	238	7	28	95	4	86	457
Upper Silver Creek	0	0	1	2	33	0	6	81
Middle Silver Creek	0	0	0	0	32	0	0	3
West Fork Silver Creek	21	509	1	8	224	22	113	244
Subtotal			9	238	1,393	27	625	1,857
Total Acres	**138**	**1,651**	**1,640**			**2,509**		

The project acres shown overlap with the acres of *identified* optimal black-backed woodpecker habitat.

Lewis' Woodpeckers

In this alternative, the tolerance level, or assurance of retaining habitat for Lewis' woodpeckers is reduced from an average of 46 percent to 38 percent across the landscape. Of the areas considered to be the most optimal *identified* habitat selected for Lewis' woodpeckers within the project area, 697 acres would be retained as unlogged leave areas under this alternative distributed across the project area (see the following table).

The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington* are, where ecologically and socially appropriate, through natural events or management, to maintain greater than 50 percent of a post-fire landscape unsalvaged (Altman 2000). Under this alternative, including all acres in all mortality classes, 54 percent of the areas proposed for salvage would remain unlogged. In addition, 2,108 acres or 43 percent of the total acres that are greater than 50 percent mortality, with low to moderate canopy closure, and high to very high volume would remain unharvested (see the following table).

Table 3.72 Alternative E Total Acres of *Identified* Optimal Lewis' Woodpecker Habitat by Subshed and Acres with 11 to 40 Percent Canopy Closure and Greater Than 50 Percent Mortality in Ponderosa Pine or Ponderosa Pine-Dominated Mixed Conifer

	***Identified* Optimal Lewis' Woodpecker Habitat**		**Suitable Lewis' Woodpecker Habitat**	
Subshed	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**
Benny Creek	27	51	263	116
East Duncan Creek	18	110	91	161
Lower Duncan Creek	11	9	192	93
Thompson Reservoir	49	120	829	235
Upper Duncan Creek	60	167	445	409
Upper Silver Creek	17	41	148	150
Middle Silver Creek	1	38	158	49
West Fork Silver Creek	20	161	703	895
Total Acres	**203**	**697**	**2,829**	**2,108**

The project acres shown overlap with the acres of *identified* optimal Lewis' woodpecker habitat

Down Wood Dependent Species

Within all harvest units under this alternative, the snags alone, retained as described in Tables 3.51, 3.52, and 3.53, would equal a minimum of 0.72 down wood percent cover. Therefore it is estimated that:

1. Down wood levels would be slightly below 1.1 – 2.5 percent down wood cover within approximately 5,759 acres of harvest units that would receive site-prep and fuels treatment. Down wood levels would be a minimum of 0.72 percent down wood cover.

2. Down wood levels would be at or above 1.1 – 2.5 percent down wood cover on approximately 5,734 acres of harvest units would not receive site-prep and fuels reductions. Down wood levels would be a minimum of 0.72 percent down wood cover **plus** all snags less than 13 inches dbh.

3. Down wood levels would greatly exceed 1.1 – 2.5 percent down wood cover on approximately 13,563 acres that would receive no harvest.

Conclusion for Alternative E

Areas Less Than 50 Percent Mortality - Overall across the landscape, snag levels are likely well above estimated historical conditions and provide sufficient habitat for cavity dependent species. In addition, in the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase, even post salvage, as the beetles move into these areas.

Areas Greater Than 50 Percent Mortality:

- **Snag Dependent Species** - All action alternatives provide for cavity-nesting habitat in the short term. In the long term (10 to 30 years), snags are expected to fall and cavity-nesting habitat would not be available. This would result in a lower tolerance level or assurance for all cavity-nesting species as displayed in Table 3.70.

- **Black-backed Woodpecker** - Although the tolerance level for black-backed woodpeckers would be reduced, it is likely that sufficient habitat is being retained to provide for viable populations of black-backed woodpeckers under this alternative.

- **Lewis' Woodpecker** - Although this is the least desirable alternative for Lewis' woodpecker habitat, it is likely that sufficient habitat is being retained to provide for viable populations of Lewis' woodpeckers.

- **Down wood Dependent Species** - In the long term, down wood levels should exceed the levels recommended to meet estimated historical or "natural conditions" as developed with the data in DecAID of 1.1 – 2.5 percent cover *across the landscape,* and should greatly exceed LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2.

Table 3.73 Alternative E Summary of Harvest and No Harvest, Site Prep and Fuel Reduction (Felling of All Material Less Than 13 inches dbh) and Reforestation, Total Acres of *Identified* and Suitable Habitat and Tolerance Levels for Black-backed Woodpeckers and Lewis' Woodpeckers

Harvest and No Harvest			Site Prep and Fuel Reduction (Felling of All Material Less Than 13 inches dbh) and Reforestation		Total Acres of Identified and Suitable Habitat for Black-backed Woodpeckers and Lewis' Woodpeckers		
	Total Acres of Harvest	**Total Acres of No Harvest**		**Total Acres**		**Total Acres of Harvest**	**Total Acres of No Harvest**
<50% Mortality Low Elevation Ponderosa Pine	592	6,169	**Total acres** of harvest with site-prep and fuels reduction	5,759	**Total acres** of *identified* optimal black-backed woodpecker habitat	138	1,651
<50% Mortality High Elevation Ponderosa Pine	3,399		**Total acres** of harvest without site-prep and fuels reduction	5,734	**Total acres** of suitable black-backed woodpecker habitat	1,640	2,509
>50% Mortality	7,503	7,394	**Total acres** of site-prep in areas outside of harvest	4,330	**Total acres** of *identified* optimal Lewis' woodpecker habitat	203	697
Total	**11,494**	**13,563**	**Total acres** of reforestation	20,753	**Total acres** of suitable Lewis' woodpecker habitat	2,829	2,108

Tolerance Levels for Black-backed and Lewis' Woodpeckers		
	Existing Condition	**Alternative E**
Tolerance level for black-backed woodpeckers	41%	20%
Tolerance level for Lewis' woodpeckers	46%	38%

Although the tolerance level would be reduced for all cavity nesters, including a reduction from 41 percent to 20 percent for black-backed woodpeckers and from 46 percent to 38 percent for Lewis' woodpeckers, it is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and, therefore, the tolerance levels overall would be lower. Also, 92 percent of the *identified* optimal habitat and 61 percent of the total suitable habitat for black-backed woodpecker habitat would remain unharvested, and 77 percent of the *identified* optimal habitat and 43 percent of the total suitable habitat for Lewis' woodpeckers would remain unharvested. And overall, 54 percent of the project area would remain unharvested.

Based on the most recent science and information available in DecAID, habitat would be retained under this alternative to provide for viable populations of all cavity nesting and down wood dependent species. Snag retention was based on the snag levels needed for cavity nesting species in: 1) green stand conditions (less than 50 percent mortality) based on the inventory data and distribution data available in DecAID, and 2) post-fire conditions (greater than 50 percent mortality) based on the wildlife data available in DecAID, most notably for black-backed woodpeckers and Lewis' woodpeckers. By taking the approach of managing for estimated historical or "natural conditions" in the green stands, and for both black-backed woodpeckers and Lewis' woodpecker that require the opposite extremes for snag densities and size requirements in the post-fire conditions, this alternative would likely provide habitat for the entire assemblage of woodpecker species.

Overall, snag levels across the landscape, including both harvest and unharvested areas, are well above LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2, and well above levels suggested by Agee (2002) and Harrod et al. (1998) for estimated historical levels. Within all harvest units or 46 percent of the project area, snags would be retained at an average of approximately 8.5 snags per acre, and 54 percent of the project area would remain unharvested and likely contain high levels of snags. In the areas that require site-prep and fuels reduction, use may be limited to the aerial insect feeders as the foraging habitat would largely be lost for the timber-drilling and bark gleaner woodpeckers. However, ample habitat should be provided within the unharvested areas and within the harvested areas that would not require site-prep in which all snags less than 13 inches dbh would be retained.

Alternative G

Areas Less Than 50 Percent Mortality

Harvest would occur on approximately 5,795 acres. Approximately 1,123 acres are low elevation ponderosa pine type in which an average of 2.9 snags per area would be retained within harvest units (see Table 3.51). Approximately 4,672 acres are high elevation ponderosa pine type in which an average of 6.1 snags per area would be retained within harvest units (see Table 3.52). Harvest would not occur on approximately 4,387 acres where snag levels are likely above estimated historical conditions.

Areas Greater Than 50 Percent Mortality:

1. **Total Acres Greater Than 50 Percent Mortality** = 14,897 acres
2. **No Harvest Acres**
    1. Total acres of greater than 50 percent mortality and low volume (L) = 947 acres
    2. Total acres of greater than 50 percent mortality and moderate volume (M) = 1,481 acres
    3. Total acres of greater than 50 percent mortality and high volume (H) = 2,469 acres
    4. Total acres of greater than 50 percent mortality and very high volume (VH) = 1,375 acres
3. **Total acres of Harvest greater than 50 percent mortality retaining 8 trees/acre 10 to 20" dbh and 2 trees/acre greater than 20" dbh =** 8,625 acres.

Within harvest units, 30 percent tolerance level would be provided for Lewis' woodpeckers, mountain bluebirds, northern flickers, and western bluebirds.

Table 3.74 Alternative G Tolerance Level for Cavity Nesting Species Within the Project Area*

		Percent of Total Project Area at Less than 30% Tolerance Level	Percent of Total Project Area at the 30% Tolerance Level	Percent of Total Project Area at the 50% Tolerance Level	Percent of Total Project Area at the 80% Tolerance Level		Approximate Average Tolerance Level Across the Project Area
Black-backed Woodpecker		64%	10%	17%	9%		19%
Hairy Woodpecker		58%	6%	10%	26%		28%
Lewis' Woodpecker		0%	74%	17%	9%		38%
Mountain Bluebird		0%	91%	9%	0%		32%
Northern Flicker		0%	91%	9%	0%		32%
Western Bluebird		0%	58%	16%	26%		46%
White-headed Woodpecker		58%	6%	10%	26%		28%

*The approximate tolerance levels are intended to be a comparative measure between alternatives. **It is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and therefore the tolerance levels overall would be lower.**

Snag Dependent Species

This alternative proposes to salvage 8,625 acres of dead material within the areas mapped as greater than 50 percent mortality. This would result in a lower tolerance level or assurance for all cavity-nesting species as displayed in the preceding table.

Due to safety (site prep for reforestation) and fuels hazard concerns, many acres of harvest would require the felling and treatment of fuels (all trees less than 13 inches dbh) through various methods, including lop and scatter, jackpot burning, crushing, etc. This treatment is proposed within approximately 8,859 acres of harvest units and would occur outside of designated snag clumps. In addition, forested areas outside of harvest units that are within a ¼ mile of private land would receive fuels treatment in which all snags less than 9 inches dbh would be felled.

Approximately 5,569 acres of harvest units would not require this type of treatment within the first 3 to 4 years. The unmerchantable material would be retained providing ample amounts of foraging habitat around the snag clumps. These areas are expected to receive greater use overall by cavity-nesters than the areas that would receive site-prep and fuels reduction treatments. If site prep is required within these 5,569 acres, it would occur in year 4 or 5 when the snags have begun to fall and the foraging habitat is less effective.

Outside of the areas proposed for salvage, approximately 3,180acres would require site prep. These areas can be described as areas that have received heavy amounts of past harvest and are now post and pole stands, or generally do not contain enough material to be considered an economically viable salvage area. Therefore, these areas likely contain low levels of cavity-nesting habitat. These areas are likely providing foraging habitat due to the smaller overall tree size. Within these areas, a 1-acre snag clump would be retained every 5 acres to retain some foraging habitat and continuity in snags, all snags outside of the leave clumps would likely be felled in 2004 or 2005, and, therefore, would decrease foraging habitat for cavity nesting species.

Snag recruitment is foregone for many years until planted trees develop into functioning mature stands in which natural snag recruitment occurs. Planting of approximately 20,728 acres under this alternative would accelerate this process.

Black-backed Woodpeckers

Under this alternative, the tolerance level, or assurance of retaining habitat for black-backed woodpeckers, is reduced from an average of 41 percent to 19 percent across the landscape. Of the 12 areas considered to be the most optimal *identified* habitat selected for black-backed woodpeckers within the project area based on the following criteria: 1) areas of high canopy closure pre-fire ranging generally between 75 to 120 acres and 2) high densities of smaller trees, 5 areas (4 in the Silver Fire and 1 in the Toolbox Fire) would remain large enough that they would be effective habitat. This is due to the increased amount of fuels treatments proposed in Alternative G within ¼ mile of private land. Although the seven areas that do not meet the contiguous size that black-backed woodpeckers selected for in the research conducted by Saab et al. (2002) of 75 to 120 acres, they may still provide habitat for black-backed woodpeckers and they range in size from 16 to 60 acres. The total amount of acres of *identified* optimal black-backed habitat retained, regardless of size, is reduced from 1,789 acres to 1,218 acres (see the following table).

In addition to the *identified* optimal habitat listed in the table below, areas of high canopy closure within the project area may provide for limited black-backed woodpecker habitat within the project area. Although much of these acres do not meet the contiguous size as defined in the literature by Saab et al. (2002), they likely do provide the high densities of trees that black-backed woodpeckers select for (see the following table). Approximately 2,351 acres or 57 percent of these areas would remain unharvested.

Table 3.75 Alternative G Total Acres of *Identified* Optimal Black-backed Woodpecker Habitat by Subshed and Acres with Greater Than 40 Percent Canopy Closure and Greater Than 50 Percent Mortality by Subshed

	***Identified* Optimal Black-backed Woodpecker Habitat**		**Suitable Black-backed Woodpecker Habitat**					
Subshed	**Total Acres Proposed for Harvest and Fuels Treatment within ¼ mile Buffer of Private Land**	**Total Acres *Not* Proposed for Harvest**	**Total Acres Proposed for Harvest**			**Total Acres *Not* Proposed for Harvest**		
			>70% Canopy Closure	**56-70% Canopy Closure**	**40-56% Canopy closure**	**>70% Canopy Closure**	**56-70% Canopy Closure**	**40-56% Canopy closure**
Benny Creek	180	145	0	84	424	0	154	231
East Duncan Creek	5	0	0	60	153	0	71	58
Lower Duncan Creek	3	120	0	57	329	0	89	241
Thompson Reservoir	206	350	0	28	206	1	77	438
Upper Duncan Creek	155	95	7	28	107	4	86	445
Upper Silver Creek	0	0	1	2	33	0	6	81
Middle Silver Creek	0	0	0	0	32	0	0	3
West Fork Silver Creek	22	508	1	8	236	22	113	231
Subtotal			9	267	1,520	27	596	1,728
Total Acres	**571**	**1,218**	**1,796**			**2,351**		

The project acres shown overlap with the acres of *identified* optimal black-backed woodpecker habitat.

Lewis' Woodpeckers

In this alternative, the tolerance level, or assurance of retaining habitat for Lewis' woodpeckers is reduced from an average of 46 percent to 38 percent across the landscape. Of the areas considered to be the most optimal *identified* habitat selected for Lewis' woodpeckers within the project area, 684 acres would be retained as unlogged leave areas under this alternative distributed across the project area (see the following table). Fuel treatments proposed within ¼ mile of private land with identified Lewis' woodpecker areas would not have an effect on Lewis' woodpecker habitat.

The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington* are, where ecologically and socially appropriate, through natural events or management, to maintain greater than 50 percent of a post-fire landscape unsalvaged (Altman 2000). Under this alternative, including all acres in all mortality classes, 43 percent of the areas proposed for salvage would remain unlogged. In addition, 1,986 acres or 40 percent of the total acres that are greater than 50 percent mortality, with low to moderate canopy closure, and high to very high volume would remain unharvested (see the following table).

Table 3.76 Alternative G Total Acres of *Identified* Optimal Lewis' Woodpecker Habitat by Subshed and Acres with 11 to 40 Percent Canopy Closure and Greater Than 50 Percent Mortality in Ponderosa Pine or Ponderosa Pine Dominated Mixed Conifer

	***Identified* Optimal Lewis' Woodpecker Habitat**		**Suitable Lewis' Woodpecker Habitat**	
Subshed	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**
Benny Creek	25	53	272	107
East Duncan Creek	18	109	99	154
Lower Duncan Creek	11	9	193	92
Thompson Reservoir	57	111	829	235
Upper Duncan Creek	64	163	511	343
Upper Silver Creek	17	41	168	130
Middle Silver Creek	1	38	158	49
West Fork Silver Creek	23	160	722	876
Total Acres	**216**	**684**	**2,952**	**1,986**

The project acres shown overlap with the acres of *identified* optimal Lewis' woodpecker habitat.

Down Wood Dependent Species

Within all harvest units under this alternative, the snags alone, retained as described in Tables 3.51, 3.52, and 3.53, would equal a minimum of 0.70 down wood percent cover. Therefore it is estimated that:

1. Down wood levels would be slightly below 1.1 – 2.5 percent down wood cover within approximately 8,859 acres of harvest units that would receive site-prep and fuels treatment. Down wood levels would be a minimum of 0.70 percent down wood cover.

2. Down wood levels would be at or above 1.1 – 2.5 percent down wood cover on approximately 5,569 acres of harvest units would not receive site-prep and fuels reductions. Down wood levels would be a minimum of 0.70 percent down wood cover **plus** all snags less than 13 inches dbh.

3. Down wood levels would likely be slightly below or at 1.1 – 2.5 percent down wood cover on approximately 5,596 acres where fuels treatment is proposed within ¼ mile of private land. Only dead material less than 9 inches dbh would be treated and all material greater than 9 inches dbh would remain.

4. Down wood levels would greatly exceed 1.1 – 2.5 percent down wood cover on approximately 10,659 acres that would receive no harvest.

Conclusion for Alternative G

Areas Less Than 50 Percent Mortality - Overall across the landscape, snag levels are likely well above estimated historical conditions and provide sufficient habitat for cavity dependent species. In addition, in the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase, even post salvage, as the beetles move into these areas.

Areas Greater Than 50 Percent Mortality:

- **Snag Dependent Species** - All action alternatives provide for cavity-nesting habitat in the short term. In the long term (10 to 30 years), snags are expected to fall and cavity-nesting habitat would not be available. This would result in a lower tolerance level or assurance for all cavity-nesting species as displayed in Table 3.74.

- **Black-backed Woodpecker** - Although this is the least desirable alternative for black-backed woodpecker habitat, it is likely that sufficient habitat is being retained to provide for viable populations of black-backed woodpeckers.

- **Lewis' Woodpecker** - Although this is the least desirable alternative for Lewis' woodpecker habitat, it is likely that sufficient habitat is being retained to provide for viable populations of Lewis' woodpeckers.
- **Down wood Dependent Species** - In the long term, down wood levels should exceed the levels recommended to meet estimated historical or "natural conditions" as developed with the data in DecAID of 1.1 – 2.5 percent cover *across the landscape,* and should greatly exceed LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2.

Table 3.77 Alternative G Summary of Harvest and No Harvest, Site Prep and Fuel Reduction (Felling of All Material Less Than 13 inches dbh) and Reforestation, Total Acres of *Identified* and Suitable Habitat and Tolerance Levels for Black-backed Woodpeckers and Lewis' Woodpeckers

Harvest and No Harvest			Site Prep and Fuel Reduction (Felling of All Material Less Than 13 inches dbh) and Reforestation		Total Acres of Identified and Suitable Habitat for Black-backed Woodpeckers and Lewis' Woodpeckers		
	Total Acres of Harvest	**Total Acres of No Harvest**		**Total Acres**		**Total Acres of Harvest**	**Total Acres of No Harvest**
<50% Mortality Low Elevation Ponderosa Pine	1,123	4,387	**Total acres** of harvest with site-prep and fuels reduction	8,859	**Total acres** of *identified* optimal black-backed woodpecker habitat	571	1,218
<50% Mortality High Elevation Ponderosa Pine	4,672		**Total acres** of harvest without site-prep and fuels reduction	5,569	**Total acres** of suitable black-backed woodpecker habitat	1,796	2,351
>50% Mortality	8,625	6,272	**Total acres** of site-prep in areas outside of harvest	3,180	**Total acres** of *identified* optimal Lewis' woodpecker habitat	216	684
Total	**14,420**	**10,659**	**Total acres** of reforestation	20,728	**Total acres** of suitable Lewis' woodpecker habitat	2,592	1,986

Tolerance Levels for Black-backed and Lewis' Woodpeckers		
	Existing Condition	**Alternative G**
Tolerance level for black-backed woodpeckers	41%	19%
Tolerance level for Lewis' woodpeckers	46%	38%

Although the tolerance level would be reduced for all cavity nesters, including a reduction from 41 percent to 19 percent for black-backed woodpeckers and from 46 percent to 38 percent for Lewis' woodpeckers, it is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and, therefore, the tolerance levels overall would be lower. Also, 68 percent of the *identified* optimal habitat and 57 percent of the total suitable habitat for black-backed woodpecker habitat would remain unharvested, and 76 percent of the *identified* optimal habitat and 40 percent of the total suitable habitat for Lewis' woodpeckers would remain unharvested. Overall, 43 percent of the project area would remain unharvested.

Based on the most recent science and information available in DecAID, habitat would be retained under this alternative to provide for viable populations of all cavity nesting and down wood dependent species. Snag retention was based on the snag levels needed for cavity nesting species in: 1) green stand conditions (less than 50 percent mortality) based on the **inventory data and distribution data** available in DecAID, and 2) post-fire conditions (greater than 50 percent mortality) based on the **wildlife data** available in DecAID most notably for black-backed woodpeckers and Lewis' woodpeckers. By

taking the approach of managing for estimated historical or "natural conditions" in the green stands, and for both black-backed woodpeckers and Lewis' woodpecker that require the opposite extremes for snag densities and size requirements in the post-fire conditions, this alternative would likely provide habitat for the entire assemblage of woodpecker species.

Overall, snag levels across the landscape including both harvest and unharvested areas, are well above LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2, and well above levels suggested by Agee (2002) and Harrod et al. (1998) for estimated historical levels. Within all harvest units or 57 percent of the project area, snags would be retained at an average of approximately 8.2 snags per acre, and 43 percent of the project area would remain unharvested and likely contain high levels of snags. In the areas that require site-prep and fuels reduction, use may be limited to the aerial insect feeders as the foraging habitat would largely be lost for the timber-drilling and bark gleaner woodpeckers, however ample habitat should be provided within the unharvested areas and within harvested the areas that would not require site-prep in which all snags less than 13 inches dbh would be retained.

Alternative H

Areas Less Than 50 Percent Mortality

Harvest would occur on approximately 5,198 acres. Approximately 966 acres are low elevation ponderosa pine type in which an average of 2.9 snags per area would be retained within harvest units (see Table 3.51). Approximately 4,232 acres are high elevation ponderosa pine type in which an average of 6.1 snags per area would be retained within harvest units (see Table 3.52). Harvest would not occur on approximately 4,949 acres where snag levels are likely above estimated historical conditions.

Areas Greater Than 50 Percent Mortality

1. **Total acres Greater Than 50 Percent Mortality** = 14,897 acres
2. **No Harvest Acres**
    1. Total acres of greater than 50 percent mortality and low volume (L) = 986 acres
    2. Total acres of greater than 50 percent mortality and moderate volume (M) = 1,550 acres
    3. Total acres of greater than 50 percent mortality and high volume (H) = 2,886 acres
    4. Total acres of greater than 50 percent mortality and very high volume (VH) = 1,658 acres
3. **Total acres of Harvest greater than 50 percent mortality retaining 8 trees/acre 10 to 20" dbh and 2 trees/acre greater than 20" dbh =** 7,817 acres.

Within harvest units, 30 percent tolerance level would be provided for Lewis' woodpeckers, mountain bluebirds, northern flickers, and western bluebirds.

Table 3.78 Alternative H Tolerance Level for Cavity Nesting Species Within the Project Area*

		Percent of Total Project Area at Less than 30% Tolerance Level	Percent of Total Project Area at the 30% Tolerance Level	Percent of Total Project Area at the 50% Tolerance Level	Percent of Total Project Area at the 80% Tolerance Level		Approximate Average Tolerance Level Across the Project Area
Black-backed Woodpecker		60%	10%	19%	11%		21%
Hairy Woodpecker		53%	7%	10%	30%		31%
Lewis' Woodpecker		0%	70%	19%	11%		39%
Mountain Bluebird		0%	89%	11%	0%		32%
Northern Flicker		0%	89%	11%	0%		32%

Table 3.78 Alternative H Tolerance Level for Cavity Nesting Species Within the Project Area* (continued)

		Percent of Total Project Area at Less than 30% Tolerance Level	Percent of Total Project Area at the 30% Tolerance Level	Percent of Total Project Area at the 50% Tolerance Level	Percent of Total Project Area at the 80% Tolerance Level		Approximate Average Tolerance Level Across the Project Area
Western Bluebird		0%	53%	17%	30%		48%
White-headed Woodpecker		53%	7%	10%	30%		31%

*The approximate tolerance levels are intended to be a comparative measure between alternatives. **It is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and therefore the tolerance levels overall would be lower.**

Snag Dependent Species

This alternative proposes to salvage 7,817 acres of dead material within the areas mapped as greater than 50 percent mortality. This would result in a lower tolerance level or assurance for all cavity-nesting species as displayed in the preceding table.

Due to safety (site prep for reforestation) and fuels hazard concerns, many acres of harvest would require the felling and treatment of fuels (all trees less than 13 inches dbh) through various methods, including lop and scatter, jackpot burning, crushing, etc. This treatment is proposed within approximately 7,535 acres of harvest units and would occur outside of designated snag clumps.

Approximately 6,885 acres of harvest units would not require this type of treatment within the first 3 to 4 years. The unmerchantable material would be retained providing ample amounts of foraging habitat around the snag clumps. These areas are expected to receive greater use overall by cavity-nesters than the areas that would receive site-prep and fuels reduction treatments. If site prep is required within these 6,885 acres, it would occur in year 4 or 5 when the snags have begun to fall and the foraging habitat is less effective.

Outside of the areas proposed for salvage, approximately 4,295 acres would require site prep. These areas can be described as areas that have received heavy amounts of past harvest and are now post and pole stands, or generally do not contain enough material to be considered an economically viable salvage area. Therefore, these areas likely contain low levels of cavity-nesting habitat. These areas are likely providing foraging habitat due to the smaller overall tree size. Within these areas, a 1-acre snag clump would be retained every 5 acres to retain some foraging habitat and continuity in snags, all snags outside of the leave clumps would likely be felled on approximately 1,000 acres in 2004, 2,295 acres in 2005, and 1,000 acres in 2006, and, therefore, would decrease foraging habitat for cavity nesting species. The areas receiving site prep in 2006 would have a lesser effect because the small tree component that would provide the foraging habitat would have already begun to fall.

Snag recruitment is foregone for many years until planted trees develop into functioning mature stands in which natural snag recruitment occurs. Planting of approximately 20,906 acres under this alternative would accelerate this process.

Black-backed Woodpeckers

For this alternative, the tolerance level, or assurance of retaining habitat, for black-backed woodpeckers is reduced from an average of 41 percent to 21 percent across the landscape. However, of the 12 areas considered to be the most optimal *identified* habitat selected for black-backed woodpeckers within the project area based on the following criteria: 1) areas of high canopy closure pre-fire ranging generally between 75 to 120 acres and 2) high densities of smaller trees, at least part of all twelve areas are being retained under this alternative and would remain large enough that they would be effective habitat. Although the total amount of acres of *identified* optimal black-backed habitat is reduced from 1,789 acres to 1,699 acres, all 12 areas would still meet the criteria as described in the literature by Saab et al. (2002). Therefore, the majority of the most optimal *identified* habitat would be retained within the project area (see the following table).

In addition to the identified optimal habitat listed in the following table, areas of high canopy closure within the project area may provide for limited black-backed woodpecker habitat within the project area. Although much of these acres do not

meet the contiguous size as defined in the literature by Saab et al. (2002), they likely do provide the high densities of trees that black-backed woodpeckers select for (see the following table). Approximately 2,579 acres or 62 percent of these areas would remain unharvested.

In the first year after the fire (2003), no logging would occur and all potential existing habitat would be available for black-backed nesting and foraging. After the beetle population decreases in the high severity stands in 2 to 4 years, it is expected that the beetles would begin to enter the low to moderate severity stands, and black-backed woodpeckers would follow the foraging source. The 7,817 acres of harvest within the greater than 50 percent mortality category would likely not provide nesting habitat for black-backed woodpeckers.

Table 3.79 Alternative H Total Acres of *Identified* Optimal Black-backed Woodpecker Habitat by Subshed and Acres with Greater Than 40 Percent Canopy Closure and Greater Than 50 Percent Mortality by Subshed

	***Identified* Optimal Black-backed Woodpecker Habitat**		**Suitable Black-backed Woodpecker Habitat**					
Subshed	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**	**Total Acres Proposed for Harvest**			**Total Acres *Not* Proposed for Harvest**		
			>70% Canopy Closure	**56-70% Canopy Closure**	**40-56% Canopy closure**	**>70% Canopy Closure**	**56-70% Canopy Closure**	**40-56% Canopy closure**
Benny Creek	24	301	0	80	408	0	158	247
East Duncan Creek	0	5	0	57	148	0	73	62
Lower Duncan Creek	0	123	0	51	197	0	96	373
Thompson Reservoir	33	523	0	29	187	1	77	457
Upper Duncan Creek	11	239	6	25	86	4	89	465
Upper Silver Creek	0	0	1	2	18	0	6	97
Middle Silver Creek	0	0	0	0	32	0	0	3
West Fork Silver Creek	22	508	1	9	231	22	113	236
Subtotal			8	253	1,307	27	612	1,940
Total Acres	**90**	**1,699**	**1,568**			**2,579**		

The project acres shown overlap with the acres of *identified* optimal black-backed woodpecker habitat.

Lewis' Woodpeckers

In this alternative, the tolerance level, or assurance of retaining habitat for Lewis' woodpeckers is reduced from an average of 46 percent to 39 percent across the landscape. Lewis's woodpeckers are most abundant in partially logged burned forests and relatively rare in unlogged units of western Idaho (Saab and Dudley 1998). Within the harvest units greater than 50 percent mortality, snags would be retained at the 30 percent tolerance level or assurance for Lewis' woodpeckers and should provide for suitable nesting habitat. Of the areas considered to be the most optimal *identified* habitat selected for Lewis' woodpeckers within the project area, 785 acres would be retained as unlogged leave areas under this alternative distributed across the project area (see the following table). Fuel treatments proposed within ¼ mile of private land with identified Lewis' woodpecker areas would not have an effect on Lewis' woodpecker habitat.

The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington* are, where ecologically and socially appropriate, through natural events or management, to maintain greater than 50 percent of a post-fire landscape unsalvaged (Altman 2000). Under this alternative, including all acres in all mortality classes, 48 percent of the areas proposed for salvage would remain unlogged. In addition, 2,348 acres or 48 percent of the total acres that are greater than 50 percent mortality, with low to moderate canopy closure, and high to very high volume would remain unharvested (see the following table).

Table 3.80 Alternative H Total Acres of *Identified* Optimal Lewis' Woodpecker Habitat by Subshed and Acres with 11 to 40 Percent Canopy Closure and Greater Than 50 Percent Mortality in Ponderosa Pine or Ponderosa Pine Dominated Mixed Conifer

	***Identified* Optimal Lewis' Woodpecker Habitat**		**Suitable Lewis' Woodpecker Habitat**	
Subshed	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**	**Total Acres Proposed for Harvest**	**Total Acres *Not* Proposed for Harvest**
Benny Creek	27	51	252	127
East Duncan Creek	3	124	65	188
Lower Duncan Creek	0	20	60	225
Thompson Reservoir	29	140	802	262
Upper Duncan Creek	33	193	407	447
Upper Silver Creek	5	53	168	130
Middle Silver Creek	1	38	154	53
West Fork Silver Creek	17	166	682	916
Total Acres	**115**	**785**	**2,590**	**2,348**

The project acres shown overlap with the acres of *identified* optimal Lewis' woodpecker habitat.

Down Wood Dependent Species

Within all harvest units under this alternative, the snags alone, retained as described in Tables 3.51, 3.52, and 3.53, would equal a minimum of 0.70 down wood percent cover. Therefore it is estimated that:

1. Down wood levels would be slightly below 1.1 – 2.5 percent down wood cover within approximately 7,535 acres of harvest units that would receive site-prep and fuels treatment. Down wood levels would be a minimum of 0.70 percent down wood cover.

2. Down wood levels would be at or above 1.1 – 2.5 percent down wood cover on approximately 6,885 acres of harvest units would not receive site-prep and fuels reductions. Down wood levels would be a minimum of 0.70 percent down wood cover **plus** all snags less than 13 inches dbh.

3. Down wood levels would greatly exceed 1.1 – 2.5 percent down wood cover on approximately 12,029 acres that would receive no harvest.

Conclusion for Alternative H

Areas Less Than 50 Percent Mortality - Overall across the landscape, snag levels are likely well above estimated historical conditions and provide sufficient habitat for cavity dependent species. In addition, in the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase, even post salvage, as the beetles move into these areas.

Areas Greater Than 50 Percent Mortality:

- **Snag Dependent Species** - All action alternatives provide for cavity-nesting habitat in the short term. In the long term (10 to 30 years), snags are expected to fall and cavity-nesting habitat would not be available. This would result in a lower tolerance level or assurance for all cavity-nesting species as displayed in Table 3.78.

- **Black-backed Woodpecker** - Although the tolerance level for black-backed woodpeckers would be reduced, it is likely that sufficient habitat is being retained to provide for viable populations of black-backed woodpeckers under this alternative.

- **Lewis' Woodpecker** - There is a very high assurance that sufficient habitat is being retained to provide for viable populations of Lewis' woodpeckers.

- **Down wood Dependent Species** - In the long term, down wood levels should exceed the levels recommended to meet estimated historical or "natural conditions" as developed with the data in DecAID of 1.1 – 2.5 percent cover *across the landscape,* and should greatly exceed LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2.

Table 3.81 Alternative H Summary of Harvest and No Harvest, Site Prep and Fuel Reduction (Felling of All Material Less Than 13 inches dbh) and Reforestation, Total Acres of *Identified* and Suitable Habitat and Tolerance Levels for Black-backed Woodpeckers and Lewis' Woodpeckers

Harvest and No Harvest			Site Prep and Fuel Reduction (Felling of All Material Less Than 13 inches dbh) and Reforestation		Total Acres of Identified and Suitable Habitat for Black-backed Woodpeckers and Lewis' Woodpeckers		
	Total Acres of Harvest	**Total Acres of No Harvest**		**Total Acres**		**Total Acres of Harvest**	**Total Acres of No Harvest**
<50% Mortality Low Elevation Ponderosa Pine	966	4,949	**Total acres** of harvest with site-prep and fuels reduction	7,535	**Total acres** of *identified* optimal black-backed woodpecker habitat	90	1,699
<50% Mortality High Elevation Ponderosa Pine	4,232		**Total acres** of harvest without site-prep and fuels reduction	6,885	**Total acres** of suitable black-backed woodpecker habitat	1,568	2,579
>50% Mortality	7,817	7,080	**Total acres** of site-prep in areas outside of harvest	4,295	**Total acres** of *identified* optimal Lewis' woodpecker habitat	115	785
Total	**13,015**	**12,029**	**Total acres** of reforestation	20,906	**Total acres** of suitable Lewis' woodpecker habitat	2,590	2,348

Tolerance Levels for Black-backed and Lewis' Woodpeckers		
	Existing Condition	**Alternative H**
Tolerance level for black-backed woodpeckers	41%	21%
Tolerance level for Lewis' woodpeckers	46%	39%

Although the tolerance level would be reduced for all cavity nesters, including a reduction from 41 percent to 21 percent for black-backed woodpeckers and from 46 percent to 39 percent for Lewis' woodpeckers, it is important to consider that on the Silver Lake Ranger District, the ponderosa pine communities are generally drier sites with lower stand densities. Therefore, the tolerance levels and respective snag densities may not be the same as what the species were selecting for in Idaho where the research was conducted. It is expected that, locally, cavity-nesters may select for areas with lower snags densities than what was selected for in Idaho, and, therefore, the tolerance levels overall would be lower. Also, 95 percent of the *identified* optimal habitat and 62 percent of the total suitable habitat for black-backed woodpecker habitat would remain unharvested, and 87 percent of the *identified* optimal habitat and 48 percent of the total suitable habitat for Lewis' woodpeckers would remain unharvested. Overall,, 48 percent of the project area would remain unharvested.

Based on the most recent science and information available in DecAID, habitat would be retained under this alternative to provide for viable populations of all cavity nesting and down wood dependent species. Snag retention was based on the snag levels needed for cavity nesting species in: 1) green stand conditions (less than 50 percent mortality) based on the **inventory data and distribution data** available in DecAID, and 2) post-fire conditions (greater than 50 percent mortality) based on the **wildlife data** available in DecAID most notably for black-backed woodpeckers and Lewis' woodpeckers. By taking the approach of managing for estimated historical or "natural conditions" in the green stands, and for both black-backed woodpeckers and Lewis' woodpecker that require the opposite extremes for snag densities and size requirements in the post-fire conditions, this alternative would likely provide habitat for the entire assemblage of woodpecker species.

Overall, snag levels across the landscape including both harvest and unharvested areas, are well above LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2, and well above levels suggested by Agee (2002) and Harrod et al. (1998) for estimated historical levels. Within all harvest units, or 52 percent of the project area, snags would be retained at an average of approximately 8.0 snags per acre, and 48 percent of the project area would remain unharvested and likely contain high levels of snags. In the areas that require site-prep and fuels reduction, use may be limited to the aerial insect feeders as the foraging habitat would largely be lost for the timber-drilling and bark gleaner woodpeckers. However, ample habitat should be provided within the unharvested areas and within the harvested areas that would not require site-prep in which all snags less than 13 inches dbh would be retained.

Mitigation Measures

Mitigation measures that apply to snag dependent and down wood dependent species can be found in Chapter 2, Mitigation and Resource Protection Measures – Wildlife.

Cumulative Effects Common to All Alternatives for Snag Dependent Species, Black-backed Woodpeckers, Lewis' Woodpeckers, and Down Wood Dependent Species

All of the activities in Appendix A have been considered for their cumulative effects on snag dependent species, black-backed woodpeckers, Lewis' woodpecker, and down wood dependent species, and the following activities have the potential to produce a cumulative effect. Due to past harvest management, including roadside hazard, fire suppression, snag and down wood removal, and overstory removal, snag and down wood numbers have declined from pre-fire historical levels. Excavators associated with open late/old ponderosa pine and wildlife associated with high levels of down wood have likely experienced a decline in habitat suitability, bird distribution, and populations. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, and fire suppression, as described in Table A-1 of Appendix A, have changed overall stand conditions on National Forest System and private lands, resulting in the forest succession from an open pine forest to a dense mixed conifer dominated forest, and from the direct removal of snag and down wood habitat. Although higher stocking levels may be creating more snags through competition and insects, the overall loss of snags through harvest has resulted in lower than historical levels. However, this condition has lead to stand replacement fires with high stand densities preferred by black-backed woodpeckers.

Prescribed fire has also likely increased snag levels locally with individual snag creation and small 1 to 10 acre patches of heavy fire mortality and understory thinning through fire has likely increased foraging habitat for black-backed woodpeckers. Wildfires, as displayed in Table A-1 of Appendix A, have increased snag numbers in the short term. However, for the most part, past wildfires have experienced some level of salvage, which minimizes the amount of future down wood, and with little retention of suitable habitat required by black-backed woodpeckers. Lewis' woodpecker populations have experienced an increase in salvage snag habitat. The snag felling involved in the 2002 suppression activities, as displayed in Table A-1 of Appendix A, involved the felling of approximately 300 to 400 trees, which reduced snag levels, but increased down wood levels slightly. Road developments, as displayed in Table A-6 of Appendix A, have had an influence in snag levels by increasing the amount of area considered to be a hazard resulting in the felling and harvest of road-side hazard snags. Personal use firewood cutting, as displayed in Table A-12 of Appendix A, have decreased snag and down wood levels across the District. The salvage on BLM land, as displayed in Table A-15 of Appendix A, is so small in comparison to the fire that there is likely no cumulative impact.

The Winter Fire is directly adjacent to the Toolbox and Silver Fires to the east. This fire was approximately 34,000 acres and currently only approximately 3,000 acres are proposed for salvage harvest. This fire is a mix of conditions including forested, unforested, and plantations. Within the forested conditions and outside of the areas proposed for salvage, ample amounts of snags are available for cavity dependent species habitat and would result in heavy down wood loading in the future. The area includes a mix of snag densities and sizes classes required by cavity-dependent and down wood dependent species. Within the 3000 acres proposed for salvage, snag retention guidelines would assure the retention of snags to meet cavity dependent species habitat and assure the retention of down wood habitat in the future as snags fall. This would include approximately 160 acres for black-backed woodpeckers and 140 acres for Lewis' woodpeckers. In addition, approximately 1,500 acres of the Toolbox and Silver Fires located in the Bridge Creek and Ana Reservoir Subshed would not be proposed for salvage and would provide additional habitat for cavity dependent and down wood dependent species.

Current trends indicate that snag and down wood numbers are increasing due to reduced harvest of snags and increased required levels in the Regional Forester's Amendment #2 Standards and Guidelines. Activities that are expected to be implemented in the Bridge Creek Subshed, including prescribed fire and silvicultural treatments designed to promote the

development of LOS habitat with a snag and down wood component and those activities displayed in Table A-16 of Appendix A including prescribed fire and thinning, are expected to improve habitat for cavity dependent and down wood dependent species. Prescribed fire is expected to increase replacement snag and down wood numbers, create understory foraging habitat, and reduce the fuel loading, thereby protecting stands from wildfire.

Due to the uncertainty of disturbance and what kinds of activities would result from future disturbance, it is unknown how black-backed woodpeckers populations would cumulatively be affected over time. Fire suppression continues to intensify and intensive salvage logging continues to occur following fires, local and regional black-backed woodpecker populations may consequently decline (Murphy and Lenhausen 1998; Johnson and O'Neil 2001). However, ample amounts of black-backed woodpecker habitat would be available in the short term that would assure population viability.

In conclusion, considering all cumulative activities, snags and down wood would be retained at levels assumed to meet Standards and Guidelines, as amended by the Regional Forester's Amendment #2, in the short term, under all alternatives. Snags and down wood would also be retained at levels assumed to support viable populations of cavity nesting and down wood dependent species under all alternatives. Alternative A provides the greatest opportunity of maintaining snags in the long term (15 or more years), and this opportunity becomes less likely, respectively, with Alternatives D, E, H, C, and G. For black-backed woodpeckers, Alternative A provides the greatest opportunity of habitat (tolerance level = 41 percent), and this opportunity becomes less likely, respectively, with Alternative D (tolerance level = 30 percent), H (tolerance level = 21 percent), E (tolerance level = 20 percent), C (tolerance level = 19 percent), and G (tolerance level = 19 percent). For Lewis' woodpeckers, Alternative A provides the greatest opportunity of habitat in the long term (tolerance level = 46 percent), and this opportunity becomes less likely, respectively, with Alternative D (tolerance level = 42 percent), H (tolerance level = 39 percent), E (tolerance level = 38 percent), G (tolerance level = 38 percent), and C (tolerance level = 38 percent). Virtually all burned trees are expected to fall in the next 30 years, resulting in an abundance of down wood habitat and a shortage of snags (Gobar 1996). Once the majority of snags fall and the beetle population declines, snag dependent species, black-backed woodpeckers, Lewis' woodpeckers, and down wood dependent species would not likely occupy the area.

Black-backed Woodpeckers

Refer to the Snag and Down Wood Dependent Species discussion under Fremont National Forest Management Indicator Species in this Wildlife section..

Threatened, Endangered, and Sensitive Species

The Endangered species Act requires National Forests to manage for the recovery of threatened and endangered species (as identified by the U.S. Fish and Wildlife Service) and the ecosystems upon which they depend. In addition, the Regional Forester has identified sensitive species for each National Forest, where species viability may be a concern. The following table displays the federal and regional listings.

Table 3.82 Threatened, Endangered, and Sensitive Species

Threatened, Endangered, and Sensitive Species	Representative of:	Page Number
Bald Eagle	Federally Listed Threatened Species	3-183
Canada Lynx	Federally Listed Threatened Species	3-185
Oregon Spotted Frog	Federally Listed Candidate Species R6 Sensitive Species List	3-186
Yellow-Billed Cuckoo	Federally Listed Candidate Species	3-187
Horned Grebe	R6 Sensitive Species List	3-187

Table 3.82 Threatened, Endangered, and Sensitive Species (continued)

Threatened, Endangered, and Sensitive Species	Representative of:	Page Number
Red-necked Grebe	R6 Sensitive Species List	3-188
Least Bittern	R6 Sensitive Species List	3-188
Bufflehead	R6 Sensitive Species List	3-188
Peregrine Falcon	R6 Sensitive Species List	3-189
Western Sage Grouse	R6 Sensitive Species List	3-191
Yellow Rail	R6 Sensitive Species List	3-192
Upland Sandpiper	R6 Sensitive Species List	3-192
Gray Flycatcher	R6 Sensitive Species List	3-193
Tricolored Blackbird	R6 Sensitive Species List	3-194
California Wolverine	R6 Sensitive Species List	3-195
Pacific Fisher	R6 Sensitive Species List	3-196
Pygmy Rabbit	R6 Sensitive Species List	3-198
Northern Leopard Frog	R6 Sensitive Species List	3-198
Columbia Spotted Frog	R6 Sensitive Species List	3-199
Northwestern Pond Turtle	R6 Sensitive Species List	3-199

Biological Evaluation for U. S. Fish and Wildlife Service Listed Threatened, Endangered, and Sensitive Species

The following table displays the threatened, endangered and sensitive species that would be affected by the Toolbox Fire Recovery Project. These species were on the January 13, 2003 US Fish and Wildlife Service list.

Table 3.83 Threatened, Endangered, and Sensitive Species Affected by the Toolbox Fire Recovery Project

Species Name	Status	Effects*			
		No Action Alternative		*Action Alternatives*	
		Species	Habitat	Species	Habitat
Bald eagle *(Haliaeetus leucocephalus)*	Threatened	NE	NE	NE	NE
Canada lynx *(Lynx canadensis)*	Threatened	NE	NE	NE	NE
Oregon spotted frog *(Rana pretiosa)*	Candidate	NI	NI	MIIH	MIIH
Yellow-billed cuckoo *(Coccyzus americanus)*	Candidate	NI	NI	NI	NI

*Effects Determination Code for Threatened or Endangered Species
NE = No Effect from the project on the species or critical habitat.
LAA = The project may affect and is likely to adversely affect the species or critical habitat. Formal Consultation with U.S. Fish & Wildlife Service is required.
NLAA = The project may affect the species or critical habitat, but those effects are not likely to adversely affect the species or critical habitat. Informal Consultation is required with concurrence from the U.S. Fish & Wildlife Service.
BE = The project would benefit a species or its habitat. Written concurrence from the U.S. Fish & Wildlife Service requested.

*Effects Determination Code for Candidate Species
NI = No Impact
MIIH = May impact individuals or habitat, but would not likely contribute to a trend toward federal listing or loss of viability to the population or species.

Biological Evaluation for Region 6 Listed Sensitive Species

The following table displays the Region 6 sensitive species that would be affected by the Toolbox Fire Recovery Project.

Table 3.84 Region 6 Sensitive Species Affected by The Toolbox Fire Recovery Project

Species Name	Effects*			
	No Action Alternative		*Action Alternatives*	
	Species	Habitat	Species	Habitat
Horned grebe *(Podiceps auritus)*	NI	NI	NI	NI
Red-necked grebe *(Podiceps grisegena)*	NI	NI	NI	NI
Least bittern *(Ixobrychus exillis)*	NI	NI	NI	NI
Bufflehead *(Bucephala albeola)*	NI	NI	MIIH	MIIH
Peregrine falcon *(Falco peregrinus)*	NI	NI	NI	NI
Western sage grouse *(Centrocercus urophasianus)*	NI	NI	NI	NI
Yellow rail *(Coturnicops noveboracensis)*	NI	NI	NI	NI
Upland Sandpiper *(Bartramia longicauda)*	NI	NI	NI	NI
Gray flycatcher *(Empidonax wrightii)*	NI	NI	MIIH	NI
Tricolored blackbird *(Agelaius tricolor)*	NI	NI	NI	NI
California wolverine *(Gulo gulo)*	NI	NI	MIIH	MIIH
Pacific fisher *(Martes pennanti)*	NI	NI	MIIH	MIIH

Table 3.84 Region 6 Sensitive Species Affected by The Toolbox Fire Recovery Project (continued)

Species Name	Effects*			
	No Action Alternative		*Action Alternatives*	
	Species	**Habitat**	**Species**	**Habitat**
Pygmy rabbit *(Brachylagus idahoensis)*	NI	NI	NI	NI
Northern Leopard Frog *(Rana boylii)*	NI	NI	MIIH	MIIH
Columbia Spotted Frog *(Rana luteiventris)*	NI	NI	MIIH	MIIH
Oregon spotted frog *(Rana pretiosa)*	NI	NI	MIIH	MIIH
Northwestern Pond Turtle *(Clemmys marmorata marmorata)*	NI	NI	MIIH	MIIH

*Effects Determination Code for R6 Sensitive Species
NI = No Impact
MIIH = May impact individuals or habitat, but would not likely contribute to a trend toward federal listing or loss of viability to the population or species

Mitigation Measures

Mitigation measures that apply to endangered, threatened, and sensitive species can be found in Chapter 2, Mitigation and Resource Protection Measures – Wildlife.

Bald Eagle

Existing Condition

Bald eagle populations have declined due to DDT-induced declines in natality rates, shooting, poisoning, habitat destruction, and disturbance (Fraser 1983). As a result, the bald eagle was placed on the federal list as a threatened species. Protective measures have been successful, eagle numbers have increased to a stable level, and the species is currently being considered for de-listing by the USFWS. Active management and protection is still crucial to maintain population levels.

The primary diet of eagles is fish, waterfowl, and small mammals. Bald eagles are susceptible to disturbance from human activities and require seclusive habitat for nesting, roosting, and foraging. Bald eagle nests are typically located in mature to overmature trees with large, widely spaced limbs capable of supporting a heavy nest. Large snags, dead-topped trees, and live open-limbed trees within the nest stand is important for providing perch sites for the adults and landing sites for the fledglings. Nests are usually located near major bodies of water with abundant amounts of fish, waterfowl, or both, or where there is an abundance of rodents or small mammals.

Isaacs and Silovsky (1981) identified public knowledge of nest site locations, timing of human activities near nest sites, pesticide use, and permanent developments as concerns within Bald Eagle Management Areas (BEMAs), in addition to habitat alteration and mortality factors. Other concerns that have surfaced are the increased amounts of fuels and the presence of dense understories that can act as ladder fuels. Together, these factors have increased the risk of crown fires that can destroy entire BEMAs. Secondly, trees that are currently used by bald eagles for nesting generally predate European settlement of the West. Stands that developed during this period were subject to different factors that determined stands structure and composition. Historically, frequent fires favored fire tolerant tree species, elevated the base of tree crowns, and resulted in wider tree spacing (Everett et al. 1993). Observations of the dense understories within BEMAs and elsewhere on the Fremont National Forest as a result of fire suppression suggest they may not be providing suitable replacement nest trees for bald eagle nesting.

Three BEMAs were affected, to some degree, by the Toolbox and Silver Fires. The Silver Creek and the Thompson Reservoir eagle nests are located approximately 1.5 miles from the project area boundary, and the Dead Indian Rim eagle nest is located within the project area boundary. The fires of 2002 significantly reduced the potential nesting habitat within Dead Indian Rim BEMA. The majority of the Dead Indian Rim BEMA burned in a mosaic pattern and the most recent known nest tree was severely burned by the fire. Due to the proximity of the nest sites to the fire activity, there was little

impact on bald eagle nesting habitat within the Silver Creek and Thompson Reservoir BEMAs. All three nests have been monitored this year and all of the pairs have successfully returned to the BEMA and have been documented incubating.

Forest Service land within the Dead Indian BEMA and the Thompson Reservoir BEMA are Management Area 2. As stated in the LRMP for Management Area 2, "Timber harvest will be used as a management tool to enhance and perpetuate bald eagle habitat where necessary and appropriate" (1989). The management objectives for bald eagle areas are to provide: 1.) an abundance of mature/overmature trees for nesting/roosting platforms, 2.) a minimum of disturbance from people, and 3.) an abundance of food (LRMP 1989).

On April 10, 2003, Forest Service specialists consulted with the USFWS regarding the Toolbox Fire Recovery project, including all potential alternative, mitigation measures, and potential effects to bald eagles and their habitat.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

This alternative has no proposed fuels treatment. Therefore, areas that naturally regenerate and the remaining bald eagle habitat could have fuels conditions that would contribute to future high intensity fires. No proposed planting would also result in a delayed advancement of future bald eagle nesting habitat.

Conclusions for Alternative A

The no action alternative would not remove, modify, or alter any bald eagle habitat. However, it would not contribute to reducing future fuel loadings or providing future sustainable vegetation.

Alternatives C, D, E, G

These alternatives propose to harvest approximately 415 acres within the Dead Indian Rim Bald Eagle Management Area. However, no existing bald eagle nesting habitat would be removed, and snag retention standards, as described in Section F of this Wildlife section would provide for adequate snags for perching, pilot trees, or both if a new nest were created in the project area. No harvest would occur within the Thompson Reservoir and the Silver Creek Bald Eagle Management Area.

Fuels treatment is proposed for approximately 400 acres within the Dead Indian Rim Bald Eagle Management Area for Alternatives C, D, E, and G, and, in addition, the ¼ mile buffer adjacent to private land would be treated in Alternative G. This would reduce fuel loadings and decrease the potential for fuels conditions that would contribute to future high intensity fires within this BEMA. Planting would expedite the recovery of bald eagle habitat and planting at lower densities of 130 to 250 trees per acres would increase the potential for producing suitable bald eagle trees in the long term.

No activities that would visually disturb bald eagles (e.g. parking vehicles, tree marking, or planning) or noise disturbing activities (e.g. falling, hauling, chainsaws, or heavy equipment use) would occur within ¼ mile of the active nest site. No visually disturbing activities (e.g. parking vehicles, tree marking or planning) and noise disturbing activities (e.g. falling, hauling, chainsaws, or heavy equipment use) that are in line of site of the nest would occur within ½ mile of the active nest site. No helicopter use (e.g. flight paths or landings) would occur within ½ mile of the active nest site. In addition, these mitigations would be monitored to assure they are effective in avoiding disturbance.

The management objectives for bald eagle areas are to provide: 1.) an abundance of mature/overmature trees for nesting/roosting platforms, 2.) a minimum of disturbance from people, and 3.) an abundance of food (LRMP 1989). All of these objectives will be met through snag retention guidelines that are adequate for providing nesting/roosting platforms, mitigation measures to avoid disturbance, and there will be no effect on foraging habitat. It is also expected that bald eagle habitat will be enhanced and perpetuated through fuels reduction that will reduce the possibility of fuels conditions that would contribute to future high intensity fires, and planting of trees to expedite future bald eagle habitat.

Conclusions for Alternatives C, D, E, and G

Based on no removal of existing bald eagle nesting habitat and mitigations in place to avoid disturbance, it is expected that Alternatives C, D, E, and G would have no effect on bald eagles or their habitat.

Alternative H

This alternative proposes no harvest within the Dead Indian Rim Bald Eagle Management Area, and therefore no existing bald eagle nesting habitat would be removed. No harvest would occur within the Thompson Reservoir Bald Eagle

Management Area or the Silver Creek Bald Eagle Management Area. In addition, no fuels treatments are proposed within any of the BEMAs, which may increase the potential for fuels conditions that would contribute to future high intensity fires. Planting would expedite the recovery of bald eagle habitat and planting at lower densities of 130 to 250 trees per acres would increase the potential for producing suitable bald eagle trees in the long term.

No activities that would visually disturb bald eagles (e.g. parking vehicles, tree marking, or planning) or noise disturbing activities (e.g. falling, hauling, chainsaws, or heavy equipment use) would occur within ¼ mile of the active nest site. No visually disturbing activities (e.g. parking vehicles, tree marking, or planning) and noise disturbing activities (e.g. falling, hauling, chainsaws, or heavy equipment use) that are in line of site of the nest would occur within ½ mile of the active nest site. In addition, these mitigations would be monitored to assure they are effective in avoiding disturbance.

The management objectives for bald eagle areas are to provide: 1.) an abundance of mature/overmature trees for nesting/roosting platforms, 2.) a minimum of disturbance from people, and 3.) an abundance of food (LRMP 1989). All of these objectives will be met through no harvest within the BEMAs to provide for providing nesting/roosting platforms, mitigation measures to avoid disturbance, and there will be no effect on foraging habitat. It is also expected that bald eagle habitat will be enhanced and perpetuated through the planting of trees to expedite future bald eagle habitat.

Conclusions for Alternative H

Based on no removal of existing bald eagle nesting habitat and mitigations in place to avoid disturbance, it is expected that Alternative H would have no effect on bald eagles or their habitat.

Mitigation Measures

Mitigation measures that apply to bald eagles can be found in Chapter 2, Mitigation and Resource Protection Measures – Wildlife.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on bald eagles, and the following activities have the potential to produce a cumulative effect. Past timber management activities on National Forest System and private land, as displayed in Table-2 and Table A-13 of Appendix A, and fire suppression activities, as displayed in Table A-3 of Appendix A, have likely reduced the abundance, distribution, and quality of potential bald eagle nesting and roosting habitat on the landscape. Green overstory removal and snag harvest have removed preferred nesting and roosting trees, and fire suppression has resulted in an increase in stand densities resulting in mortality of select overstory trees, loss of tree structure that provide large heavy open limbs, and reduced flight access. Some recreational activities, as displayed in Table A-5 of Appendix A, have had a negative impact on nesting success and productivity where recreational sites are located near nest sites. Diversions, dams, and reservoirs, as displayed in Table A-10 of Appendix A, have increased bald eagle habitat by creating large water bodies of water adjacent to forested stands that provide for the nesting and foraging habitat required by eagles. Examples of this are Thompson Reservoir and the Diversion Dam, both of which have active bald eagle nests.

Reasonably foreseeable future activities include treatments within the Bridge Creek Subshed and treatments displayed in Table A-16 of Appendix A, within the project area subsheds. Silvicultural activities include restoration thinning and harvest that would promote large open-limbed growth of ponderosa pine, open the understory for flight access, increase replacement snag levels, and reduce the likelihood of habitat loss through catastrophic fire. Salvage on BLM, as displayed in Table A-15 of Appendix A, is minimal enough that it would likely have no effects on eagle habitat. Cumulatively, it is anticipated that bald eagle populations and their habitat would continue increase over time and, with all cumulative effects considered, including the activities associated with this project, it is likely that the effects would not lead to any adverse effects to the population, nor would it contribute to a trend toward federal listing or loss of viability to the population or species.

Canada Lynx

Existing Condition

Habitat for Canadian lynx occurs in the boreal, sub-boreal, and western montane forests of North America. Engelmann spruce, subalpine fir, and lodgepole pine, are the primary habitat in Washington and Oregon. Secondary habitats contain western larch, Douglas fir, Pacific silver fir, western red cedar/mountain hemlock, and the upper elevations of ponderosa pine forests. Deep winter snow packs often occur in lynx habitat. Fire and other landscape-disturbance processes are

typically associated with lynx habitat and that of their main prey, the snowshoe hare. Denning habitat consists of late successional forest stands where downed logs, root wads, and other structural elements are available.

Surveys designed specifically to detect the presence or absence of lynx occurred in the Yamsey Mountain Semi-Primitive Non-Motorized Wilderness Area in 1997, located approximately 3 to 4 miles west of the project area. Lynx were not detected with these surveys. Based on historical trapping records and incidental sightings, individuals of this species have ranged this far south; however, habitat would be considered atypical and preferred prey species is not abundant. It is suspected that these lynx are dispersing or transient and that habitat quantity and quality are lacking for the establishment of a self-sustaining population.

Conclusions for All Alternatives

No potential habitat for this species would be modified, altered, or removed by implementing any alternative proposed. Based on the above information, this species would not be further addressed in this document.

Oregon Spotted Frog

Existing Condition

Primary habitat for spotted frogs is mainly tied to marsh habitat that offers a perennial water source, floating and submergent vegetation, and deeper water for refuge. Water temperatures exceeding 20 degrees C. (68 deg. F.) are required during the active season. Oregon spotted frogs have not been found above 5,000 feet in elevation, which probably relates to these specific temperature requirements. Over-wintering areas, however, may occur in nearby spring/seep areas where colder water is present (Hayes 1997).

There are no documented sightings of Oregon spotted frog within the project area. No specific Oregon spotted frog surveys were conducted for this project. Habitat may exist along perennial streams or water sources such as Silver Creek, West Fork Silver Creek, North Fork Silver Creek, or Guyer Creek generally below 5,000 feet in elevation. There are no other permanent water sources that may provide habitat within the project area.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

This alternative would have no direct or indirect impact on Oregon spotted frogs or their habitats.

Conclusions for Alternative A

This alternative would not remove, modify, or alter any Oregon spotted frog habitat and there would be no projects that would have the potential to cause disturbance.

Alternative C, D, E, G, H

In all action alternatives, no harvest would occur immediately adjacent to any perennial water sources except when the perennial stream is within a road buffer identified for harvest. In all action alternatives, road buffer harvest includes only 201 acres of salvage harvest immediately adjacent to perennial water sources. Within these acres, and in the areas proposed for instream down wood placement in all action alternatives, direct effects may occur to Oregon spotted frog and their habitat. Outside of roadside buffer harvest, Class 1 RHCAs would be buffered by 300 feet in Alternatives D, G, and H and by 200 feet in Alternatives C and E. Class 3 RHCAs would be buffered by 75 feet in Alternatives C, E, and G and by 150 feet in Alternatives D and H.

Conclusions for Alternatives C, D, E, G, and H

It is expected that with the small area of habitat affected, the action alternatives may have impacts on Oregon spotted frogs or their habitat, but it is not likely to result in a trend toward federal listing or loss of viability for Oregon spotted frog.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on Oregon spotted frogs, and the following activities have the potential to produce a cumulative effect. Any activities associated with dozer line construction from the 2002 fire suppression activities, as displayed in Table A-1 of Appendix A, may have had a localized negative

effect on Oregon spotted frog habitat. Past harvest, as displayed in Table A-2 of Appendix A, and fire suppression activities, as displayed in Table A-3 of Appendix A, have led to dense overstocked stands along riparian corridors that has led to a decrease in riparian vegetation and have increased the potential for stand replacement fire. Minimal effects may occur as a result of ongoing recreational activities adjacent to perennial water sources, as displayed in Table A-5 of Appendix A, from trails and human disturbance.

Road developments, as displayed in Table A-6 of Appendix A, that cross perennial water sources have had an effect on Oregon spotted frog habitat directly related to the road developments and also to increased sedimentation associated with roads. Culvert replacements, as displayed in Table A-9 of Appendix A, may have had a marginal localized effect on Oregon spotted frog. Any diversions or reservoirs, as displayed in Table A-10 of Appendix A, have likely had a negative influence on Oregon spotted frog by diverting water to larger waterbodies that become too warm for Oregon spotted frog habitat. With all cumulative effects considered, including the activities associated with this project, it is likely that the effects would not lead to any adverse effects to the population, nor would it contribute to a trend toward federal listing or loss of viability to the population or species.

Yellow-billed Cuckoo

Existing Condition

Grinnell and Miller (1944) identify habitat in California as, “river bottomlands, where tracts of cottonwood, willow and mesquite adjoin weedy open ground; near vicinity of water a necessity.” Potential habitat includes areas with willow-cottonwood greater than 10.ha., wider than 100 m., and at less than 1,300 m. elevation (Laymon and Halterman 1987, cited in Littlefield 1988).

Hughes (1999) cites Laymon and Halterman (1987) as saying that western populations suffered catastrophic range reductions in twentieth century due to loss of riparian habitat through clearing for agriculture, flood control, and urbanization. Riparian streamside habitat in the west has been degraded by or removed by logging, cattle grazing, dams, water diversions, and water pumping.

The yellow-billed cuckoo is listed by the US Fish and Wildlife Service as a bird of conservation concern, meaning that without additional conservation actions, it is likely to become a candidate for listing under the Endangered Species Act of 1973 (2002).

This species is not known to occur within or adjacent to the proposed project area and habitat for this species is not present within the proposed project area.

Conclusions for All Alternatives

Based on the above information, this species would not be further addressed in this document.

Horned Grebe

Existing Condition

Horned Grebes normally breed on large marshes and small lakes where permanent open water has a substantial border of emergent vegetation. Most winter on salt water and a few winter inland. Nests are made of underwater plants, rotting vegetation, rubbish, and mud and consist of floating platforms in shallow water that are often anchored in emergent vegetation (Ehrlich et al. 1988). Diet includes aquatic insects, crustaceans, and mollusks.

This species is not known to occur within the proposed project area, nor are there any documented sightings on the Silver Lake Ranger District. The nearest potential habitat would be located at Thomson Reservoir that is located 1/2 mile east of project area or Sycan Marsh located approximately 2 miles southeast of the project area.

No potential habitat for this species would be modified, altered, or removed by implementing any alternative proposed. Based on the above information, this species would not be further addressed in this document.

Red-necked Grebe

Existing Condition

The red-necked grebe is a rare to uncommon winter resident, found primarily in central and northern California. Red-necked grebes are rare or very uncommon in central and northern California from October to April. This species is more closely associated with estuarine and marine subtidal waters, and, occasionally, in lacustrine habitats. Nesting typically occurs in the northernmost contiguous U.S., Canada, and Alaska. Usually nests within, or on the edge of, emergent vegetation bordering shallow inland lakes, which, usually, are larger than 4 ha. (10 ac.). Lakes with nests are found in forested or unforested habitats. Nests have been found as far south as Upper Klamath Lake, Oregon; however, many die when forced to alight on land when exhausted, or when blown off course by storms, because they cannot take flight from land (Cogswell 1977, McCaskie et al. 1979, Garrett and Dunn 1981).

This species is not known to occur within the proposed project area, nor are there any documented sightings on the Silver Lake Ranger District. The nearest potential habitat would be located at Thomson Reservoir that is located 1/2 mile east of the project area or Sycan Marsh located approximately 2 miles southeast of the project area.

Conclusions for All Alternatives

No habitat for this species would be modified, altered, or removed by implementing any alternative proposed. Based on the above information, this species would not be further addressed in this document.

Least Bittern

Existing Condition

Least Bitterns live in emergent vegetation in freshwater and are occasionally found in brackish marshes. They nest near or over water, on the ground in emergent vegetation, or in low shrubs. They forage on insects, amphibians, and small mammals. Least bitterns are solitary to loosely colonial birds (Ehrlich 1988).

This species is not known to occur within the proposed project area, nor are there any documented sightings on the Silver Lake Ranger District. The nearest potential habitat would be located at Thomson Reservoir that is located 1/2 mile east of the project area or Sycan Marsh located approximately 2 miles south of the project area.

No habitat for this species would be modified, altered, or removed by implementing any alternative proposed. Based on the above information, this species would not be further addressed in this document.

Bufflehead

Existing Condition

Buffleheads live by lakes, rivers, and bays, breeding in the northwestern part of North America, and migrating to coastal water on the Atlantic, Gulf, and Pacific coasts as far south as Mazatlan. They seek out either small lakes or permanent freshwater ponds with no outlets adjacent to aspen or coniferous forests. This small diving duck nests in tree cavities, primarily those excavated by northern flickers or in nest boxes. They dive for their food, which includes freshwater and saltwater aquatic invertebrates such as insects, crustaceans, and mollusks, and also feed on seeds of bulrushes and pond seeds.

This species is known to occur within and adjacent to the proposed project area. The Toolbox and Silver have increased potential nesting habitat by creating numerous snags adjacent to riparian areas. There are several small to moderate size ponds within the project area that could provide foraging and nesting habitat for bufflehead. Ponds include Foster Flat, Buckaroo Lake, and Grassy Lake. Some of these potential water sources are only available during high water years. In addition, potential habitat is available at Thompson Reservoir, located approximately ½ from the project area, and Sycan Marsh located approximately 2 miles southeast of the project area. Based on the habitat definition, there is foraging and nesting habitat present within the proposed project area. No specific bufflehead surveys were conducted for this project.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

There would be no projects that would have the potential to cause disturbance. Stands adjacent to ponds that burned would regenerate naturally and would likely provide nesting habitat.

Conclusions for Alternative A

The no action alternative would not remove, modify, or alter any bufflehead habitat.

Alternative C, D, G, E, H

Salvage harvest would reduce potential future nesting habitat by reducing snags that could be used for nest trees. The effects would be the greatest with Alternative C, which proposes the greatest amount of salvage and the least with Alternative D, which proposes the least amount of salvage. Alternative C proposes 14,441 acres of salvage, Alternative G proposes 14,419 acres of salvage, Alternative H proposes 13,031 acres of salvage, Alternative E proposes 11,490 acres of salvage, and Alternative D proposes 6,367 acres of salvage. However, in all action alternatives, snags would be maintained within riparian areas and across the landscape as described in Section F of this Wildlife section. In all action alternatives, road buffer harvest would include only 201 acres of salvage harvest immediately adjacent to Class 1 or 3 RHCA water sources. Within these acres, and in the areas proposed for instream down wood placement in all action alternatives, direct effects may occur to bufflehead and their habitat. Outside of roadside buffer harvest, Class 1 RHCAs would be buffered by 300 feet in Alternatives D, G, and H and by 200 feet in Alternatives C and E. Class 3 RHCAs would be buffered by 75 feet in Alternatives C, E, and G and by 150 feet in Alternatives D and H. Any harvest or activity during the breeding season may have a direct effect on nesting.

Conclusions for Alternatives C, D, G, E, H

Implementation of any of the action alternatives may impact individuals or habitat, but would not likely contribute to a trend toward federal listing or loss of viability to the population or species.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on bufflehead, and the following activities have the potential to produce a cumulative effect. The reduction of snag habitat on National Forest System and private lands through harvest, as displayed in Table A-2 and A-13 of Appendix A, or personal use firewood cutting, as displayed in Table A-12 of Appendix A, adjacent to water sources has likely decreased nesting habitat. Minimal effects may occur as a result of ongoing recreational activities adjacent to water sources, as displayed in Table A-5 of Appendix A, from trails and human disturbance. Grazing activities, as displayed in Table A-8 of Appendix A, likely have increased bufflehead habitat by creating more livestock ponds that provide foraging habitat for bufflehead. Any diversions or reservoirs, as displayed in Table A-10 of Appendix A, have likely had a positive effect on bufflehead by diverting water to larger waterbodies that become bufflehead habitat. With all cumulative effects considered, including the activities associated with this project, it is likely that the project activities would not lead to any adverse effects to the population, nor would it contribute to a trend toward federal listing or loss of viability to the population or species.

Peregrine Falcon

Existing Condition

Peregrine falcon populations have mainly declined due to DDT-induced declines in natality rates. As a result, the peregrine falcon was placed on the federal list as a threatened species. Protective measures have been successful, falcon numbers have increased to a stable level, and the species has been de-listed by the USFWS. Active management and protection is still crucial to maintain population levels. Eggshell thinning from contaminated prey (primarily DDT) still remains a serious problem in the Pacific Northwest, including the local nesting population (Pagel, personal communication, 1996).

Peregrine falcon nesting habitat consists of tall cliffs (at least 75 feet tall) near surface water (streams, marshes, rivers, reservoirs, or lakes). Mean heights of cliffs with nests found by Pagel have been 125 to 160 feet. All nest sites found by Pagel have been within 1/4 to 1/2 mile of some source of water from a Class 4 intermittent stream to riparian, lacustrine, or marine systems (personal communication). Foraging occurs in wooded areas, marshes, open grasslands, and shorelines.

Prey species consist almost entirely of birds, with waterfowl, shorebirds, passerines, and galliformes being a main part of the diet.

The peregrine falcon is listed by the USFWS as a bird of conservation concern, meaning that, without additional conservation actions, it is likely to become a candidate for listing under the Endangered Species Act of 1973 (2002).

An active peregrine falcon nest site is located approximately 0.2 miles from the project area boundary. The entire Peregrine Falcon Management Area (PFMA) and the Peregrine Falcon Consideration Area (PFCA) burned at high intensity during the Toolbox and Winter Fires. Thirty-six percent of the PFCA is located within the project area and 10 percent of the PFMA is located within the project area. The PFMA is Management Area 2 in which the direction is to "manage and retain their natural character and a high degree of solitude and to provide an adequate food base" (1989). Timber management activities near an active nest will be managed to provide for a variety of habitats to support an adequate food base (LRMP 1989). Although the primary foraging base for this nest is waterfowl from Summer Lake, the fire likely improved habitat for falcons by creating more openings and providing foraging habitat in the uplands within the fire.

Monitoring of this nest is conducted annually on the district. Falcon habitat surveys on the Fremont National Forest were conducted using helicopter flights and aerial surveys, and ground surveys were used to rate priority cliff habitat areas for peregrine nesting potential. The pre-field review of the project area found potential cliff sites with varying levels of qualities within and adjacent to the project area. No falcons were sited during field review for this project. No specific falcon surveys were conducted for this project.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

The no action alternative would not remove, modify, or alter any peregrine falcon habitat. There would be no projects that would have the potential to cause disturbance.

Alternative C, D, E, G, H

These alternatives propose to harvest approximately 25 acres in Alternatives C, G, and H, 15 acres in Alternative E, and 5 acres in Alternative D within the PFMA. However, no peregrine falcon nesting habitat would be altered, and snag retention standards as described in Section F of this Wildlife section would provide for adequate snags for perching and down wood for small mammal habitat. Therefore, the timber management activities will be managed to provide for an adequate food base as directed in the LRMP (1989).

Fuels treatment is proposed for the ¼ mile buffer adjacent to private land in Alternative G only. This would reduce fuel loadings and decrease the potential for fuels conditions that would contribute to future high intensity fires within this PFMA.

No visually disturbing activities (e.g. parking vehicles, tree marking or planning) and noise disturbing activities (e.g. falling, hauling, chainsaws, or heavy equipment use) would occur within ¼ mile of the active nest site, and no helicopter use (e.g. flight paths or landings) would occur within ½ mile of the active nest site. No helicopter harvest is proposed for Alternative H. No activities are within view of the nest site. In addition, these mitigations would be monitored to assure they are effective in avoiding disturbance.

Conclusions for Alternatives C, D, E, G, and H

Based on no removal of peregrine falcon nesting habitat and mitigations in place to avoid disturbance, it is expected that Alternatives C, D, E, G, and H would have no impact on peregrine falcons or their habitat and would not likely contribute to a trend toward federal listing or loss of viability to the population or species.

Mitigation Measures

Mitigation measures that apply to peregrine falcons can be found in Chapter 2, Mitigation and Resource Protection Measures – Wildlife.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on peregrine falcons, and the following activities have the potential to produce a cumulative effect. Past management activities, as displayed in Table A-2 of Appendix A, and fire suppression activities, as displayed in Table A-3 of Appendix A, have converted open ponderosa pine stands to overstocked stands with dense understories. This has likely decreased peregrine falcon foraging habitat by reducing flight access. Prescribed burning and understory thinning, as displayed in Table A-3 of Appendix A, have improved foraging habitat by creating more open understory conditions.

Recreational activities have had little effect on peregrine falcons as they nest in large cliffs that are generally not near any recreational facilities. The nest was not active last year, so the 2002 fire suppression activities had no effect on the active peregrine falcon nest. Peregrine falcons populations have declined from pre-fire historical levels, but this is due largely to the historical use of the chemical DDT and is not directly related to the cumulative activities that have taken place within the project area. Therefore, is expected that the cumulative activities mentioned would not likely contribute to a trend toward federal listing or loss of viability to the population or species.

Western Sage Grouse

Existing Condition

Primary habitat for western sage grouse varies by season and includes dense stands of big sagebrush for nesting and wintering sites, open areas for breeding displays (leks) and semi-open wet grassy areas for rearing and/or foraging habitat for young chicks. Primary habitat usually involves large open sagebrush areas with few, if any, trees. Upland spring areas are also important since they are directly related to insect abundance, upon which the chicks depend during the first 2 to 3 weeks of life. Low sagebrush, interspersed grasslands, or both, may also occur near lek areas. Nesting occurs at the base of dense sagebrush patches where cover and adjacency to food supplies are present.

Marginal habitat may exist within the project area. On the northern portion of the project area, there are inclusions of low sagebrush and big sagebrush flats intermixed with ponderosa pine stands and stringers. The majority of these areas experienced moderate to high burn severities, thereby reducing habitat qualities for sage grouse. There have been no documented sightings of sage grouse within the project area and no sage grouse were sited during field review for this project. No specific sage grouse surveys were conducted for this project.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action), C, D, E, G, H

Conclusions for All Alternatives

The prescribed burning proposed in Alternatives C, D, G, and H would not affect potential sage grouse habitat. Therefore, it is expected that these alternatives would have no impact on sage grouse or their habitat and would not likely contribute to a trend toward federal listing or loss of viability to the population or species.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on sage grouse, and the following activities have the potential to produce a cumulative effect. Prescribed fire treatments, as displayed in Table A-3 of Appendix A, may have affected sage grouse habitat depending upon the nature of the burning. If the burning was a mosaic, it likely improved habitat for sage grouse by creating a mix of shrub and grass/forbs communities. Noxious weed treatments, as displayed in Table A-4 of Appendix A, have likely reduced the likelihood of native grass loss. Juniper thinning, as displayed in Table A-9 of Appendix A, may improve sage grouse habitat by reducing the loss of sagebrush and grass to juniper competition. Livestock grazing, as displayed in Table A-8 and Table A-17 of Appendix A, may have impacted sage grouse habitat by reducing the shrub and grass cover available for nesting. Overall, sage grouse habitat is extremely marginal within the project area. With all cumulative effects considered, including the activities associated with this project, it is likely that the effects would not lead to any adverse effects to the population, nor would it contribute to a trend toward federal listing or loss of viability to the population or species.

Yellow Rail

Existing Condition

Yellow rails are very secretive birds that reside in wet sedge meadows. The two important habitat characteristics for yellow rail are water levels and cover of vegetation (Popper and Stern 1999). Over the fours years of the Popper and Stern study, the average water depth at yellow rail locations was 7.0 cm (1999). Vegetative levels should allow sufficient senescent and live vegetative cover that averaged almost 100 percent at known yellow rail sites and height to be available for next year (Popper and Stern 1999). Summer food diets for yellow rail indicate a wide variety of resources including both animal and vegetal matter, which reflects an opportunistic foraging strategy (Michel et al. 1997). During the summer, they predominately feed on arthropods and secondarily on seeds (Michel et al. 1997).

A study in Texas revealed that yellow rails would not use recently burned wetlands due to the lack of vegetative cover, and, additionally, would not use burned areas a year after burning because the plant community was too tall and dense (Mizell 1998). Burning and grazing together, or burning in a mosaic of burned/unburned patched appeared to increase potential yellow rail habitat (Mizell 1998). Prescribed fire is also found to be a method of managing for yellow rail habitat because wet sedge meadows are a pioneer community subject to succession, and left unmanaged, this type of habitat can become occupied by dense stands of leatherleaf, bog birch, or willows (Burkman 1993). Prescribed fire effectively reduces the percentage and height of shrubs present, acidic pH found on burned sites discourage shrub species, and the swift reestablishment of the herbaceous layer results in the rapid formation of a new senescent layer utilized by yellow rails for cover (Burkman 1993).

The yellow rail is listed by the US Fish and Wildlife Service as a bird of conservation concern, meaning that without additional conservation actions, it is likely to become a candidate for listing under the Endangered Species Act of 1973 (2002).

This species is not known to occur within the proposed project area, nor are there any documented sightings on the Silver Lake Ranger District. The nearest potential habitat would be located at Sycan Marsh located approximately 2 miles southeast of the project area.

Conclusions for All alternatives

No habitat for this species would be modified, altered, or removed by implementing any alternative proposed. Based on the above information, this species would not be further addressed in this document.

Upland Sandpiper

Existing Condition

Upland sandpipers are restricted primarily to extensive, open tracts of short grassland habitat. They nest in native prairie dry meadows, pastures, domestic hayfields, short-grass savanna, and plowed fields. Nesting is also known to occur in dry patches of wet meadows. Preferred habitat includes large areas of short grass for feeding and courtship with interspersed or adjacent taller grasses for nesting and brood cover (Carter 1992). Vegetation height is an important factor in the selection of nesting sites, with 54 percent of nests in cover between 25 to 40 cm in height, not exceeding 70 cm at the time of egg hatching. Upland sandpipers accept a variety of native and introduced grasses, including timothy, bluegrass, quackgrass, Junegrass, needlegrass, bluestem, and bromegrass.

Prescribed burning, grazing, or mowing can be used to provide essential nesting conditions, but these activities can be detrimental if conducted inappropriately (Carter 1992). It is recommended that burning take place every 5 - 10 years after September 1 or before May 1, and only part of large units should be burned in any year (Jones and Vickery 1997).

This species is not known to occur within the proposed project area, nor are there any documented sightings on the Silver Lake Ranger District. The nearest potential habitat would be located at Sycan Marsh located approximately 2 miles southeast of the project area.

Conclusions for All Alternatives

No habitat for this species would be modified, altered, or removed by implementing any alternative proposed. Based on the above information, this species would not be further addressed in this document.

Gray Flycatcher

Existing Condition

Gray flycatchers breed in semi-arid woodlands and brushy areas that include pinyon pine and/or juniper woodlands, open woodlands of juniper and mountain mahogany, tall sagebrush/greasewood plains, open ponderosa pine forests, and open ponderosa pine forests with pinyon and/juniper understory. They winter in arid, edge, or open riparian woodlands. The primary food for gray flycatchers is insects, including butterflies, moths, bees, grasshoppers, and beetles. From Late May through July, nests are placed primarily 2 to 11 feet high in a shrub or crotch of a juniper or pinyon pine. When nesting in juniper woodlands, the nest is largely made of strips of juniper bark and, therefore, is well camouflaged. Conservation issues that are affecting gray flycatchers are the decline of mature and old growth juniper and brood parasitism by brown-headed cowbirds. Conservation strategies recommended in the *Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington* document suggest to retain and protect mature and old-growth juniper trees where populations of gray flycatchers occur within the historical range of this habitat type (Altman and Holmes 2000). There is a highly significant short term (1980 to 1998) increasing trend of 15.4 percent/year of gray flycatcher numbers (Altman and Holmes 2000), likely due to the expansion of juniper.

Gray flycatcher habitat does exist within the project area in ponderosa pine stands that burned light to moderate, and in the northern portion of the project area where there are inclusions of juniper/sagebrush flats intermixed with ponderosa pine stands and stringers. Gray flycatchers were not sited during field review for this project and no specific gray flycatcher surveys were conducted for this project. The fire increased grass and forbs, which is likely to increase the abundance of insects for foraging. Light to moderate burning in the lower elevation ponderosa pine stands resulted in thinned understories, which reduced the risk of catastrophic fire and produced the open pine character preferred by gray flycatchers.

There are several documented sightings of gray flycatchers within the project area. In addition, Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Graham Creek is the only site that is adjacent to ponderosa pine/juniper communities and where gray flycatchers were detected. Below is the total number of detections of gray flycatchers at Graham Creek from 1994 to 2001:

Table 3.85 Gray Flycatcher Sightings at Graham Creek

Location	1994	1995	1996	1997	1998	1999	2000	2001
Graham Creek	1	2	0	1	0	0	0	0

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

There would be no effects to gray flycatcher populations or habitat under this alternative. Therefore, it is expected that this alternative would have no impact on gray flycatchers or their habitat and would not likely contribute to a trend toward federal listing or loss of viability to the population or species.

Alternatives C, D, E, G, and H

No green ponderosa pine trees would be affected with any of the alternatives; therefore gray flycatcher habitat would not be affected. Reforestation and precommercial thinning in these alternatives would produce mature ponderosa pine stands more rapidly than with no treatments as proposed in Alternative A. Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire, and planting would produce gray flycatcher habitat much more quickly into the future than natural regeneration under Alternative A. The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680

acres of fuels treatment. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting. Any harvest or activity during the breeding season may have a direct effect on nesting.

Conclusions for Alternatives C, D, E, G, and H

There would be no effects to gray flycatcher habitat under any of these alternatives. Although there may be direct effects associated with harvest and other activities and individuals may be impacted, it is not likely to contribute to a trend toward federal listing or loss of viability to the population or species.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on gray flycatchers, and the following activities have the potential to produce a cumulative effect. Past management activities, as displayed in Table A-2 of Appendix A, and fire suppression activities, as displayed in Table A-3 of Appendix A, have converted open ponderosa pine stands to overstocked stands with dense understories and reduced overall large ponderosa pine trees. This has likely decreased gray flycatcher habitat. Prescribed burning and understory thinning, as displayed in Table A-3 of Appendix A, have improved conditions by creating more open understory conditions.

Recreation activities, as displayed in Table A-5 of Appendix A, may cause a disturbance if recreational facilities are located near nest sites. Grazing activities, as displayed in Table A-8 and Table A-17 of Appendix A, may have a slight impact on gray flycatcher habitat by reducing grass and forb abundance that provide for insect populations. Juniper thinning projects on National Forest System and BLM land, displayed in Table A-9 and A-15 of Appendix A, has likely reduced gray flycatcher habitat; however, the large old growth juniper was retained. Although open ponderosa pine habitat has diminished due to increased understory densities, juniper has expanded beyond its range within ponderosa pine stands and shrub-steppe communities, thereby increasing primary habitat. With all cumulative effects considered, including the activities associated with this project, it is likely that the effects would not lead to any adverse effects to the population nor would it contribute to a trend toward federal listing or loss of viability to the population or species.

Tricolored Blackbird

Existing Condition

Nesting usually occurs in dense stands of cattails and tules, with nests located a few feet above water. Nesting colonies are sometimes transient, frequenting emergent marsh, blackberry thickets, or fallow agricultural fields overgrown with mustards. The nests are built out of mud and plant materials, and may be located as far as 4 miles from foraging areas. Tricolored blackbirds are highly colonial nesters, requiring nesting areas large enough to support as least 50 pairs. Colonies may breed in different locations from year to year. Roosting areas for large winter flocks usually are in extensive stands of marsh vegetation (Elrich 1988).

Tricolored blackbirds feed on both plant and animal matter, depending mostly on season. In spring and summer the majority of their diet is composed of insects, grasshoppers, and spiders, and in the fall and winter, seeds and grain crops such as oats and rice constitute the dominant food source. An abundant, concentrated supply of insects is important to the success of tricolor breeding colonies. Foraging occurs on the ground in croplands, grassy fields, flooded land, and along the edges of ponds (Elrich 1988).

The tri-colored blackbird is listed by the US Fish and Wildlife Service as a bird of conservation concern, meaning that without additional conservation actions, it is likely to become a candidate for listing under the Endangered Species Act of 1973 (2002).

This species is not known to occur within the proposed project area nor are there any documented sightings on the Silver Lake Ranger District. The nearest potential habitat would be located at Sycan Marsh located approximately 2 miles southeast of the project area.

Conclusions for All alternatives

No habitat for this species would be modified, altered, or removed by implementing any alternative proposed. Based on the above information, this species would not be further addressed in this document.

California Wolverine

Existing Condition

Wolverines are solitary animals that range widely over a wide variety of habitats. Isolation from human impacts and a diverse prey base seem to be the most important habitat components. Within large roadless areas, wolverine use appears to be concentrated in medium to scattered mature timber and in ecotonal areas around natural openings such as cliffs, slides, basins, and meadows. There seems to be little use in stands of dense young timber or in openings such as clear-cuts or wet meadows (Reel et al., 1989, Butts, 1992).

The wolverine is non-migrating, non-hibernating and has a large home range. Home ranges in Alaska have been estimated at 257 square miles for males and 36 square miles for females. In Montana, home ranges for males and females were calculated at 163 and 150 square miles, respectively. There is little information about wolverines in Oregon, but because this is the southern end of their range, it might be safe to assume that average home ranges are larger than those in Alaska or Montana. Wolverines are territorial. Males would challenge other males within their home range, but would accept females. However, wolverine home ranges are too large to be aggressively defended so they might overlap on the edges (CWHR Internet 2002).

Wolverine habitat may occur within the project area and surveys designed specifically to detect the presence/absence of wolverine have not been conducted within the project area. The Oregon Natural Heritage Database shows three documented sightings of wolverines or tracks on the Fremont National Forest: 1) 1962 - a wolverine was sighted on the edge of a meadow by Ingram guard station near Elder Creek on the Paisley district; 2) 1975 - a fairly reliable observer reported a wolverine at Camas Creek on the Lakeview district, and 3) 1978 - a fairly reliable observer reported wolverine tracks near Fremont Point on the Silver Lake District. Track surveys have been conducted on the Silver Lake Ranger District in the areas of Fremont Point and Yamsey Mountain. No wolverine tracks were located; however, this is inconclusive as to whether wolverines were present or using the area.

Wolverines generally prefer remote or wilderness areas. Assuming that the proposed project area is within a wolverine home range, it would likely be the most eastern edge or the most western edge of a home range. The only areas that could remotely provide the home range size required for wolverine would be in the Yamsey Mountain Semi-primitive Non-motorized Recreation Area, located approximately 3 miles west of the project area, or the top and face of Winter Rim, immediately east of the project area. The Winter Fire heavily impacted Winter Rim, and almost the entire area located adjacent to the Toolbox Fire Recovery Project area to the east experienced very high vegetation mortality and likely no longer provides habitat for wolverine due to the loss of canopy closure and structure. However, because of the wolverine's nature, it would most likely travel outside of these areas if they are currently being occupied by wolverines. While being analyzed here, it is unlikely that the proposed project area is being utilized by wolverines, or truly provides them with functional habitat.

Direct and Indirect Effects

Alternative A (No Action)

Assuming wolverine occupy the area, use may continue on the eastern and western edge of the project area in areas of low to moderate vegetation mortality. There would be no increase in human disturbance. No proposed planting would result in a delayed advancement of future wolverine habitat.

Conclusions for Alternative A

Wolverine use is expected to continue at current levels.

Alternative C, D, E, G, and H

These alternatives could cause short term negative effects on wolverines by causing them to adjust use or movement patterns due to disturbance caused by the increase in human activity that would be part of these alternatives. This increase in human activity could affect wolverines if they are present by altering its suitability during the time of increased human activity. Based on the size of the project area and the fact that the project would only potentially effect the very edge of their potential home range, and the large home ranges that wolverines utilize, it is estimated that the disturbance and treatments would only affect a very small amount of habitat with these alternatives. None of the treatment areas include denning habitat and, with no increase in roads and motorized travel, the risk of disturbance to wolverines is considered low.

Conclusions for Alternatives C, D, E, G, and H

None of the alternatives would affect wolverine habitat or species viability because the principal big game prey base in expected to remain stable. The action alternatives may have impacts on wolverines or their habitat, but it is not likely to result in a trend toward federal listing or loss of viability for wolverines.

Cumulative Effects of Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on wolverines and the following activities have the potential to produce a cumulative effect. Past management activities have likely decreased the potential habitat available for fisher within the project area. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, have changed overall stand conditions on National Forest System and private lands. These activities have removed large diameter trees, snags and down wood, reduced patch sizes and connectivity, and diminished the amount of high quality LOS interior habitat and overstory canopy cover all required for wolverine habitat. Recreation activities, as described in Table A-5 of Appendix A, have likely increased the potential for human disturbance to wolverines.

Snag and down wood loss through personal use firewood cutting, as described in Table A-12 of Appendix A, and through past timber management activities including salvage and hazard removal, as described in Table A-2 of Appendix A, and through salvage harvest on several acres of private land as described in Table A-13 of Appendix A have decreased snag and down wood levels. Road developments, as displayed in Table A-6 of Appendix A, has created a very fragmented roaded landbase, thereby decreasing habitat potential for wolverines.

Reasonably foreseeable future activities include treatments within the Bridge Creek Subshed and treatments displayed in Table A-16 of Appendix A within the project area subsheds. Silvicultural activities include restoration thinning and harvest that would promote open understory sustainable ponderosa pine stands. These activities, in conjunction with prescribed fire and road closures, are expected to increase habitat for wolverines by creating more contiguous unfragmented future LOS. With all cumulative effects considered, including the activities associated with this project, it is likely that the effects would not lead to any adverse effects to the population nor would it contribute to a trend toward federal listing or loss of viability to the population or species.

Pacific Fisher

Existing Condition

Multi-storied Douglas fir, conifer-hardwood, and mixed conifer vegetation types with a minimum tree size of 24 inches DBH and a canopy closure of at least 40 percent characterize suitable fisher habitat. Fishers require snags and downed logs for protection, movement, and prey species habitat. Fishers require a minimum of 9,800 acres of moderate quality habitat for a home range, which accommodates one adult male and two adult females. Moderate quality home range habitat requires a minimum stand size of 80 to 120 acres of adjacent mature timber stands.

There are no known documented fisher sightings on the Silver Lake Ranger District. The nearest potential habitat is located approximately 3 miles west of the project area within the Yamsey Semi-primitive Non-motorized Recreation Area. General reconnaissance following the Toolbox and Silver Fires resulted in no fisher sightings. No formal surveys were conducted for this project.

Direct and Indirect Effects

Alternative A (No Action)

It is anticipated that within the interior of the fire in large patches of high vegetation mortality, fisher use is not expected due to the entire loss of LOS character and because fisher tend to avoid very large openings. Fisher use may continue on the edges between areas of high vegetation mortality and low to vegetation mortality, and foraging opportunities may become optimal on these edges when down wood becomes abundant in 20 to 30 years. Large numbers of jackstraw down wood would provide for the complex physical structure near the ground needed for nesting sites and access to subnivian prey. Although habitat quality may increase, other factors may preclude the future use of this habitat by fisher including the lack of connectivity for travel corridors most notably within the area of the fire. No proposed planting would result in a delayed advancement of future fisher habitat.

Conclusions for Alternative A

Fisher use is expected to continue at current levels.

Alternative C, D, E, G, and H

In the long term, salvage activities proposed under these alternatives may reduce the likelihood of fisher use within the planning area due to decreased future down wood levels. The effects would be the greatest with Alternative C, which proposes the greatest amount of salvage and the least with Alternative D, which proposes the least amount of salvage. Alternative C proposes 14,441 acres of salvage, Alternative G proposes 14,419 acres of salvage, Alternative H proposes 13,031 acres of salvage, Alternative E proposes 11,490 acres of salvage, and Alternative D proposes 6,367 acres of salvage. Units proposed for fuels treatment would likely diminish fisher habitat due to the loss of all non-commercial down wood that would provide the complex structure needed for nesting sites and access to subnivian prey. This would have the greatest effect where fuels treatment is proposed along the edges of high vegetation mortality areas and low to moderate vegetation mortality areas. However, reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire. The effects of fuels treatment would be the greatest with Alternative G, which proposes the greatest amount of fuels treatment and the least with Alternative D, which proposes the least amount of fuels treatment. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment.

It is anticipated that, within the interior of large patches where the vegetation mortality was very high, fisher use is not expected due to the entire loss of LOS character and because fisher tend to avoid very large openings. Fisher use may continue along the edges of lightly burned and severely burned stands. Foraging opportunities may increase within riparian corridors where salvage is not proposed. Although foraging quality may slightly increase within the riparian corridors, other factors may preclude the future use of this habitat by fishers including the lack of connectivity for travel corridors most notably within the area of the fire.

Planting is expected to accelerate development of future fisher at a much quicker rate than natural regeneration under Alternative A. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting.

Conclusions for Alternatives C, D, E, G, and H

Although fisher habitat would remain stable under all alternatives, populations have the greatest potential to increase with the alternatives that provide for the greatest amount of down wood habitat for denning and nesting. This is directly related to salvage and, therefore, Alternative D has the greatest potential for fisher populations to increase, followed by Alternative E, H, C, and G, respectively. It is expected that all action alternatives may have an effect on fishers and their population, but it is not likely to result in a trend toward federal listing or loss of viability for fisher populations.

Cumulative Effects of Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on fisher and the following activities have the potential to produce a cumulative effect. Past management activities have likely decreased the potential habitat available for fisher within the project area. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, have changed overall stand conditions on National Forest System and private lands. These activities have removed large diameter trees, snags and down wood, reduced patch sizes and connectivity, and diminished the amount of high quality LOS interior habitat and overstory canopy cover all required for fisher habitat.

Fire suppression, as described in Table A-1 of Appendix A, have changed stand conditions providing more dense understories and have converted many stands previously dominated by open large diameter pine, to stands now characterized as multi-storied stands with white fire and pine in the understory. Recreation activities, as described in Table A-5 of Appendix A, and grazing, as described in Table A-8 of Appendix A, likely have had little affect on fisher. Snag and down wood loss through personal use firewood cutting, as described in Table A-12 of Appendix A, and through past timber management activities including salvage and hazard removal, as described in Table A-2 of Appendix A, and through salvage harvest on several acres of private land as described in Table A-13 of Appendix A have decreased snag and down wood levels. This has likely decreased overall denning and foraging habitat for fisher.

Reasonably foreseeable future activities include treatments within the Bridge Creek Subshed and treatments displayed in Table A-16 of Appendix A, within the project area subsheds. Silvicultural activities include restoration thinning and harvest that would promote open understory sustainable ponderosa pine stands. These activities, in conjunction with prescribed fire, are expected to increase habitat for fisher by creating more contiguous future LOS. With all cumulative

effects considered, including the activities associated with this project, it is likely that the effects would not lead to any adverse effects to the population nor would it contribute to a trend toward federal listing or loss of viability to the population or species.

Pygmy Rabbit

Existing Condition

Pygmy rabbits are found primarily in big sagebrush (*Artemisia tridentata*) and rabbitbrush (*Chrysothamnus spp*.) dominated communities. Pygmy rabbits are also found in areas where greasewood (*Sarcobatus spp*.) is abundant and are generally limited to areas on deep soils with tall, dense sagebrush that is used for cover and food. Individual sagebrush plants in areas inhabited by pygmy rabbits are often 6 feet or greater in height. Dense stands of big sagebrush along streams, roads, and fencerows provide dispersal corridors. Big sagebrush may be 99 percent of a pygmy rabbit's forage in winter (Green and Flinders 1980). In summer, big sagebrush is used less (51 percent of diet). Grasses and forbs and other shrubs comprise the remainder of the summer diet. Some pygmy rabbits never range more than 60 feet from their burrows; however, others have been observed to range up to 328 feet from their burrows. Most activity is within 100 ft radius of burrow. Pygmy rabbits are seldom found in areas of sparse cover and seem to be reluctant to cross open space.

Conclusions for All Alternatives

This species is not known to occur within or adjacent to the proposed project area. Habitat for this species is not present within the proposed project area because the existing big sagebrush areas are not large and contiguous enough to provide for pygmy rabbit habitat. Furthermore, the majority of the big sagebrush openings within the project area experienced moderate to high vegetation mortality. Based on the above information, this species would not be further addressed in this document.

Northern Leopard Frog

Existing Condition

Northern leopard frogs are a highly aquatic species. However, adults may be found up to a mile from the nearest water (Slevin 1928), but only during or following rains. Water at breeding sites must persist long enough to permit the completion of larval development. Shoreline cover, submerged and emergent aquatic vegetation, appears to be an important habitat characteristic. For reproduction leopard frogs prefer cattail and sedge marshes, weedy ponds, or other water with aquatic vegetation (Nussbaum et al. 1983). Eggs are attached to emergent vegetation. Tadpoles use shallow water near shores. At colder localities, adults hibernate on the bottoms of unfrozen bodies of water. Submerged vegetation is apparently unnecessary for hibernation cover. Individuals do not hibernate in southern California, but may become inactive during the coldest periods.

Adults are opportunistic feeders, taking a variety of aquatic and terrestrial prey. They primarily eat small adult insects, but sowbugs, spiders, leeches, snails, small fishes, amphibians (cannibalism has been reported), small snakes, and birds are also taken (Stebbins 1972, Nussbaum et al. 1983). Tadpoles probably feed primarily by filtering algae and diatoms, but may also consume some plant material and animal food incidentally encountered.

Small natural ponds and perennial streams in the proposed project area would provide habitat for this species. No surveys have been conducted within the proposed project area, and there are no documented sightings of northern leopard frog on the Silver Lake Ranger District.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

The no action alternative would not remove, modify, or alter any northern leopard frog habitat.

Alternative C, D, E, G, and H

In all action alternatives, no harvest would occur immediately adjacent to any Riparian Habitat Conservation Area (RHCA), which should include all natural ponds and perennial water sources, except when the perennial stream is within a road buffer identified for harvest. In all action alternatives, this includes only 201 acres of salvage harvest immediately adjacent to perennial water sources. Within these acres and in the areas proposed for instream down wood placement, direct effects may occur to Northern leopard frogs and their habitat. Outside of roadside buffer harvest, Class 1 RHCAs would be buffered by 300 feet in Alternatives D, G, and H and by 200 feet in Alternatives C and E. Class 3 RHCAs would be buffered by 75 feet in Alternatives C, E, and G and by 150 feet in Alternatives D and H. Direct effects associated with logging may occur in the uplands as Northern leopard frogs may move up to a mile from their water source.

Conclusions for Alternatives C, D, E, G, and H

It is expected that with the small area of habitat affected, the action alternatives may have impacts on Northern leopard frogs or their habitat, but it is not likely to result in a trend toward federal listing or loss of viability for Northern leopard frogs.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on Northern leopard frogs, and the following activities have the potential to produce a cumulative effect. Any activities associated with dozer line construction from the 2002 fire suppression activities, as displayed in Table A-1 of Appendix A, may have had a localized negative effect on Northern leopard frog habitat. Past harvest, as displayed in Table A-2 of Appendix A, and fire suppression activities, as displayed in Table A-3 of Appendix A, have led to dense overstocked stands along riparian corridors that have led to a decrease in riparian vegetation and have increased the potential for stand replacement fire. Minimal effects may occur as a result of ongoing recreational activities from trails and human disturbance adjacent to perennial water sources, as displayed in Table A-5 of Appendix A.

Road developments, as displayed in Table A-6 of Appendix A, that cross perennial water sources have had an effect on Northern leopard frog habitat directly related to the road developments and also to increased sedimentation associated with roads. Grazing, as displayed in Table A-8 of Appendix A, likely has had the largest influence on Northern leopard frog habitat. Cattle use and disturbance adjacent to perennial water sources has decreased habitat for Northern Leopard frogs. Allotments that receive late season grazing likely experience a higher degree of disturbance. Culvert replacements, as displayed in Table A-9 of Appendix A, may have had a marginal localized effect on Northern leopard frogs. Any diversions or reservoirs, as displayed in Table A-10 of Appendix A, have likely had positive influence on Northern leopard frogs by diverting water to larger waterbodies that may create marshy habitat. Future grazing, as displayed in Table A-17 of Appendix A, has the greatest likelihood of negatively effecting Northern leopard frog habitat in the future. With all cumulative effects considered, including the activities associated with this project, it is likely that the effects would not lead to any adverse effects to the population nor would it contribute to a trend toward federal listing or loss of viability to the population or species.

Columbia Spotted Frog

Existing Condition

The Columbia spotted frog is a recent split from the Oregon Spotted Frog, and, prior to splitting the species, their habitat was considered the same. Therefore, for the purposes of this document, their habitat and effects analysis would be identical to that of the Oregon spotted frog. Refer to Section J of this Wildlife section.

Northwestern Pond Turtle

Existing Condition

Western pond turtles historically occurred in a wide variety of permanent and intermittent aquatic habitats, but, generally, in slow moving water below 6,000 feet elevation. Populations have been found in rivers, streams, lakes, ponds and other seasonal or permanent wetlands. In intermittent streams, western pond turtles are able to use permanent pools present after the stream has dried. The presence of suitable refugia (spaces under rocks, downed logs, holes in banks and, most importantly, undercut banks) may be critical to allow populations to maintain themselves in small streams. Western pond turtles require basking sites such as partially submerged logs, rocks, mud banks or emergent vegetation (Zeiner 1988).

Females excavate nest depressions in May, June, or July that are generally located in open areas upslope from riparian areas dominated by grasses or herbaceous annuals, and are primarily on south or southwest facing slopes. Females leave the watercourse in the late afternoon or early evening and move overland to excavate one or more nests. Nests are known to range from 17 to 20 meters (56 to 66 feet) from water, although some have been documented as far as 500 meters (1,640 feet). Hatchlings emerge and move to the watercourse in early spring, which is usually March or April. Survivorship among hatchlings and first year animals is low, averaging 8 to 12 percent.

The Northwestern pond turtle is known as a dietary generalist with small aquatic invertebrates making up a large portion of its diet. The diet does also include fish and frog larvae, carrion, and some plant material. Western pond turtles forage throughout the water column and use both sight and smell to detect prey. Foraging throughout the year takes place during daylight, however, nighttime foraging has been documented in the summer months when water temperature is higher. Western pond turtles usually leave watercourses by October or November to over winter in upland habitats.

Small ponds and perennial streams in the proposed project area would provide habitat for this species. No surveys have been conducted within the proposed project area, and there are no documented sightings of Northwestern pond turtles on the Silver Lake Ranger District.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for alternative A

The no action alternative would not remove, modify, or alter any northwestern pond turtle habitat.

Alternative C, D, E, G, and H

In all action alternatives, no harvest would occur immediately adjacent to any Riparian Habitat Conservation Areas which should include all natural ponds and perennial water sources, except when the perennial stream is within a road buffer identified for harvest. In all action alternatives, this includes only 201 acres of salvage harvest immediately adjacent to perennial water sources. Within these acres and in the areas proposed for instream down wood placement, direct effects may occur to Northwestern pond turtles and their habitat. Outside of roadside buffer harvest, Class 1 RHCAs would be buffered by 300 feet in Alternatives D, G, and H and by 200 feet in Alternatives C and E. Class 3 RHCAs would be buffered by 75 feet in Alternatives C, E, and G and by 150 feet in Alternatives D and H.

Conclusions for Alternatives C, D, E,G, and H

It is expected that with the small area of habitat affected, that the action alternatives may have impacts on Northwestern pond turtles or their habitat, but it is not likely to result in a trend toward federal listing or loss of viability for Northwestern pond turtles.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on Northwestern pond turtles, and the following activities have the potential to produce a cumulative effect. Any activities associated with dozer line construction from the 2002 fire suppression activities, as displayed in Table A-1 of Appendix A, may have had a localized negative effect on Northwestern pond turtle habitat. Past harvest, as displayed in Table A-2 of Appendix A, and fire suppression activities, as displayed in Table A-3 of Appendix A, have led to dense overstocked stands along riparian corridors that have led to a decrease in riparian vegetation and have increased the potential for stand replacement fire. Minimal effects may occur as a result of ongoing recreational activities from trails and human disturbance adjacent to perennial water sources, as displayed in Table A-5 of Appendix A.

Road developments, as displayed in Table A-6 of Appendix A, that cross perennial water sources have had an effect on Northwestern pond turtle habitat directly related to the road developments and also to increased sedimentation associated with roads. Grazing, as displayed in Table A-8 of Appendix A, likely has had the largest influence on Northwestern pond turtle habitat. Cattle use and disturbance adjacent to perennial water sources has decreased habitat for Northwestern pond turtles. Allotments that receive late season grazing likely experience a higher degree of disturbance. Culvert replacements, as displayed in Table A-9 of Appendix A, may have had a marginal localized effect on Northwestern pond turtles. Any diversions or reservoirs, as displayed in Table A-10 of Appendix A, have likely had positive influence on Northwestern pond turtles by diverting water to larger waterbodies that may create habitat. Future grazing, as displayed in Table A-17 of

Appendix A, had the greatest likelihood of negatively effecting Northwestern pond turtle habitat in the future. With all cumulative effects considered, including the activities associated with this project, it is likely that the effects would not lead to any adverse effects to the population nor would it contribute to a trend toward federal listing or loss of viability to the population or species.

Focal Species Identified for the Subprovince Central Oregon/Klamath Basin

The following table displays those focal species identified for the Subprovince Central Oregon/Klamath Basin in the *Conservation Strategy for Landbirds of the East Slope of the Cascade Mountains in Oregon and Washington* (species addressed for only those habitats found within the project area).

Table 3.86 Focal Species Identified for the Subprovince Central Oregon/Klamath Basin

III. Focal Species Identified for the Subprovince Central Oregon/Klamath Basin *species addressed for only those habitats found within the project area	Representative of:	Page Number
White-headed Woodpecker	Ponderosa Pine – large patches of old forest with large snags	3-201
Pygmy Nuthatch	Ponderosa Pine – large trees	3-204
Chipping Sparrow	Ponderosa Pine – open understory with regenerating pines	3-206
Lewis' Woodpecker	Ponderosa Pine – patches of burned old Forest	3-208
Brown Creeper	Mixed Conifer (Late Successional) – large trees	3-208
Williamson's Sapsucker	Mixed Conifer (Late Successional) – large snags	3-210
Flammulated Owl	Mixed Conifer (Late Successional) – interspersion grassy opening and dense thickets	3-212
Hermit Thrush	Mixed Conifer (Late Successional) – multi-layered/dense canopy	3-213
Olive-sided Flycatcher	Mixed Conifer (Late Successional) – Edges and openings created by wildfire	3-215
Black-backed Woodpecker	Lodgepole Pine – old growth	3-217
Sandhill Crane	Meadows	3-217
Red-naped Sapsucker	Aspen	3-218

White-headed Woodpecker

Existing Condition

White-headed woodpeckers prefer old-growth ponderosa pine with large diameter trees (Garrett et al. 1996). A study in Central Oregon on the Winema and Decshutes National Forests discovered that the mean dbh of nest trees is 27.6 inches, mean height of nest trees is 50 feet, 87 percent of the nests were found in ponderosa pine, and the mean canopy closure is 6.4 percent at nest sites (Frenzel 1998). Habitat is not suitable without relatively large snags for nest sites and large trees for foraging. Ponderosa pine is the preferred seed cone for foraging, and large trees are necessary for insect foraging substrate, seed cone production, and recruitment snags. Continuous tracts of late-successional forests provide higher quality habitat than fragmented areas, and there is little overlap in home range per pair (Altman 2000). White-headed

woodpecker populations are abundant in burned or cut forests where residual large-diameter live and dead trees are present (Raphael 1991, Raphael and White 1984, Raphael et al. 1987).

The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically appropriate, initiate actions in ponderosa pine stands to provide for a mean of 10 trees/acre greater than 21 inches dbh and at least 2 of the trees are greater than 31 inches dbh, a mean of 1.4 snag/acre greater than 8 inches dbh with 50 percent greater than 25 inches dbh in a moderate to advanced state of decay, and a mean canopy closure of 10 to 40 percent (Altman 2000). Where ecologically appropriate, these conditions should be greater than 350 acres in predominately old-growth areas or greater than 700 acres when the area is 26 to 75 percent old growth (Altman 2000).

White-headed woodpecker populations are predicted to decline because adult mortality is higher that recruitment of young (Frenzel 2001). The conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are (Altman 2000):

1. Extensive loss of large diameter ponderosa pine trees to timber harvest.

2. Lack of recruitment of young ponderosa pine due to factors such as fire suppression that has allowed understory encroachment of firs and exotics, and intensive grazing which can suppress development of young pines.

3. Dependence on large pine seeds as food during non-breeding season and almost all ponderosa pine seed production is by large, dominant trees in open situations (Oliver and Ryker 1990).

4. Fire suppression that has allowed understory encroachment and increased fuel loads that predispose these areas to stand-replacement fires.

5. Fragmented habitat increases energy expenditure and risk of predation to secure resources.

6. Loss of snags and down wood from timber harvest and fuelwood cutting.

The wildlife data in DecAID demonstrates the following snags densities for white-headed woodpeckers at the 30 percent, 50 percent, and 80 percent tolerance level (Mellen et al. 2003).

Table 3.87 Snag Densities for White-Headed Woodpecker at 30, 50, and 80 Percent Tolerance Level

	30% Tolerance Level # snags/acre	50% Tolerance Level # snags/acre	80% Tolerance Level # snags/acre
Snags >10 inches dbh	0.3	1.7	3.7
Snags >20 inches dbh	0.5	1.8	3.8

The white-headed woodpecker is listed by the US Fish and Wildlife Service as a bird of conservation concern, meaning that without additional conservation actions, it is likely to become a candidate for listing under the Endangered Species Act of 1973 (2002).

Habitat does exist and white-headed woodpeckers have been documented within the project area. Although past harvest and the Toolbox and Silver Fires created a more fragmented landscape within the ponderosa pine communities, snag levels have increased and large diameter ponderosa pine snags are more abundant on the landscape. Habitat for white-headed woodpeckers has decreased overall within the project area as a result of the fire, but the remnant ponderosa pine stands that burned light to moderate are likely in better condition due to the increase in large snags.

Although no specific white-headed woodpecker surveys were conducted for this project, they were sited on several occasions during field review for this project. In addition, Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Although all sites are located in close proximity to ponderosa pine communities, white-headed woodpeckers were not detected during these point count surveys.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

This alternative would provide for the greatest number of snags for white-headed woodpeckers. All existing snags would be available in several size classes with differing densities. The likelihood of meeting snag levels into the future with increased snag longevity and retention would be the greatest under this alternative, with large diameter snags expected to last 20 to 30 years. In the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase, even post salvage, as the beetles move into these areas.

This alternative has no proposed fuels treatment, so the likelihood of naturally regenerated stands and the remaining habitat that burned light to moderate have the potential to have fuels conditions that would contribute to future high intensity fires, more so than if the fuels were managed. No proposed planting would also result in a delayed advancement of future white-headed woodpecker nesting and foraging habitat.

Conclusions for Alternative A

This alternative provides the greatest opportunity to provide snag numbers required by white-headed woodpeckers in the short term and long term (15 or more years).

Alternative C, D, E, G, H

Ponderosa pine habitat with large patches of old forest with large snags would be found in the less than 50 percent mortality areas only. Within these areas, snag retention in harvest units was based on the snag levels needed for cavity nesting species in: 1) green stand conditions (less than 50 percent mortality) based on historical or "natural conditions" developed with the data available in DecAID. Clumps would range from 2 to 20 snags per clump throughout the harvest units. Based on the snag retention guidelines for harvest units that are less than 50 percent mortality described in Section F of this Wildlife Section, combined with the areas that are less than 50 percent mortality where no harvest is being proposed and where snags levels are likely above historical range (approximately 4,381 acres in Alternative C, 8,164 acres in Alternative D, 6,169 acres in Alternative E, 4,387 acres in Alternative G, and 4,949 acres in Alternative H), these alternatives would likely manage at 80 or greater percent tolerance level or assurance for white-headed woodpeckers across the landscape. In addition, in the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase post-salvage, as the beetles move into these areas.

In the long term, planting and fuels reduction may improve white-headed woodpecker habitat. This is expected to reduce the likelihood of fuels conditions that would contribute to future high intensity fires and would accelerate development of future foraging and nesting habitat. Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire, and planting would produce white-headed woodpecker habitat much more quickly into the future than natural regeneration under Alternative A.

Conclusions for Alternatives C, D, E, G, and H

These alternatives would retain ample amounts of habitat for white-headed woodpeckers. Salvage logging may have a direct effect on white-headed woodpecker nesting.

The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, and Alternative D proposes 20,743 acres

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on white-headed woodpeckers while considering the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are (Altman 2000), and the following activities have the potential to produce a cumulative effect. Due to past harvest management, including roadside hazard, fire suppression, snag removal, and

overstory removal, snag numbers have declined from pre-fire historical levels. Excavators associated with open late/old ponderosa pine like the white-headed woodpecker, have likely experienced a decline in habitat suitability, bird distribution, and populations. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, and fire suppression, as described in Table A-1 of Appendix A, have changed overall stand conditions on National Forest System and private lands, resulting in the forest succession from an open pine forest to a dense mixed conifer-dominated forest, and from the direct removal of snag habitat. Although higher stocking levels may be creating more snags through competition and insects, the overall loss of snags through harvest has resulted in lower than historical levels.

Prescribed fire has also likely increased snag levels locally with individual snag creation and small 1 to 10 acre patches of heavy fire mortality. Wildfires, as displayed in Table A-1 of Appendix A, have increased snag numbers in the short term, but, for the most part,, past wildfires have experienced some level of salvage. The snag felling involved in the 2002 suppression activities, as displayed in Table A-1 of Appendix A, involved the felling of approximately 300 to 400 trees which reduced snag levels, but increased down wood levels. Road developments, as displayed in Table A-6 of Appendix A, have had an influence in snag levels by increasing the amount of area considered to be a hazard resulting in the felling and harvest of road-side hazard snags. Personal use firewood cutting, as displayed in Table A-12 of Appendix A, has decreased snag levels across the District. The salvage on BLM land, as displayed in Table A-15 of Appendix A, is so small in comparison to the fire that there is likely no cumulative impact.

Current trends indicate that snag numbers are increasing due to reduced harvest of snags and increased required levels in the Regional Forester's Amendment #2 Standards and Guidelines. Activities that are expected to be implemented in the Bridge Creek Subshed, including prescribed fire and silvicultural treatments designed to promote the development of LOS habitat with a snag and down wood component and those activities displayed in Table A-16 of Appendix A including prescribed fire and thinning, are expected to improve habitat for white-headed woodpeckers. Prescribed fire is expected to increase replacement snag and down wood numbers and reduce the fuel loading thereby protecting stands from wildfire.

Pygmy Nuthatch

Existing Condition

Pygmy nuthatches are found in open ponderosa pine forests or mixed conifer forests with a significant component of ponderosa pine (Altman 2000). The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically appropriate, initiate actions in ponderosa pine forests to maintain or provide a mean of 10 trees/acre greater than 21 inches dbh and at least 2 of the trees are greater than 31 inches dbh and a mean of 1.4 snags/acre greater than 8 inches dbh with 50 percent greater than 25 inches dbh in a moderate to advanced state of decay (Altman 2000).

The conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000) are:

1. Extensive loss of large diameter ponderosa pine trees to timber harvesting.

2. Lack of recruitment of young ponderosa pine due to factors such as fire suppression that has allowed understory encroachment of firs and exotics, and intensive grazing which can suppress development of young pines.

3. Fire suppression that has allowed understory encroachment and increased fuel loads that predispose these areas to stand-replacement fires.

4. Fragmented habitat increases energy expenditure and risk of predation to secure resources.

Habitat does exist and pygmy nuthatches have been documented within the project area. Although past harvest and the Toolbox and Silver Fires have created a more fragmented landscape within the ponderosa pine communities, snag levels have increased and large diameter ponderosa pine snags are more abundant on the landscape. Habitat for pygmy nuthatches has decreased overall within the project area as a result of the fire, but the remnant ponderosa pine stands that burned light to moderate are likely in better condition due to the increase in large snags.

Although no specific pygmy nuthatch surveys were conducted for this project, they were sited on several occasions during field review for this project. In addition, Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Although all sites are located in close proximity to

ponderosa pine communities, pygmy nuthatches were only detected at Graham Creek and West Fork Silver Creek. Below is the total number of detections of pygmy nuthatches at Graham Creek and West Fork Silver Creek from 1994 to 2001:

Table 3.88 Pygmy Nuthatch Sightings at Graham Creek and West Fork Silver Creek

Location	1994	1995	1996	1997	1998	1999	2000	2001
Graham Creek	3	0	3	0	1	3	4	2
West Fork Silver Creek	0	0	1	0	0	0	0	0

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

This alternative would provide for the greatest number of snags for pygmy nuthatches. All existing snags would be available in several size classes with differing densities. The likelihood of meeting snag levels into the future with increased snag longevity and retention would be the greatest under this alternative, with large diameter snags expected to last 20 to 30 years. In the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase post salvage, as the beetles move into these areas.

Conclusions for Alternative A

This alternative provides the greatest opportunity to provide the appropriate mix of live large ponderosa pine and the snag numbers required by pygmy nuthatches in the short term and long term (15 or more years). This alternative has no proposed fuels treatment so the likelihood of naturally regenerated stands and the remaining habitat that burned light to moderate, have the potential to have fuels conditions that would contribute to future high intensity fires, more so than if the fuels were managed. No proposed planting would also result in a delayed advancement of future pygmy nuthatch nesting and foraging habitat.

Alternative C, D, E, G, and H

Ponderosa pine habitat with large trees would be found in the less than 50 percent mortality areas only. Within these areas, snag retention in harvest units was based on the snag levels needed for cavity nesting species in: 1) green stand conditions (less than 50 percent mortality) based on historical or "natural conditions" developed with the data available in DecAID. Clumps would range from 2 to 20 snags per clump throughout the harvest units. Based on the snag retention guidelines for harvest units that are less than 50 percent mortality described in Section F of this Wildlife section, combined with the areas that are less than 50 percent mortality where no harvest is being proposed and where snags levels are likely above historical range (approximately 4,381 acres in Alternative C, 8,164 acres in Alternative D, 6,169 acres in Alternative E, 4,387 acres in Alternative G, and 4,949 acres in Alternative H), these alternatives would likely manage for sufficient habitat for pygmy nuthatches across the landscape. In addition, in the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase post-salvage, as the beetles move into these areas.

In the long term, planting and fuels reduction may improve pygmy nuthatch habitat. This is expected to reduce the likelihood of fuels conditions that would contribute to future high intensity fires and would accelerate development of future foraging and nesting habitat. Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire, and planting would produce pygmy nuthatch habitat much more quickly into the future than natural regeneration under Alternative A.

Conclusions for Alternatives C, D, E, G, and H

With ample amounts of snags retained and with no removal of green ponderosa pine trees, these alternatives would retain ample amounts of habitat for pygmy nuthatches in all action alternatives. Salvage logging may have a direct effect on pygmy nuthatch nesting.

The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes

9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on pygmy nuthatches while considering the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are (Altman 2000), and the following activities have the potential to produce a cumulative effect. Due to past harvest management including roadside hazard, fire suppression, snag removal, and overstory removal, large ponderosa pine trees and snag numbers have declined from pre-fire historical levels. Excavators associated with open late/old ponderosa pine, such as the pygmy nuthatch, have likely experienced a decline in habitat suitability, bird distribution, and populations. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, and fire suppression, as described in Table A-1 of Appendix A, have changed overall stand conditions on National Forest System and private lands resulting in the forest succession from an open pine forest to a dense mixed conifer dominated forest, and from the direct removal of snag habitat. Although higher stocking levels may be creating more snags through competition and insects, the overall loss of snags through harvest has resulted in lower than historical levels. Prescribed fire has also likely increased snag levels locally with individual snag creation and small 1 to 10 acre heavy fire mortality. Wildfires, as displayed in Table A-1 of Appendix A, have increased snag number in the short term, but, for the most part, past wildfires have experienced some level of salvage. The snag felling involved in the 2002 suppression activities, as displayed in Table A-1 of Appendix A, involved the felling of approximately 300 to 400 trees which reduced snag levels, but increased down wood levels.

Road developments, as displayed in Table A-6 of Appendix A, have had an influence in snag levels by increasing the amount of area considered to be a hazard resulting in the felling and harvest of road-side hazard snags. Personal use firewood cutting, as displayed in Table A-12 of Appendix A, have decreased snag levels across the District. The salvage on BLM land, as displayed in Table A-15 of Appendix A, is so small in comparison to the fire that there is likely no cumulative impact.

Current trends indicate that snag numbers are increasing due to reduced harvest of snags and increased required levels in the Regional Forester's Amendment #2 Standards and Guidelines. Activities that are expected to be implemented in the Bridge Creek Subshed, including prescribed fire and silvicultural treatments designed to promote the development of LOS habitat with a snag and down wood component and those activities displayed in Table A-16 of Appendix A including prescribed fire and thinning, are expected to improve habitat for white-headed woodpeckers. Prescribed fire is expected to increase replacement snag and down wood numbers and reduce the fuel loading thereby protecting stands from wildfire.

Chipping Sparrow

Existing Condition

Chipping sparrows are found in areas with a relatively open understory with a heterogenous understory of herbaceous openings and patches of shrubs and/or seedling trees, especially pines (Altman 2000). The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically appropriate, initiate actions in ponderosa pine forests to maintain or provide an interspersion of herbaceous ground cover with shrub and regenerating pine patches, 20 to 60 percent cover in the shrub layer (includes shrubs and small trees) with greater than 20 percent of the shrub layer in regenerating sapling conifers, especially pines, and a mean canopy cover of 10 to 30 percent.

The conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are (Altman 2000):

1. Understory removal because of fire hazard or as part of restoration activities – timing, extent, and location of removal.

2. Intensive grazing may reduce adequate herbaceous cover for foraging and inhibit development of regenerating seedlings of pine for recruitment trees and nesting habitat.

3. Vulnerable to cowbird parasitism where multiple land-use provides for cowbirds.

Habitat does exist and chipping sparrows have been documented within the project area. The Toolbox and Silver Fires have likely decreased habitat for chipping sparrows due to the large-scale loss of shrubs and regenerating pines.

No specific chipping sparrow surveys were conducted for this project. Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Chipping Sparrows were only detected at Graham Creek, Bottle Springs, and West Fork Silver Creek. Below is the total number of detections of chipping sparrows at Graham Creek, Bottle Springs, and West Fork Silver Creek from 1994 to 2001:

Table 3.89 Chipping Sparrow Sightings at Graham Creek, Bottle Springs, and West Fork Silver Creek

Location	1994	1995	1996	1997	1998	1999	2000	2001
Graham Creek	6	2	0	2	2	2	3	2
Bottle Springs	0	1	2	3	2	3	2	2
West Fork Silver Creek	0	0	0	0	0	0	0	1

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

The no action alternative would not remove, modify, or alter any chipping sparrow habitat. This alternative has no proposed fuels treatment, so the likelihood of naturally regenerated stands and the remaining habitat that burned light to moderate have the potential to have fuels conditions that would contribute to future high intensity fires, more so than if the fuels were managed. No proposed planting would also result in a delayed advancement of future chipping sparrow nesting and foraging habitat.

Alternative C, D, E, G, and H

In the action alternatives, prescribed fire is the only activity that has the potential to affect chipping sparrow habitat. Burning may further reduce the understory regeneration and shrub component for which chipping sparrows select. Alternatives C and G propose 3,572 acres of prescribed fire, Alternatives D and H propose 2,450 acres of prescribed fire, and Alternative E proposes no prescribed fire. It is expected that the proposed prescribed fire is not large enough in scale to affect chipping sparrow populations under any of the action alternatives. Salvage activities may have a direct effect on chipping sparrow nesting.

Planting and fuels reduction are expected to reduce the likelihood of fuels conditions that would contribute to future high intensity fires and would accelerate development of future foraging and nesting habitat. Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire, and planting would produce brown creeper habitat much more quickly into the future than natural regeneration under Alternative A.

Conclusions for Alternatives C, D, E, G, and H

In the long term, planting and fuels reduction may improve chipping sparrow habitat. The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on chipping sparrows while considering the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are (Altman 2000), and the following activities have the potential to produce a cumulative effect. Past timber harvest activities, as displayed in Table A-2 of Appendix A, and fire suppression activities, as displayed in Table A-1 of Appendix A, have likely improved chipping sparrow habitat by increasing understory regeneration and shrubs. However, the loss of overstory large ponderosa pine has likely had a negative impact on chipping sparrows.

Fuels reduction projects that have occurred within the project area, as displayed in Table A-3 of Appendix A, include prescribed fire and understory thinning in a mosaic thereby creating a mix of understory conditions. This has likely improved habitat for chipping sparrows. Grazing, as displayed in Table A-8 and A-17 of Appendix A, has likely reduced understory forage, but has not been intensive enough to inhibit seedling regeneration. Grazing has also increased the cowbird population that has led brood parasitism and the eventual decline of chipping sparrow populations. Noxious weed treatments, as displayed in Table A-4 of Appendix A, has decreased the likelihood of noxious weeds out-competing native grasses.

Lewis' Woodpecker

Existing Condition

Refer to the Snag and Down Wood Dependent Species section of the Fremont National Forest Management Indicator Species discussion in this Wildlife section.

Brown Creeper

Existing Condition

Brown creepers are a bark-gleaning insectivore associated with late-successional forests and mature trees (Altman 2000). The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically appropriate, initiate actions in mixed conifer forests to maintain or provide for blocks of late-successional habitat greater than 75 acres with 4 trees/acre greater than 18 inches, with at least 2 trees greater than 24 inches dbh (Altman 2002).

Some of the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are (Altman 2000):

1. Reduction in the presence of large trees across the landscape due to timber harvests, high-grading, and shorter rotations.

2. Indicators that it may be a forest interior species that is area-sensitive (Rosenberg and Raphael 1986, Nelson 1989, McGarigal and McComb 1995)

Habitat does exist within the project area. However, the majority of the mixed conifer habitat within the project area is within the riparian zones that generally experienced moderate to high vegetation mortality.

There are many documented brown creeper sightings within the project area. No specific brown creeper surveys were conducted for this project. Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Brown Creepers were detected at all locations. Below is the total number of detections of brown creepers from 1994 to 2001:

Table 3.90 Brown Creeper sightings at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek

Location	1994	1995	1996	1997	1998	1999	2000	2001
Bottle Springs	1	0	0	4	2	2	3	1
Graham Creek	0	1	0	1	3	2	4	6
Guyer Creek	2	1.3	1	2	3	3	1	2
West Fork Silver Creek	0	2	1	3	5	2	3	2

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for alternative A

This no action alternative would not remove, modify, or alter any brown creeper habitat. This alternative has no proposed fuels treatment so the likelihood of naturally regenerated stands and the remaining habitat that burned light to moderate have the potential to have fuels conditions that would contribute to future high intensity fires, more so than if the fuels were managed. No proposed planting would also result in a delayed advancement of future brown creeper nesting and foraging habitat.

Alternative C, D, E, G, and H

In the long term, planting and fuels reduction may improve brown creeper habitat. This is expected to reduce the likelihood of fuels conditions that would contribute to future high intensity fires and would accelerate development of future foraging and nesting habitat. Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire, and planting would produce brown creeper habitat much more quickly into the future than natural regeneration under Alternative A. The advantages of fuels reduction treatment would be the greatest with Alternative G,, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting.

Conclusions for Alternatives C, D, E, G, and H

These alternatives would not affect brown creeper habitat because no green trees would be harvested under any of the action alternatives. Salvage activities may have a direct effect on brown creeper nesting. Overall, these alternatives are expected to have little effect on brown creeper populations or habitat.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on brown creepers while considering the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000), and the following activities have the potential to produce a cumulative effect. Past timber harvest activities, as displayed in Table A-2 of Appendix A, have led to the loss of overstory large ponderosa pine and white fir that has likely had a negative impact on brown creepers. Grazing, as displayed in Table A-8 and A-17 of Appendix A, has increased the cowbird population that has led brood parasitism and the possible reduction in brown creeper populations. No other cumulative activities are expected to have an affect on brown creepers.

Williamson's Sapsucker

Existing Condition

Williamson's sapsuckers inhabit mature and old growth mixed conifer forests (Thomas et al. 1979). The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically appropriate, initiate actions in mixed conifer forests to maintain or provide 1 snag/acre greater than 12 inches dbh except ponderosa pine should be greater than 18 inches dbh and a mean canopy cover 25 to 70 percent (Altman 2002).

Some of the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000) are:

1. Williamson's sapsuckers are dependent on relatively large snags or dying trees for nesting and foraging.
2. The loss of large snags under intensive forest management practices.
3. Fire suppression has resulted in closed understories that inhibit growth of large trees.

The Williamson's sapsucker is listed by the USFWS as a bird of conservation concern, meaning that without additional conservation actions, it is likely to become a candidate for listing under the Endangered Species Act of 1973 (2002).

Habitat does exist within the project area. The majority of the mixed conifer habitat within the project area is within the riparian zones that generally experienced moderate to high vegetation mortality, thereby increasing snags levels. However, in the mixed conifer stands that burned light to moderate, Williamson's habitat has likely improved due to an increase in snags.

There are many documented Williamson's sapsucker sightings within the project area. No specific Williamson's sapsucker surveys were conducted for this project. Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Williamson's sapsuckers were detected at Bottle Springs, Graham Creek, and West Fork Silver Creek locations. Below is the total number of detections of Williamson's sapsuckers from 1994 to 2001:

Table 3.91 Williamson's Sapsucker Sightings at Bottle Springs, Graham Creek, and West Fork Silver Creek

Location	1994	1995	1996	1997	1998	1999	2000	2001
Bottle Springs	1.3	0	0	0	0	0	1	0
Graham Creek	0	0	0	1	0	2	0	0
West Fork Silver Creek	0	0	0	0	0	0	1	0

Environmental Consequences)

Direct and Indirect Effects

Alternative A (No Action)

This alternative would provide for the greatest number of snags for Williamson's sapsucker. All existing snags would be available in several size classes with differing densities. The likelihood of meeting snag levels into the future with increased snag longevity and retention would be the greatest under this alternative, with large diameter snags expected to last 20 to 30 years. In the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase, even post-salvage, as the beetles move into these areas.

Conclusions for Alternative A

This alternative provides the greatest opportunity to provide snag numbers required by Williamson's sapsucker in the short term and long term (15 or more years).

Alternative C, D, E, G, H

Mixed conifer habitat with large patches of old forest with large snags would be found in the less than 50 percent mortality areas only. Within these areas, snag retention in harvest units was based on the snag levels needed for cavity nesting species in: 1) green stand conditions (less than 50 percent mortality) based on historical or "natural conditions" developed with the data available in DecAID. Clumps would range from 2 to 20 snags per clump throughout the harvest units. Based on the snag retention guidelines for harvest units that are less than 50 percent mortality described in Section F of this Wildlife section, combined with the areas that are less than 50 percent mortality where no harvest is being proposed and where snags levels are likely above historical range (approximately 4,381 acres in Alternative C, 8,164 acres in Alternative D, 6,169 acres in Alternative E, 4,387 acres in Alternative G, and 4,949 acres in Alternative H), these alternatives would likely provide sufficient habitat for Williamson's sapsucker across the landscape. In addition, in the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase post salvage, as the beetles move into these areas.

Planting and fuels reduction are expected to reduce the likelihood of fuels conditions that would contribute to future high intensity fires and would accelerate development of future foraging and nesting habitat. Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire, and planting would produce Williamson's sapsucker habitat much more quickly into the future than natural regeneration under Alternative A.

Conclusions for Alternatives C, D, E, G, and H

These alternatives would retain ample amounts of habitat for Williamson's sapsucker in all action alternatives. Salvage logging may have a direct effect on Williamson's sapsucker nesting.

In the long term, planting and fuels reduction may improve Williamson's sapsucker habitat. The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on Williamson's sapsuckers while considering the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are (Altman 2000), and the following activities have the potential to produce a cumulative effect. Due to past harvest management, including roadside hazard, fire suppression, snag removal, and overstory removal, snag numbers have declined from pre-fire historical levels. Excavators associated with mixed conifer communities like the Williamson's sapsucker, have likely experienced a decline in habitat suitability, bird distribution, and populations. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, and fire suppression, as described in Table A-1 of Appendix A, have changed overall stand conditions on National Forest System and private lands, resulting in the forest succession from an open pine forest to a dense mixed conifer dominated forest, and from the direct removal of snag habitat. Although higher stocking levels may be creating more snags through competition and insects, the overall loss of snags through harvest has resulted in lower than historical levels.

Prescribed fire has also likely increased snag levels locally with individual snag creation and small 1 to 10 acre patches of heavy fire mortality. Wildfires, as displayed in Table A-1 of Appendix A, have increased snag number in the short term, but, for the most part,, past wildfires have experienced some level of salvage. The snag felling involved in the 2002 suppression activities, as displayed in Table A-1 of Appendix A, involved the felling of approximately 300 to 400 trees which reduced snag levels, but increased down wood levels. Road developments, as displayed in Table A-6 of Appendix A, have had an influence in snag levels by increasing the amount of area considered to be a hazard, resulting in the felling and harvest of road-side hazard snags. Personal use firewood cutting, as displayed in Table A-12 of Appendix A, has decreased snag levels across the District. The salvage on BLM land, as displayed in Table A-15 of Appendix A, is so small in comparison to the fire that there is likely no cumulative impact.

Current trends indicate that snag numbers are increasing due to reduced harvest of snags and increased required levels in the Regional Forester's Amendment #2 Standards and Guidelines. Activities that are expected to be implemented in the Bridge Creek Subshed, including prescribed fire, silvicultural treatments designed to promote the development of LOS habitat with a snag and down wood component, and those activities displayed in Table A-16 of Appendix A, including prescribed fire and thinning, are expected to improve habitat for Williamson's sapsuckers. Prescribed fire is expected to increase replacement snag and down wood numbers and reduce the fuel loading thereby protecting stands from wildfire.

Flammulated Owl

Existing Condition

Flammulated owls inhabit habitat with a mosaic of old dry forest with large trees and snags, low canopy closure, openings of grasslands or dry meadows, with a primarily herbaceous understory with a few scattered small patches of young sapling thickets (Atman 2000). The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically appropriate, initiate actions in mixed conifer forests to maintain or provide greater than 10 snags/100 acres greater than 12 inches dbh and 6 feet tall, greater than 8 trees/acre greater than 21 inches dbh to function as recruitment snags, at least one large or two smaller dense brushy thickets of saplings/pole trees for roosting habitat, and at least one large, or two smaller, grassy openings within the territory (Altman 2002).

Some of the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000) are:

1. Loss of mature and old growth trees and snags for nest and roost trees.

2. Loss of open understory because of invasion of exotics and fire tolerant species due to fire suppression.

The flammulated owl is listed by the USFWS as a bird of conservation concern, meaning that without additional conservation actions, it is likely to become a candidate for listing under the Endangered Species Act of 1973 (2002).

Habitat does exist within the project area. One historical nest site is located within the project area. The majority of the mixed conifer habitat within the project area is within the riparian zones that generally experienced moderate to high vegetation mortality. In the areas that burned light to moderate, habitat for flammulated owls is probably improved due to the increase in snags and creation of small openings. There are only a few flammulated owl sightings within the project area. No specific flammulated owl surveys were conducted for this project.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

The no action alternative would not remove, modify, or alter any flammulated owl habitat. However, increased fuel loading does present a risk of future stand replacement fires in existing habitat.

Alternative C, D, E, G, and H

Based on the snag retention guidelines for harvest units that are less than 50 percent mortality, described in Section F of this Wildlife section, combined with the areas that are less than 50 percent mortality where no harvest is being proposed and where snags levels are likely above historical range (approximately 4,381 acres in Alternative C, 8,164 acres in Alternative D, 6,169 acres in Alternative E, 4,387 acres in Alternative G, and 4,949 acres in Alternative H), these alternatives would likely provide sufficient habitat for flammulated owls across the landscape. In addition, in the stands that experienced low to moderate vegetation mortality, it is expected that snags would continue to increase post-salvage, as the beetles move into these areas. Salvage activities may have a direct effect on flammulated owl nesting. It is expected that these alternatives would have little effect on flammulated owl populations or habitat.

Planting and fuels reduction are expected to reduce the likelihood of fuels conditions that would contribute to future high intensity fires and would accelerate development of future foraging and nesting habitat. Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand

replacement fire, and planting would produce flammulated owl habitat much more quickly into the future than natural regeneration under Alternative A.

Conclusions for Alternatives C, D, E, G, and H

These alternatives would not affect flammulated owl habitat because no green trees would be harvested under any of the action alternatives.

In the long term, planting and fuels reduction may improve flammulated owl habitat. The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on flammulated owls while considering the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000), and the following activities have the potential to produce a cumulative effect. Due to past harvest management, including roadside hazard, fire suppression, snag removal, and overstory removal, large ponderosa pine trees and snag numbers have declined from pre-fire historical levels. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, and fire suppression, as described in Table A-1 of Appendix A, have changed overall stand conditions on National Forest System and private lands resulting in the forest succession from an open pine forest to a dense mixed conifer dominated forest, and from the direct removal of snag habitat. Although higher stocking levels may be creating more snags through competition and insects, the overall loss of snags through harvest has resulted in lower than historical levels.

Prescribed fire has also likely increased snag levels and small openings locally with individual snag creation and small 1 to 10 acre patches of heavy fire mortality Wildfires, as displayed in Table A-1 of Appendix A, have increased snag number in the short term, but, for the most part, past wildfires have experienced some level of salvage. The snag felling involved in the 2002 suppression activities, as displayed in Table A-1 of Appendix A, involved the felling of approximately 300 to 400 trees, which reduced snag levels but increased down wood levels. Road developments, as displayed in Table A-6 of Appendix A, have had an influence in snag levels by increasing the amount of area considered to be a hazard resulting in the felling and harvest of road-side hazard snags. Personal use firewood cutting, as displayed in Table A-12 of Appendix A, has decreased snag levels across the District. The salvage on BLM land, as displayed in Table A-15 of Appendix A, is so small in comparison to the fire that there is likely no cumulative impact.

Hermit Thrush

Existing Condition

Hermit thrush abundance is significantly less in precommercial thinned versus unthinned stands, and is positively correlated with foliage volume of shrubs and small trees indicating a preference for areas having a dense understory (Altman 2000). The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically appropriate, initiate actions in mixed conifer forests to maintain or provide for patches of forest with multi-layered structure and a dense understory shrub layer (Altman 2002).

The conservation issue identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000) is:

1. Alteration of habitats (loss of understory and structural complexity) from fire, grazing, and winter recreational activities.

Habitat does exist within the project area. However, the majority of the mixed conifer habitat within the project area is within the riparian zones that generally experienced moderate to high vegetation mortality and, therefore, generally do not provide for dense conditions. In the areas that burned light to moderate, habitat has likely decreased due to the loss of understory regeneration, structure, and shrubs.

There are many documented sightings of hermit thrush within the project area. No specific hermit thrush surveys were conducted for this project. Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Hermit thrush were detected at all locations. Below is the total number of detections of hermit thrush from 1994 to 2001:

Table 3.92 Hermit thrush sightings at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek

Location	1994	1995	1996	1997	1998	1999	2000	2001
Bottle Springs	2.5	1	2	3	3	2	0	0
Graham Creek	0	1	0	0	0	0	0	0
Guyer Creek	1	2	2	0	2	3	0	2
West Fork Silver Creek	1	1	0	2	2	2	0	1

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

This alternative has no proposed fuels treatment so the likelihood of naturally regenerated stands and the remaining habitat that burned light to moderate, have the potential to have fuels conditions that would contribute to future high intensity fires, more so than if the fuels were managed. No proposed planting would also result in a delayed advancement of future hermit thrush nesting and foraging habitat.

Conclusions for Alternative A

The no action alternative would not remove, modify, or alter any hermit thrush habitat.

Alternative C, D, E, G, and H

In the action alternatives, prescribed fire is the only activity that has the potential to effect hermit thrush habitat. Burning may further reduce the understory regeneration and complexity and shrub component for which hermit thrush select. Alternatives C and G propose 3,572 acres of prescribed fire, Alternatives D and H propose 2,450 acres of prescribed fire, and Alternative E proposes no prescribed fire.

Planting and fuels reduction are expected to reduce the likelihood of fuels conditions that would contribute to future high intensity fires and would accelerate development of future foraging and nesting habitat. Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire, and planting would produce hermit thrush habitat much more quickly into the future than natural regeneration under Alternative A.

Conclusions for alternatives C, D, E, G, and H

It is expected that the proposed prescribed fire is not large enough in scale to affect hermit thrush populations under any of the action alternatives. Salvage activities may have a direct effect on hermit thrush nesting.

In the long term, planting and fuels reduction may improve hermit thrush habitat. The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E

proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on hermit thrush while considering the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000), and the following activities have the potential to produce a cumulative effect. Past timber harvest activities, as displayed in Table A-2 of Appendix A, and fire suppression activities, as displayed in Table A-1 of Appendix A, have likely increased hermit thrush habitat by increasing understory regeneration and complexity, and shrubs. However, the loss of overstory large ponderosa pine and white fir has likely had a negative impact on hermit thrush.

Fuels reduction projects that have occurred within the project area, as displayed in Table A-3 of Appendix A, include prescribed fire and understory thinning. These activities are generally designed to create a mosaic, thereby creating a mix of understory conditions. This has likely improved habitat for hermit thrush. Grazing, as displayed in Table A-8 and A-17 of Appendix A, has likely reduced understory forage, but has not been intensive enough to inhibit seedling regeneration. Grazing has also increased the cowbird population that has led to brood parasitism and the possible reduction in hermit thrush populations. Noxious weed treatments, as displayed in Table A-4 of Appendix A, have decreased the likelihood of noxious weeds out-competing native grasses.

Olive-sided Flycatcher

Existing Condition

Olive-sided flycatchers are aerial insectivores that breed in natural or man-made openings and edges of coniferous forests where tall trees and snags are present for singing and foraging perches (Altman 2000). The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically and socially appropriate, through natural events or management, to maintain greater than 2 percent of the landscape as post-fire habitat and greater than 40 percent of the landscape as unsalvaged (Altman 2002). Where salvage logging is occurring in post-fire old ponderosa pine forests, maintain or provide in burns greater than 100 acres, greater than 50 percent of the standing and down wood unsalvaged. In all burns, retain all trees/snags greater than 20 inches dbh and greater than 50 percent of those 12 to 20 inches dbh. In addition, retain patches with a mix of live and dead trees/snags to provide for potential nest trees (live) within the context of potential foraging and singing perches (dead) (Altman 2000).

The conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000) are:

1. Changes in fire regimes that has resulted in fewer fires, but larger more destructive fires that has reduced the amount of edge of early and late seral forest (Wisdom et al. in press).

2. Brush control and grazing limit understory growth that provides insect productivity.

3. Insect control during the breeding season could limit prey availability and reduce olive-sided flycatcher productivity.

Habitat does exist within the project area. The variety of burn severities within the fire has created a mosaic of burned and unburned areas, thereby creating an increase in edge habitat preferred by olive-sided flycatchers.

There are many documented sightings of olive-sided flycatchers within the project area. No specific olive-sided flycatcher surveys were conducted for this project. Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Olive-sided flycatchers were detected at Bottle Springs and Graham Creek. Below is the total number of detections of olive-sided flycatchers from 1994 to 2001:

Table 3.93 Olive-sided Flycatcher Sightings at Bottle Springs and Graham Creek

Location	1994	1995	1996	1997	1998	1999	2000	2001
Bottle Springs	0	0	0	0	0	0	0	1
Graham Creek	0	0	0	0	1	2	1	1

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

This alternative provides optimal conditions for olive-sided flycatchers. With increased nesting opportunities as snags begin to soften and foraging opportunities as the aerial insect population increase, an increase in olive-sided flycatchers populations within the burned area is expected until the large trees begin to fall (20 to 30 years).

Alternative C, D, E, G, and H

The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically and socially appropriate, through natural events or management, to maintain greater than 40 percent of a post-fire landscape unsalvaged (Altman 2000). Including all acres in all mortality classes, 42 percent of the areas proposed for salvage would remain unlogged in Alternative C, 75 percent in Alternative D, 54 percent in Alternative E, 43 percent in Alternative G, and 48 percent in Alternative H.

Conclusions for Alternatives C, D, E, G, and H

Any harvest or activity during the breeding season may have a direct effect on nesting. It is expected that all alternative would provide sufficient habitat for olive-sided woodpeckers.

Cumulative Effects Common to All alternatives

All of the activities in Appendix A have been considered for their cumulative effects on olive-sided flycatchers while considering the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000), and the following activities have the potential to produce a cumulative effect. Due to past harvest management, including roadside hazard, fire suppression, snag removal, and overstory removal, snag numbers have declined from pre-fire historical levels. Past timber harvest activities, as described in Table A-2 and A-13 of Appendix A, and fire suppression, as described in Table A-1 of Appendix A, have changed overall stand conditions on National Forest System and private lands, resulting in the forest succession from an open pine forest to a dense mixed conifer-dominated forest, and from the direct removal of snag habitat.

Prescribed fire has also likely increased snag levels locally with individual snag creation and small 1 to 10 acre patches of heavy fire mortality. Wildfires, as displayed in Table A-1 of Appendix A, have increased snag number in the short term, but, for the most part, past wildfires have experienced some level of salvage. The snag felling involved in the 2002 suppression activities, as displayed in Table A-1 of Appendix A, involved the felling of approximately 300 to 400 trees which reduced snag levels, but increased down wood levels. Road developments, as displayed in Table A-6 of Appendix A, have had an influence in snag levels by increasing the amount of area considered to be a hazard resulting in the felling and harvest of road-side hazard snags. Personal use firewood cutting, as displayed in Table A-12 of Appendix A, has decreased snag levels across the District. The salvage on BLM land, as displayed in Table A-15 of Appendix A, is so small in comparison to the fire that there is likely no cumulative impact.

The Winter Fire is directly adjacent to the Toolbox and Silver Fires to the east. This fire was approximately 34,000 acres and currently only approximately 3,000 acres are proposed for salvage harvest. This fire is a mix of conditions including forested, unforested, and plantations. Within the 3,000 acres proposed for salvage, snag retention guidelines would assure the retention of snags to meet cavity dependent species habitat. In addition, approximately 1,500 acres of the Toolbox and Silver Fires located in the Bridge Creek and Ana Reservoir Subshed would not be proposed for salvage and would provide additional habitat for olive-sided flycatchers.

Black-backed Woodpecker

Existing Condition

Refer to the Snag and Down Wood Dependent Species section of the Fremont National Forest Management Indicator Species discussion in this Wildlife section.

Sandhill Crane

Existing Condition

Sandhill cranes nest, roost, and rear young in wet meadows and forage in dry and wet meadows (Altman 2000). The biological objectives for habitat recommended in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are, where ecologically appropriate, initiate actions in wet/dry meadows to maintain or provide tracts of suitable habitat greater than 300 acres where both wet and dry meadows are part of the meadow complex. Where only wet meadow habitat is present, tracts can be smaller (less than 20 acres) if dry meadow habitat is present within 0.3 miles. Manage hydrology, where appropriate, to include both wet and dry meadow habitat throughout the nesting season (Altman 2000).

Some of the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* are (Altman 2000):

1. Livestock grazing may reduce habitat suitability of not managed properly and interfere with reproductive success.
2. Conifer invasion at edge of meadows.
3. Susceptible to human disturbance.

Habitat does exist within the project area. Historical nest sites are located at Buckaroo Lake, Grassy Lake, Labrie Lake, and Thompson Reservoir. No specific sandhill crane surveys were conducted for this project.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

The no action alternative would not remove, modify, or alter any sandhill crane habitat.

Alternative C, D, E, G, and H

The areas mentioned above are considered to be Class 3 Riparian Habitat Conservation Areas, all of which would be buffered under all action alternatives. These areas would be buffered by 75 feet in Alternatives C, E, and G, and by 150 feet in Alternatives D and H, both of which would be sufficient for sandhill crane habitat. In addition, these meadows would not receive planting within 200 feet of the meadow to prevent encroachment into these meadow systems.

Conclusions for Alternatives C, D, E, G, and H

In all action alternatives, no harvest would occur immediately adjacent to any open meadows. The disturbance involved with salvage activities may have a direct effect on sandhill crane nesting.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on sandhill cranes while considering the conservation issues identified in the *Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington* (Altman 2000), and the following activities have the potential to produce a cumulative effect. Any activities associated with dozer line construction from the 2002 fire suppression activities, as displayed in Table A-1 of Appendix A, may have had a localized negative effect on sandhill crane habitat. Fire suppression has led to the expansion of conifers into meadow systems, thereby reducing habitat for sandhill cranes. Minimal effects may occur as a result of ongoing recreational activities adjacent to meadows, as displayed in Table A-5 of Appendix A, from trails and human disturbance.

Grazing, as displayed in Table A-8 of Appendix A, likely has had the largest influence on sandhill crane habitat. Cattle use and disturbance adjacent to meadows has decreased habitat for sandhill cranes. Allotments that receive late season grazing likely experience a higher degree of disturbance. Any diversions or reservoirs, as displayed in Table A-10 of Appendix A, have likely had both a negative influence on sandhill cranes by diverting water to larger waterbodies rather than shallow meadow complexes. Future grazing, as displayed in Table A-17 of Appendix A, had the greatest likelihood of negatively affecting sandhill crane habitat in the future, however the current grazing strategies and annual operating plans appear to retain suitable habitat. With all cumulative effects considered, including the activities associated with this project, it is likely there would be little effect on sandhill cranes or their habitat.

Red-naped Sapsuckers

Existing Condition

Refer to the Snag and Down Wood Dependent Species discussion under Fremont National Forest Management Indicator Species in this Wildlife section.

Other Species, Habitats, and Wildlife Issues of Concern

Table 3.94 Other Species, Habitats, and Wildlife Issues of Concern

Other Species, Habitats, and Wildlife Issues of Concern	Page Number
Neotropical Migratory Birds and Songbirds	3-218
Designated Old Growth	3-220
Connectivity Corridors	3-222
Fragmentation	3-223
Rocky Mountain Elk	3-224
Wild Turkeys	3-226

Neotropical Migratory Birds and Songbirds

Existing Condition

Neotropical migratory birds are those that breed in the United States and winter south of the border in Central and South America. They include a large group of species, including many hawks, shorebirds, warblers, and other song birds, with diverse habitat needs spanning nearly all successional stages of most plant community types (Niles 1992). Nationwide declines in population trends for neotropical migrants have developed into an international concern.

Some neotropical migratory birds have a positive effect from fires, while others have a negative effect. It is possible that the decline of some neotropical migratory bird species, such as the olive-sided flycatcher, is linked to a century of fire suppression in western forests (Sallabanks and McIver 1998). Overall, wildfire was found to have a somewhat negative effect, reducing bird species richness wherever burn intensity was the highest (Sallabanks and McIver 1998).

Within the project area, it is expected that species richness and overall species abundance has decreased as a result of the fire, with these measures decreasing as burn intensities increase. Species that are foliage or crown feeders and overstory nesting species may disappear within the high intensity burn areas. Some of these local species may include the golden-crowned kinglets, mountain chickadees, hermit thrush, ruby-crowned kinglet, yellow-rumped warbler, and western tanager. An increase in flycatchers, seedeaters, and cavity nesters is expected. Local species that may benefit from the fire include the olive-sided flycatcher, western-wood peewee, Hammond's flycatcher, dusky flycatcher, cordilleran flycatcher, dark-eyed junco, Cassin's finch, evening grosbeak, American robin, and several primary and secondary cavity nesters. Species

that require more open ponderosa pine habitats such as the white-headed woodpecker, flammulated owl, chipping sparrow, Townsend's solitaire, and pygmy nuthatch likely would increase in the stands that experienced low to moderate vegetation mortality as understory densities decreases as a result of the fire. The species which prefer more dense understories, such as the Townsend's warbler, red-breasted nuthatch, warbling vireo, American robin, spotted towhee, and Nashville warbler may decrease as a result of the fire (OR/WA partners in Flight 2001).

Neotropical point count surveys were conducted on the Silver Lake Ranger District at designated locations from 1994 to 2001. Four of the locations are within the project area located at Bottle Springs, Graham Creek, Guyer Creek, and West Fork Silver Creek. Monitoring would continue at the West Fork Silver Creek location to compare pre- and post-fire bird responses.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

This alternative provides the greatest opportunity for maintaining nesting and foraging habitat for those species that respond well to fire. Most notably, habitat would be maintained for the olive-sided flycatcher, which is a rapidly declining species. Local populations of neotropical migratory bird species that utilize burned areas may increase.

Alternative C, D, E, G, H

Bird species richness has already decreased due to the high intensity of the burn. Due to the differing responses of individual species to tree size class and density, leaving variable clump sizes, variable diameter sizes, and unsalvaged areas in these alternatives would help assure that habitat is provided for a variety of species. Habitat maintenance for species that utilize burned areas is greatest with Alternative D, which proposes the least amount of harvest. Alternative C proposes 14,441 acres of salvage, Alternative G proposes 14,419 acres of salvage, Alternative H proposes 13,031 acres of salvage, Alternative E proposes 11,490 acres of salvage, and Alternative D proposes 6,367 acres of salvage.

Salvage logging between May and August may have direct effects on Neotropical migratory bird nesting. However, logging is only expected to take place for one year and, therefore, the effects would be short-term. Although little is known about the effects of salvage logging in stand replacement fires on Neotropical migratory birds, it is expected that salvage of snags within harvest units under these alternatives could have a negative effect on potential population numbers of cavity nesting birds. Within areas designated for no harvest, there is expected to be little effect on Neotropical birds. Potential population numbers for grass and shrub nesting birds is expected to increase in the all areas in the long-term.

Conclusions for Alternatives C, D, E, G, and H

Overall, some species will be negatively affected in some areas due to salvage harvest in the short-term, while other species will be positively affected in the short-term within the areas of no-harvest. In the long-term, sufficient habitat within harvest and no-harvest areas should be retained to provide for viable populations of all Neotropical migratory birds.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on neotropical migratory birds, and the following activities have the potential to produce a cumulative effect. Because neotropical birds include such a wide range of species, all activities benefit some species while negatively impacting others. Past timber management activities, as displayed in Table A-2 of Appendix A, and fire suppression activities, as displayed in Table A-1 of Appendix A, have converted open ponderosa pine stands to those with dense understories favoring those species that prefer dense understories. Current silvicultural activities and prescribed fire are converting these dense stands to more open ponderosa pine stands, favoring those that prefer open stand conditions. Noxious weed treatments, as displayed in Table A-4 of Appendix A, have decreased the likelihood of noxious weeds out-competing native grasses.

Livestock grazing, as displayed in Table A-8 and A-17 of Appendix A, has likely decreased the grass/forbs and shrub communities that may have a negative effect on ground-nesters. However, the current management plans and operating plans currently in place appear to be adequate to maintain shrubs and grass/forbs in the project area. Grazing has also increased the cowbird population that has led to brood parasitism and the possible reduction in some populations of neotropical migratory bird species. The aspen treatments identified in Table A-9 of appendix A has likely improved

habitat for species that nest in aspen, while the juniper thinning identified in this Table A-9 has likely decrease habitat for species that nest in juniper. Although cumulative activities have caused alterations in habitat that favored some species over others, monitoring indicates that neotropical migratory bird viability has not been affected for most species.

Designated Old Growth

Existing Condition

The Fremont LRMP includes Management Areas 3 and 14. Management Area 3 is old growth habitat for dependent species above the management requirement level and Management Area 14 is old growth to provide management requirements for dependent species (1989). These management areas are to help maintain viable populations of dependent native vertebrate species including goshawks, black-backed woodpeckers, pine marten, and pileated woodpeckers (1989). As stated in the LRMP, "salvage activities would take place only when catastrophic events occur (such as wildfire, insect infestations, windthrow, etc.) and the affected old growth stand is no longer considered suitable old growth habitat. A new old growth stand should be delineated to replace the original habitat" (1989).

Within the Toolbox and Silver Fires, sixteen Management Area 3 and 14 old growth stands (1,191 acres) were affected to some degree by the fire. Each individual old growth stand was assessed on the ground to determine if the stand remains as functional habitat for the species for which it is designated. Each old growth area was mapped individually into four vegetation mortality categories (0 to 25 percent, 25 to 50 percent, 50 to 85 percent, greater than 85 percent) to assist in determining if the area is still functional. For old growth areas that are managed for species whose habitat requirements include green stands with large trees and high canopy closure, such as the goshawk, pileated woodpecker, and pine marten, the majority of the old growth area needed to be less than 50 percent mortality, preferably less than 25 percent mortality. If it was determined that the stand remains functional, no harvest would occur within the old growth area. If is was determined that the stand is non-functional, harvest would occur within the existing old growth area and a new old growth stand was mapped. Replacement old growth areas were identified using the Region 6 Interim Old Growth Definitions (Hopkins et al. 1992) as a guide and the fieldwork included the following procedures:

> Random plots were placed on aerial photos 200 to 300 feet apart in areas that appeared to have potential. At each plot, a basal area factor of 10 was used to gather the data. The trees in each plot were counted and recorded. The results revealed the approximate number of trees per acre 16 or more inches dbh. Notes were also taken on the abundance of snags and down wood in the stand.

For old growth areas that are managed for species whose habitat is improved with post fire conditions, such as the black-backed woodpecker, the old growth areas may include areas of high vegetation mortality, or greater than 50 percent mortality. These areas would remain as designated old growth areas (MA 3 or 14) for approximately 10 years when it is expected the trees would have fallen and the stand would no longer provide the habitat required for black-backed woodpeckers. Potential replacement areas have been identified and would be reevaluated in 10 years to determine if they meet the criteria for old growth. At this time, these potential replacement areas would experience no harvest and the land management allocation would not change for approximately 10 years and would occur under another NEPA document. Total acres of old growth affected under this NEPA decision would increase from 1,191 to 1,267 acres.

Table 3.95 Management Area 3 and 14 Allocated Old Growth Within the Project Area

Old Growth Area	Management Area	Fire	Species	Functionality Determination	Acres of Original Old Growth Area	Acres of Replacement Old Growth Area`
PPGOGO414015	14	Silver	Goshawk	Functional	60	
PPGOGO414109	14	Silver	Goshawk	Functional	61	
PPGOGO414112	14	Silver	Goshawk	Functional	61	
LPTTTT403049	3	Silver	Black-backed Woodpecker	Functional	72	

Table 3.95 Management Area 3 and 14 Allocated Old Growth Within the Project Area (continued)

Old Growth Area	Management Area	Fire	Species	Functionality Determination	Acres of Original Old Growth Area	Acres of Replacement Old Growth Area`
LPTTTT414050	14	Silver	Black-backed Woodpecker	Non-functional Replace in 10 years	56	
LPTTTT414041	14	Silver	Black-backed Woodpecker	Functional	80	
LPTTTT414040	14	Silver	Black-backed Woodpecker	Non-functional Replace in 10 years	116	
LPTTTT414038	14	Silver	Black-backed Woodpecker	Functional	66	
PPGOGO414002	14	Toolbox	Goshawk	Non-functional Replace immediately	71	71
PAGOGO414136	14	Toolbox	Goshawk	Non-functional Replace immediately	97	128
LPTTTT403107	3	Toolbox	Black-backed Woodpecker	Non-functional Replace in 10 years	76	
PPGOGO414105	14	Toolbox	Goshawk	Functional	115	
PPGOGO414109	14	Toolbox	Goshawk	Non-functional Replace immediately	68	68
PAGOGO414108	14	Toolbox	Goshawk	Non-functional Replace immediately	80	121
PPGOGO414122	14	Toolbox	Goshawk	Functional	52	
PPGOGO414106	14	Toolbox	Goshawk	Non-functional Replace immediately	60	64

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

This alternative does not offer the opportunity to reallocate non-functional old-growth areas within the project area.

Alternative C, D, E, G, H

Conclusions for Alternatives C, D, E, G, and H

Salvage is proposed in the designated old growth stands that are no longer functional. No harvest or other activities would occur within the existing old growth stands that are functional or the stands designated to replace the non-functional old growth stands. Old growth areas identified for immediate replacement would be reallocated from Management Area 5 to Management Area 3 or 14 under the Forest Plan. Replacement areas identified for replacement in 10 years would be analyzed under a separate NEPA decision. Total acres of old growth affected under this NEPA decision would increase from 1,191 to 1,267 acres.

Increased snags and future down wood have likely improved habitat for old growth dependent species. Reducing fuel loadings adjacent to old growth areas should prevent the functional and replacement old growth areas from experiencing a large stand replacement fire. The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment,

Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on old growth, and the following activities have the potential to produce a cumulative effect. Designated old growth areas were identified on the District after the most recent LRMP decision in 1989. As recommended in the LRMP, these areas have only received treatments that are designed to protect and enhance the area as old growth. Prescribed fire, as displayed Table A-3 of Appendix A, and understory thinning, as displayed in Table A-2 of Appendix A, 3 are some examples of treatments designed to enhance and protect old growth. Overall, there has been very little cumulative effect on designated old growth.

Connectivity Corridors

Existing Condition

The Regional Forester's Amendment #2 requires the identification of connectivity corridors designed to connect designated old growth areas and LOS habitat types across the landscape. These corridors are to allow movement and interaction of adults and dispersal of young. Corridors do not necessarily meet the same description of “suitable” habitat for breeding, but allow free movement between suitable breeding habitats. Connectivity corridors are considered stands in which medium to larger trees are common and canopy closure are within the top-third of site potential. Stand widths should be at least 400 feet wide at their narrowest point, unless it is impossible to meet the 400 foot width with current vegetative conditions. If these stands meeting these descriptions are not available, the next best available habitat would be identified. Harvesting within connectivity corridors is permitted if all the criteria in the above can be met and if the amount of understory is left in patches or scattered to assist in supporting stand density and cover.

Connectivity corridors were identified and mapped prior to the fire. Because of the fire and change in old growth locations, these areas were reevaluated to determine if they still function as connectivity corridors. Using vegetation mortality mapping and post fire aerial photos, each connectivity corridor was evaluated to determine if it appeared to be functional. If it appeared to be non-functional due to the degree of vegetation mortality or a change in old growth location, a new connectivity corridor was identified in the best available habitat, preferably in the less than 50 percent vegetation mortality category. In most cases, the newly identified connectivity corridors are marginal due to the fragmentation resulting from the fire.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

This alternative would have no effect on connectivity corridors.

Alternative C, D, E, G, H

Limited salvage is proposed in the functional and replacement connectivity corridors. Of the approximately 4,000 acres of connectivity corridors identified for this project only 307 acres are proposed for harvest in Alternatives C and G, 305 in Alternative H, 268 in Alternative E, and 251 acres in Alternative D. Within the connectivity corridors that are not proposed for salvage, high snag levels would provide for the unique habitat required by many species. The connectivity corridors would provide continuity for woodpeckers and other snag and down wood dependent species across the project area and aid in reducing large-scale fragmentation.

Reducing fuel loadings adjacent to the corridors should prevent the functional and replacement connectivity corridors from experiencing a large stand replacement fire.

Conclusions for Alternatives C, D, E, G, and H

Within areas of connectivity corridors proposed for harvest, it is expected that the snag retention guidelines, as described in Section F of this Wildlife section, would be sufficient for the purposes of functional connectivity corridors.

The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. The identified connectivity corridors that experienced moderate to high vegetation mortality would receive planting, but no site-pre or fuels treatment would occur to maintain the snag habitat.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on connectivity corridors, and the following activities have the potential to produce a cumulative effect. Connectivity corridors were identified on the District after the direction from the Regional Forester's Amendment #2 became effective in 1994. As recommended, only treatments that could would maintain the site potential, as described above, and further enhance the area as a connectivity corridor have been applied. Prescribed fire, as displayed Table A-3 of Appendix A, and understory thinning, as displayed in Table A-2 of Appendix A, 3 are some examples of treatments designed to enhance and protect identified connectivity corridors. Overall, there has been very little cumulative effect on connectivity corridors on the District.

Fragmentation

Existing Condition

Fragmentation occurs when an expanse of habitat is broken into two or more patches separated by different types of habitat. Fragmentation can lead to habitat loss, edge effects, and patch size effects. "Patches" refer to contiguous areas of fairly homogeneous vegetation conditions. "Edge" refers to the margins of patches. There are inter-relationships between patch sizes, the amount of edge, and the area in the interior of patches.

There is also a level of "natural" fragmentation related to landscape physiography. For example, contrasting vegetation edges occur where there are changes in aspect as well as changes in soil types or geology. Native wildlife species have evolved in a landscape with a high degree of fragmentation, abundant edge, and relatively small patch sizes as a result of natural processes and topography.

Silvicultural practices on the Silver Lake Ranger District created openings that, in general, are probably larger then those created through historic fire events in the ponderosa pine communities. Had fire played a more natural role on the landscape, it is expected that the land would be continuous and that openings, in general, would be less than 5 acres in size. Roads also play a role in fragmentation of habitat. Disturbance, whether it is achieved through fire or other silvicultural practices, is needed to maintain some level of fragmentation, edges, and patches to provide for the diversity of habitats consistent with the natural range of conditions.

The Toolbox and Silver Fires created a wide variety of patch sizes. Overall, the fire created a mosaic of different burn severities that range in size from 1 acre to 790 acres in size. The vegetation mortality mapping can be used as a tool to determine the patch type and size created by the fire, although recognizing the patches could be reduced even further using other factors including vegetation, slope, and past silvicultural practices. Patches of 0 to 25 percent vegetation mortality range from 1 to 790 acres in size, patches of 25 to 50 percent vegetation mortality mapping range from 1 to 450 acres in size, patches of 50 to 85 percent vegetation mortality range from 1 to 295 acres in size, and patches of greater than 85 percent vegetation mortality range from 1 to 650 acres in size.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action), C, D, E, G, and H

Current vegetation patterns are a product of topography, historical fire regimes, fire suppression, management activities and other natural factors that combine to produce a diverse landscape, including vegetation ranging from grasslands to old growth forests. The landscape has always been naturally fragmented to some degree by natural factors, especially topography. Patch sizes have been highly variable over time, primarily due to fire, the single greatest force in shaping the vegetation patterns of the District.

Conclusions for All Alternatives

None of the alternatives would have an effect on patch sizes or fragmentation of habitats, because none of the proposed actions would substantially alter the juxtaposition of post fire vegetation. However, the proposed road closures or decommissioning would have a positive effect on fragmentation. Alternative D proposes to close 147.1 miles, Alternative H proposes to close 144.5 miles, Alternative C proposes to close 141.9 miles, and Alternative E and G 82 propose to close miles.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on fragmentation, and the following activities have the potential to produce a cumulative effect. Past harvest, including clearcutting, as displayed in Table A-2 of Appendix A, has increased fragmentation by creating openings. However, these opening are small and tend to be less than 40 acres. Timber harvest on private land, as described in Table A-13 of Appendix A, has a larger affect by creating very large-scale openings and plantations. Wildfires, as displayed in Table A-1 of Appendix A, have also contributed to creating larger openings than fire likely created historically. Road developments, as displayed in Table A-6 of Appendix A, has also divided the landscape

Rocky Mountain Elk

Existing Condition

Elk forage in a variety of habitats that vary with the season and location. Generally, elk eat grasses and parts of woody plants in winter; grass in spring and fall; grass and forbs (low-growing, soft-stemmed plants) in summer. Meadows and forest opening typically provide foraging habitat for elk. Elk also need cover to hide from predators and to moderate weather conditions, although hiding covers seems the more important of the two. LRMP Standards and Guidelines address habitat for this species only pertaining to special habitats such as licks, calving areas, and wallows.

This area is within the South Central Elk Management Zone and the management objective is 3,000 elk. The population is thought to be stable to slightly increasing (Hedrick, personal communication). The area of the proposed project is within the Interstate Herd summer range. The fire improved foraging habitat for elk, but cover habitat was reduced.

Environmental Consequences

Direct and Indirect Effects

Overall, down wood percent cover is extremely low in all alternatives. Cover for elk would be minimal for many years until conifers are re-established through natural regeneration or planting. The few small patches of cover that remain in the fire are likely to get heavy use from elk. Forage production in the form of grasses and forbs is expected to increase. Although forage may improve, cover may be limited to the point of ineffectiveness in much of the interior of the burn. Increased down wood levels in the future are expected to improve calving habitat by increasing calving protection.

Mountain mahogany stands that burned severely would be monitored for natural regeneration. If it appears that natural regeneration is not occurring within the next 5 to 10 years, mountain mahogany planting or seeding may be considered under another NEPA decision.

Alternative A (No Action)

Conclusions for Alternative A

No harvest would allow the burned area to recover at a natural rate. This would result in a more delayed return of cover than with Alternatives C, D, E, G, and H. This alternative does not offer the opportunity to close or decommission any existing roads, which would increase elk security. Although elk population numbers are expected to increase with this alternative, distribution and use as a result of the project activities may change.

Alternatives C and G

Although cover would remain limited for many years, planting under these alternatives is expected to provide cover at a much quicker rate (approximately 10 to 15 years) than Alternative A. With a diversity in planting with variable spacing and trees per acre, some areas would recover as hiding cover more quickly while some areas would remain open for forage longer. This treatment is expected to provide a distribution of cover to forage in the long term that is favorable to elk. The

few small patches of cover that remain in the fire are likely to get heavy use from elk. Forage should remain plentiful within the plantations until the stands begin to close in (30 to 40 years). Planting at lower densities of 130 to 250 trees per acres would provide foraging habitat longer into the future. The silvicultural prescription for the plantation thinning would all be designed to maintain cover. This should open up plantations and improve forage production, thereby producing a mix of cover and forage that is optimal for elk.

These alternatives would have a slight effect on cover. It is estimated that the proposed prescribed burning may reduce cover within existing cover stands by 35 percent. Although the loss of cover is marginal, overall cover loss due to the fire was significant and further loss may have a negative effect on elk habitat.

Table 3.96 Effects of Cover Loss in Alternatives C and G

	Lower Duncan Creek Subshed Summer Range	Upper Duncan Creek Subshed Summer Range	East Duncan Creek Subshed Summer Range	East Duncan Creek Subshed Transition Range
Acres of existing cover stands proposed for prescribed fire	96 acres	100 acres	231 acres	33 acres

Conclusions for Alternatives C and G

Alternative C has a greater effect on elk security than Alternative G by closing 141.9 miles of road versus 82 miles of road in Alternative G. Salvage alternatives may result in a delayed or slower rate of response for some forage species. Elk populations are expected to increase with these alternatives and distribution and use as a result of the fire in the local area may change.

Alternatives D, E, and H

Although cover would remain limited for many years, planting under these alternatives is expected to provide cover at a much quicker rate (approximately 10 to 15 years) than Alternative A. With a diversity in planting with variable spacing and trees per acre, some areas would recover as hiding cover more quickly while some areas would remain open for forage longer. This treatment is expected to provide a distribution of cover to forage in the long term that is favorable to elk. The few small patches of cover that remain in the fire are likely to get heavy use from elk. Forage should remain plentiful within the plantations until the stands begin to close in (30 to 40 years). Planting at lower densities of 130 to 250 trees per acres would provide foraging habitat longer into the future. The silvicultural prescription for the plantation thinning would all be designed to maintain cover. This should open up plantations and improve forage production, thereby producing a mix of cover and forage that is optimal for elk.

Conclusions for Alternatives D, E, and H

Alternative D and H have a greater impact on elk security than Alternative E by closing 147.1 and 144.5 miles of road, respectively, versus 82 miles of road in Alternative E. Salvage alternatives may result in a delayed or slower rate of response for some forage species. Elk populations are expected to increase with these alternatives and distribution and use as a result of the fire in the local area may change.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on elk and the following activities have the potential to produce a cumulative effect. Past management activities have likely increased the potential habitat for elk within the project area. Timber harvest, as displayed in Table A-2 of Appendix A, in conjunction with fuels reduction projects, as described in Table A-3 of Appendix A, have likely improved elk habitat by burning shrubs and increasing grass and forbs. Recreation activities, as described in Table A-5 of Appendix A, may have some effect on elk security near campgrounds or other recreational sites. Grazing, as described in Table A-8 of Appendix A, has created competition with elk for early green-ups, forbs, and winter browse. However, the current management plans and operating plans currently in place appear to be adequate to maintain grass/forbs in the project area. Noxious weed treatments, as described in Table A-4 of Appendix A, have reduced the spread of noxious weed, which maintains native vegetation for elk forage.

Wildlife and watershed improvement projects, as described in Table A-9 of Appendix A, include aspen enhancement and juniper thinning projects. Aspen enhancement increases regeneration, a valuable forage for elk, and juniper thinning increases forage and production in areas where the juniper is out-competing the native vegetation. Down wood loss

through personal use firewood cutting, as described in Table A-12 of Appendix A, and through past timber management activities, as described in Table A-2 of Appendix A, have decreased calving habitat and protection. Road construction, as displayed in Table A-6 of Appendix A, has reduced elk security, although efforts to close and decommission roads (approximately 60 miles in the West Fork Silver Creek, Upper Silver Creek, Thompson Reservoir, and Benny Creek Subsheds), as displayed in Table A-9 of Appendix A, are reducing this effect.

Reasonably foreseeable future activities include treatments within the Bridge Creek Subshed and treatments displayed in Table A-16 of Appendix A within the project area subsheds. It is anticipated that prescribed fire and silvicultural treatments that move dense stands to a more open condition would increase forage. Riparian improvements, including the large woody debris placement projects in the West Fork Silver Creek (Table A-16 of Appendix A) and in the Bridge Creek Subshed would likely increase riparian vegetation and likely improve elk habitat and success. Grazing, as displayed in Table A-17 of Appendix A, would continue to occur, and would continue to allow competition with elk for forage resources habitat. Dispersed recreation and hunting would continue to occur, and would directly affect elk. In addition, increases during hunting season contribute to altering movement patterns and habitat use. Cumulatively, all present and future cumulative activities including the activities proposed with this project, would likely increase local elk populations.

Wild Turkey

Existing Condition

Wild turkeys need mature, open forests for traveling and seeing predators interspersed with grassy openings. The amount of openings required ranges from 10 to 25 percent of the total range. In Oregon, wild turkeys prefer to roost in large ponderosa pines on easterly slopes (Fremont National Forest FEIS 1989). Turkeys eat fruits, seeds, tubers, bulbs, and greens of locally common plants, as well as snails, spiders, grasshoppers, millipedes, and salamanders (Fremont National Forest FEIS 1989, Schroeder 1985). Grasses are usually important spring foods and poults rely on insects for protein.

Prescribed burning can be used to stimulate growth of food plants and promote early spring green up of grasses (Fremont National Forest FEIS 1989, Schroeder 1985). Fire can also reduce litter, exposing seeds and insects, and create edges to increase nesting habitat (Fremont National Forest FEIS 1989, Stoddard 1961).

Wild turkeys have only been documented on the north and west side of Hager Mountain, approximately 2 to 3 miles from the project area. No turkeys have been documented on the Silver Lake Ranger District since 1996, and it is thought that the local population may be exterminated due to drought and predation. Habitat does exist within the fire in areas of large open spaced ponderosa pine that burned light to moderate.

Environmental Consequences

Direct and Indirect Effects

Alternative A (No Action)

Conclusions for Alternative A

The no action alternative would not remove, modify, or alter any wild turkey habitat.

Alternatives C, D, E, G, and H

No green ponderosa pine trees would be affected with any of the alternatives, so wild turkey habitat would not be affected. Reforestation and precommercial thinning in the action alternatives would produce mature ponderosa pine stands more rapidly than with no treatments as proposed in Alternative A. Reducing fuel loadings should sustain the existing habitat that remains within the fire and protect future habitat from experiencing a large stand replacement fire and planting would produce wild turkey habitat much more quickly into the future than natural regeneration under Alternative A. The advantages of fuels reduction treatment would be the greatest with Alternative G, which proposes the greatest amount of these treatments, and the least with Alternative D, which proposes the least amount of these treatments. Alternative G proposes 16,950 acres of fuels treatment, Alternative C proposes 10,244 acres of fuels treatment, Alternative H proposes 9,070 acres of fuels treatment, Alternative E proposes 6,723 acres of fuels treatment, and Alternative D proposes 5,680 acres of fuels treatment. The advantages of planting would be the greatest with Alternative C, which proposes the greatest amount of planting, and the least with Alternative H, which proposes the least amount. Alternative C proposes 20,906 acres of planting, Alternative E proposes 20,753 acres of planting, Alternative D proposes 20,743 acres of planting, Alternative G proposes 20,728 acres of planting, and Alternative H proposes 20,721 acres of planting. Logging during the breeding season may cause a disturbance to nesting wild turkeys in Alternatives C, D, E, G, and H.

Conclusions for Alternatives C, D, E, G, and H

There would be no effects to wild turkeys habitat under any of these alternatives. Although there may be direct effects associated with logging activities and individuals may be impacted in Alternatives C, D, E, G, and H, it is not expected to have an impact on local populations or habitat.

Cumulative Effects Common to All Alternatives

All of the activities in Appendix A have been considered for their cumulative effects on wild turkeys, and the following activities have the potential to produce a cumulative effect. Past management activities, as displayed in Table A-2 of Appendix A, and fire suppression activities, as displayed in Table A-3 of Appendix A, have converted open ponderosa pine stands to overstocked stands with dense understories and reduced overall large ponderosa pine trees. This has likely decreased wild turkey habitat. Prescribed burning and understory thinning, as displayed in Table A-3 of Appendix A, have improved conditions by creating more open understory conditions and increasing deciduous vegetation. Grazing activities, as displayed in Table A-8 and Table A-17 of Appendix A, may have a slight impact on wild turkey habitat by reducing grass and forb abundance that provides for insect populations. Locally, wild turkey populations have been largely affected by weather, rather than by the cumulative activities discussed.

Consistency with the Forest Plan

Goshawks: Fremont National Forest LRMP standards and guidelines for goshawks, as amended by the Regional Forester's Amendment #2, are to protect a 30-acre nest core, to delineate a 400-acre post fledging area with an emphasis of maintaining existing LOS stands and enhancing younger stands towards LOS condition, and to protect every known active and historical nest site from disturbance. A 30-acre nest stand and a 400-acre post family fledging area has been delineated for every known historical and active goshawk nest, and this will be done for every new nest discovered through surveys conducted during the summer of 2003. No disturbance is expected because there are no proposed harvest units within ½ mile of a known nest.

Mule Deer and MA 1: LRMP Standards and Guidelines that apply to this project are:

1.) Retain a minimum of 30 percent cover on summer range, 30 percent cover on transition range, and 50 percent cover on winter range. Alternatives C, D, G and H each include the use of prescribed fire outside of harvest areas. The amount and location of the additional prescribed fire in Alternatives C and G is expected to result in a minor decrease in cover in mule deer summer range (Lower Duncan Creek, Upper Duncan Creek and East Duncan Creek subwatersheds) and transition range (East Duncan Creek subwatershed). This would require a site-specific Forest Plan Amendment in relation to mule deer cover for the summer range in Lower Duncan Creek, Upper Duncan Creek, and East Duncan Creek subwatersheds and transition range in East Duncan Creek subwatershed, and in relation to Habitat Effectiveness for the summer range in the Lower Duncan subwatershed. Prescribed fire would be applied to the ground with the intention of creating a mosaic of burned and unburned area and breaking up the continuity of the fuels. Prescribed fire would not occur in existing areas mapped as cover in Alternatives D and H and therefore would not reduce percent cover and would not require a site specific Forest Plan Amendment.

2.) Retain 50 percent HE on summer range, 60 percent HE on transition range, and 80 percent HE on winter range. Habitat effectiveness would not be reduced in any alternative.

3.) Where shrubs are part of the plant community, retain 10 to 20 percent of the project unit in shrubs on summer range and 30 to 40 percent of the project unit in shrubs on transition range. Where bitterbrush is a component on winter range, retain at least 40 percent of the area in bitterbrush distributed throughout the area. Within the areas proposed for prescribed fire in Alternatives C, D, G, and H, the desired condition is to produce a mosaic of shrub habitat and cover while increasing forest sustainability. The objective would be to achieve a 40 - 60 percent ***burned*** / 60 - 40 percent ***unburned*** mosaic, which will likely maintain shrubs on 60 percent of the area proposed for prescribed fire.

4.) Fawning cover should be emphasized in riparian areas where a high density of shrubs, lush forage, and running water are available during the fawning season. In all action alternatives, no harvest would occur immediately adjacent to any Riparian Habitat Conservation Areas which include perennial water sources, except when the perennial stream is within a road buffer identified for harvest. In all action alternatives, this includes only 201 acres of salvage harvest immediately adjacent to perennial water sources. Outside of roadside buffer harvest, Class 1 RHCAs would be buffered by 300 feet in Alternatives D, G, and H and by 200 feet in Alternatives C and E. Class 3 RHCAs would be buffered by 75 feet in

Alternatives C, E, and G and by 150 feet in Alternatives D and H. Snag retention guidelines will provide for sufficient amounts of down wood for fawning protection. In all alternatives, fawning habitat quality will be maintained.

5.) Roads open to motorized vehicle traffic would be managed at a level of 2.5 miles or less per square mile on summer range and 1.0 miles or less per square mile on winter range. Where possible, road densities will be dropped to 1.0 mile or less of open road density per square mile on summer/transition range. Road management objectives will move substantially toward Forest Plan direction on summer/transition range by reducing road densities to from 3.68 miles per square mile to 2.57 miles per square mile in Alternatives E and G, to 1.76 miles per square mile in Alternative C, to 1.72 miles per square mile in Alternative H, and to 1.68 miles per square mile in Alternative D. Road management objectives will move substantially toward Forest Plan direction on winter range by reducing road densities from 2.4 miles per square mile to 1.87 miles per square mile in Alternatives E and G, and to 1.28 miles per square mile in Alternative C, D, and H.

Snags and Down Wood: LRMP Standards and Guidelines, as amended by the Regional Forester's Amendment #2, require that, "All sale activities (including regeneration, select cutting, thinning, or salvage) will maintain snag and green tree replacement/roost trees greater than 15 inches dbh at 100 percent population potential levels of primary cavity excavators, and this should be determined using the best available data on species requirements as applied through current snag models or other documented procedures." The best available science at the time determined this to be 4 snags per acre, 3 snags greater than 15 inches dbh (greater than 20 inches dbh preferred), and 1 snag greater than 10 inches dbh (12 inches dbh preferred). Down wood requirements are to manage for 80 lineal feet of down wood in ponderosa pine communities, and 120 lineal feet of down wood in mixed conifer communities. In all alternatives, snag levels will exceed LRMP Standard and Guidelines, as amended by the Regional Forester's Amendment #2, and down wood levels will exceed LRMP Standard and Guidelines, as amended by the Regional Forester's Amendment #2, in the long term.

Connectivity Corridors: The Regional Forester's Amendment #2 requires the identification of connectivity corridors designed to connect designated old growth areas and LOS habitat types across the landscape. Connectivity corridors are considered stands in which medium to larger trees are common and canopy closure are within the top-third of site potential. Stand widths should be at least 400 feet wide at their narrowest point, unless it is impossible to meet the 400 foot width with current vegetative conditions. If stands meeting these descriptions are not available, the next best available habitat would be identified. Harvesting within connectivity corridors is permitted if all the criteria in the above can be met and if the amount of understory is left in patches or scattered to assist in supporting stand density and cover. All the criteria for connectivity corridors will be met under all alternatives.

Old Growth: The Fremont LRMP includes Management Areas 3 and 14. Management Area 3 is old growth habitat for dependent species above the management requirement level and Management Area 14 is old growth to provide management requirements for dependent species (1989). As stated in the LRMP, "Salvage activities would take place only when catastrophic events occur (such as wildfire, insect infestations, windthrow, etc.) and the affected old growth stand is no longer considered suitable old growth habitat. A new old growth stand should be delineated to replace the original habitat" (1989). This direction has been followed under all alternatives.

Threatened and Endangered Species Habitat – MA 2: In Bald Eagle Management Areas designated as MA 2, "Timber harvest will be used as a management tool to enhance and perpetuate bald eagle habitat where necessary and appropriate" (1989). The management objectives for bald eagle areas are to provide: 1.) an abundance of mature/overmature trees for nesting/roosting platforms, 2.) a minimum of disturbance from people, and 3.) an abundance of food (LRMP 1989). All of these objectives will be met in all alternatives through snag retention guidelines that are adequate for providing nesting/roosting platforms and mitigation measures to avoid disturbance. There will be no effect on foraging habitat. It is also expected that bald eagle habitat will be enhanced and perpetuated through fuels reduction that will reduce the possibility of fuels conditions that would contribute to future high intensity fires and through planting of trees to expedite future bald eagle habitat.

In Peregrine Falcon Management Areas designated as MA 2, the direction is to, "Manage and retain their natural character and a high degree of solitude and to provide an adequate food base" (1989). Timber management activities near an active nest will be managed to provide for a variety of habitats to support an adequate food base (LRMP 1989). In all alternatives, the fire and consequent salvage will likely improve habitat for falcons by creating more openings and providing foraging habitat in the uplands within the fire.

Rocky Mountain Elk: LRMP direction is, where possible, road densities should be reduced to one mile of open road per square mile of summer range. Road management objectives will move substantially toward Forest Plan direction on summer range by reducing road densities to from 3.68 miles per square mile to 2.57 miles per square mile in Alternatives E

and G, to 1.76 miles per square mile in Alternative C, to 1.72 miles per square mile in Alternative H, and to 1.68 miles per square mile in Alternative D.

Other Raptors: LRMP direction states that when an active raptor nest is discovered, the nest tree and four adjacent large trees will be left standing. The nest and perch trees may be harvested after the young have left the area. This direction will be met with the following mitigation measure: If an active raptor nest is found during operation, LRMP Standards and Guidelines would be followed at a minimum. The LRMP states that "major activities such as logging and road construction adjacent (300 yards) to active raptor nests, should be postponed until young have fledged (usually around July 30)" (LRMP, 180). The Wildlife Biologist would be contacted.

Threatened, Endangered, and Sensitive Species: All alternatives, would meet al.l regulatory laws and regulations required for these species.

Monitoring

Methods to monitor the effectiveness of prescriptions designed to maintain habitat for sensitive woodpeckers, including black-backed woodpeckers, Lewis' woodpeckers, and white-headed woodpeckers can be found in Appendix D – Monitoring.

GEOLOGY, GEOMORPHOLOGY, AND SOILS

- Introduction
- Key Issue
- Purpose and Need
- Regulatory Framework
- Background Information
- Analysis Area and Methods
- Existing Condition
- Direct and Indirect Effects
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- Forest Plan Consistency

Introduction

This Geology, Geomorphology, and Soils section discusses erosion and sediment, forest density and soil fertility, and compaction within the Toolbox Fire Recovery Project area and the potential effects of the proposed activities on soil productivity. Two themes pertinent to soil productivity are discussed: loss of topsoil and soil water functions relative to soil compaction.

Key Issue: Effects on Soils, Watersheds, and Aquatic Habitat

Issue Statement: The proposed salvage and connected actions, including temporary road construction, could potentially have adverse effects on watershed and riparian function and cumulatively contribute to adverse effects on soils.

Measurement Indicator: The following indicators will be evaluated for the effects on soil productivity for each of the alternatives:

- Fertility
- Sediment Risk (including the contribution of roads to sediment transport)
- Compaction

Gains and loss in soil productivity are now presented as soil quality gradients. Soil quality differs from the limited soil erosion or loss perspective. In soil quality there is attention to gains and recovery. Soil quality is an ecological awareness of soils as biological systems central to human environmental health. From the broader soil productivity or quality perspective, the interaction among forest composition, cover, and soil biology are considered. The Toolbox Complex burn patterns affect soil quality because they alter forest composition, stand density, and ground cover patterns that affect soil biology (DeBano et al., 1998, ecological report by Frederic Hall, 2003, West and Young, 2000).

In semiarid pine forest soil recovery is a function of forest gaps and it's floristic richness. Soil productivity gains are fostered by the Toolbox project purpose and need actions to a) develop a long-term sustainable forest that functions with fire rather than the current over dense forest (Friedrichsen, 2003) and its extensive fire mortality; b) reducing dense forest fuels loads to reduce adverse soil effects from long residence heating from heavy down fuel, which is to restore grass and shrub fuel load that correspond the soils dark soft "mollic" features; c) recover habitats lost with the fire and the dense

forest which are gap associated semiarid forest soil biology: and d) to restore riparian areas damaged in the Toolbox Fire Complex.

Timely wildfire and forest practices are essential for maintaining healthy pine forests (Biswell, 1989). Re-establishment of historic forest structure in overly dense stands requires prudent actions that take into account the findings of broad scale analyses and at the same time answer several soil resource based questions. For this project, questions raised by both of the watershed analyses that have been completed for this area, need to be addressed. The Silver Creek Ecosystem Analysis (Forest Service, 1997) raised integration questions pertaining to soil compaction or disturbance and sedimentation. So compaction surveys and erosion estimated need to be better related to soil productivity. Fortunately, Water Erosion Prediction Project (WEPP, 2001) technology can help to better estimate soil hydrologic values and functions. Canopy closure well above historic values is identified in Silver Lake Watershed Assessment (Friedrichsen, 2003) sets the stage for soil productivity detritus nutrient topics. The manner in which conifer density corresponds to tree mortality raises questions about sustainable forest structure. The encroachment of ponderosa pine onto Hydric Soils in riparian areas raises wetland loss questions.

Purpose and Need

The purpose and need of this project includes six elements, two of which directly or indirectly relate to soil qualities:

- Reduce future surface fuel loading in order to influence subsequent fire behavior and effects. Reduce the risk of adverse effects on vegetation and soils that can result from long residence heat caused by heavy down fuels.
- Restore riparian areas damaged by the Toolbox Fire Complex.
- Develop a long-term sustainable forest that is maintainable by re-introduction of fire.

Regulatory Framework

Fremont Forest Plan

The Fremont National Forest Land and Resource Management Plan (often referred to as “the Forest Plan”) sets a management goal, for all resource activity, of maintaining or improving soil productivity. Two related goals are to produce thrifty stands of timber and maintain or improve vegetative conditions of rangelands, which affect soil humus, biology, recovery, and productivity.

Long term research is the basis for a broader soil productivity or quality perspective among forest composition, soil fertility, and biology. The thrifty forest gains soil humus, biology, and productivity. Soil humus from a soil microbial point of view varies with carbon nitrogen ratios. Soils with carbon to nitrogen ratios approaching 5 to 1 have high fertility while carbon to nitrogen ratios approaching 100 to 1 have low fertility, and sites with higher total volume of carbon and nitrogen are more productive. Busse’s et al. (1996) sandy eastside pine study areas have carbon nitrogen ratios of about 25 that improved 2 to 3 percent with understory ground cover. With ground cover vegetation there is 30 percent more nitrogen and increases in total volume of carbon and nitrogen. This “store house of nitrogen enriched soil humus” sustains vigorous forest growth. Pine trees with ground cover eclipsed the non ground cover pine site in 12 to 20 years. The time line in this 35-year study indicate likely nutrient re-supply periods that affect eastside pine forest growth. Similarly, statistical analysis of Riegel’s Fremont data set (Riegel 2002) for wet and moist meadows shows promising correlation among carbon and nitrogen and ecological gradient. Soil humus and statue relationships in select riparian habitat may soon facilitate rangeland soil productivity monitoring. The long-term perspective supports the “thrift” semiarid forest goal, with well-developed grassy ground vegetation. For example, Hopkins (1979) ponderosa pine forest should have ample cover and composition of grass and grass-like plants such as Idaho fescue, Wheeler’s bluegrass, and long-stolon sedge.

The second goal for soils: high quality water is understood with thinking similar to infiltration-based WEPP technology. The recognition of the importance of infiltration has a history dating back to the establishment of the National Forest System. Bernhard Fernow, chief of the US Division of Forestry in 1896 stressed infiltration for water regulation as he promoted the expansion of National Forest (Rowley, 1994). Fernow asserted, “If there were no other means by which a forest cover acted as a preserver of water supplies, the mere existence of the root systems, penetrating the soil in all directions and facilitating percolation of the water would be beneficial.” Fernow’s assertion has been born out by subsequent soil conservation and quality findings (Faulkner, 1943, Hillel, 1991, Lamarca, 1996). Similarly, Riegel’s Fremont data set shows promising correlation among infiltration and ecological gradient in select riparian habitat, which will facilitate monitoring soil productivity and addressing rangeland fish and livestock issues.

Forest Service Manuals and Handbooks

Forest Service Manual 2500, Chapter 2520, Watershed Protection and Management, R-6 Supplement 2500-98-1, sets a criterion for detrimental soil condition to not exceed 20 percent, as follows:

Standards and Guidelines:

- For initial entries, plan and design new activities that do not exceed detrimental soil conditions on more than 20 percent of an activity area.
- In areas where less than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 20 percent.
- In areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and the goal is to move toward a net improvement in soil quality and to achieve less than 20 percent detrimental soil conditions in the long term.

A variety of indices have been used to estimating detrimental soil condition. In rangelands, litter cover is popular yet litter's relationship to soil productivity is complex. Still litter cover is useful when it has been correlated to specific plant community dynamics. Currently, litter cover correlation work has not been done for Hopkins' (1979) plant associations. The Forest Plan features erosion, compaction, mass movement, and displacement. Mass movement, displacement, and compaction are physical and geotechnical properties of the soils that vary with the geologic terrain. Mass movement is associated with steep deeply weathered terrains with ample moisture such the Klamath Mountains, where active nested slide complexes are common. Generally low mass movement potential is listed for soil capability areas in the Fremont National Forest. In the Toolbox tablelands weathered steep slope mass movement feature are uncommon. During construction activity, soil displacement is visually obvious, but in wildlands recognizing displacement has proved to be problematic. Displaced soils move around a slope more than they move off a slope and displaced soils are often deposited under adjacent shrubs or grass clumps. WEPP technology accounts for hill-slope displacement and deposition in wildland erosion estimates. In Great Basin terrain, displaced soils are practical issues at construction sites or along roadways. Detrimental soil compaction was emphasized in the Pacific Northwest Region workshop on the Fremont Winema National Forest**.** Compaction features and interpretations are well studied in cropland, rangelands, and in forest the interpretations are supported by long tern soil productivity research in a variety of soil textures (Gomez et al. (2002).

The "Soil Productivity Guide for Ground Disturbing Activities" for the Fremont National Forest was developed to provide guidance in achieving Regional Soil Policy, FSM 2521.03. The Guide was developed with input from the Lake County Sustained Yield Group, Timber Sale Purchasers, Operators, Sale Administrators and Contracting Officer (Forest Service, 2000). Comments from Fremont National Forest Watershed Specialists, Region 6 Soil Scientists, and Fremont and Winema National Forests Line and Staff Officers were used to refine the Guide. The Guide is intended to be dynamic and refined as new technology becomes available to meet objectives and as monitoring results are obtained. The Soil Productivity Guide is included in Appendix C of this EIS.

Legal Framework

The National Forest Management Act of 1976 (NFMA) requires serving the national interest with resource programs based on a) supply and demand, b) analysis of economic and environmental impacts, and c) knowledge derived by coordinated research that promotes sound technical and ecological basis for use and protection of the Nation's resources. Programs are required to provide for the diversity of plant and animal communities based on the suitability and capability of specific lands.

The Organic Administration Act of 1897 (OA) established National Forests with the purpose of improving and protecting the forest, or securing favorable conditions of water flows and continuous supply of timber, for the use and necessities of citizens of the United States.

Short and long term interactions and relationships among soil, plant, and animals are encapsulated in soil quality. An ecological awareness of soil biological systems is central to environmental health. For example, favorable conditions of water flow, as per the 1897 OA, vary with the nature of the soil fauna and microbial biology that sustains soil structures that allow favorable infiltration, instead of contributing to excess erosion or runoff.

Wetlands are protected under Executive Order 11990, which directs federal agencies to "minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands….”

Background Information

Soil Resource Inventory

Soil, geomorphic and geologic surveys on National Forest are shaped by the regulatory framework. For example the Forest Plan set a goal to maintain or improve soil productivity in all resource activity (Forest Service, 1989), which is a basis for surveys. Yet most of the knowledge we have on soil productivity is based on plant nutrients studied on agricultural lands. Productivity gains are associated with soil humus accumulation and plant community detritus nutrient webs. The types and conditions of plant communities and the minerals in the underlying geologic rock effects the rate of soil humus gains. Productivity losses are associated with erosion and sediment transport that vary with plant community, geomorphic topography, slope, mineral grain sizes, and especially climate. Prior to the Water Erosion Prediction Project technology (WEPP, 2001) erosion estimates on National Forest were statistical extrapolations of crop studies with limited forest studies. WEPP technology is a computer model bases on the Green-Amp infiltration equation that uses local climate data sets, soil texture, vegetation type, ground cover, and topography. Roadway and wildfires studied for WEPP model calibration by the Rocky Mountain Research Station scientist makes WEPP particularly well suited to National Forest assessments and Forest Plan goals.

With the advent of Forest Plans, soil surveys were adopted by the National Forests. Soil surveys have evolved over 300 hundred years for a wide range of land use assessments. A standard county soil survey contains plant production, nutrition, geographic, and geotechnical information for hundreds of land use interpretations. To meet Forest Plan timelines the National Forest produced simplified surveys called Soil Resource Inventories. Current National Forest work is underway to upgrade the vegetation information for types and conditions of plant communities to better estimate trends such as in range condition or forest health.

Watershed Analyses

Two Watershed Analyses were compiled for the Toolbox area: the Silver Creek Watershed/Ecosystem Analysis (Forest Service, 1997) and the Silver Lake Watershed Assessment (Friedrichsen, 2003). The analyses have complimentary and contrasting interpretations. The Silver Creek Ecosystem Analysis has multiple topics, so some key integration is lost. Geologic and geomorphic information is presented but geomorphic interpretation such as flows are not presented in a standard way. The flows are presented as “flashy” but the linear and low drainage density geomorphology is unlikely to produce “flashy” flows. In the watershed analysis, road densities are added to the steam densities (which are twice the value of the perennial and intermittent streams in the Forest data base); however, roads must be near the stream for hydrologic connection. With the Cross Drain portion of WEPP, hydrologic road effect can now be better estimated.

Erosion in the Silver Creek Ecosystem Analysis is presented in a way that emphasizes erosion, for example, of 419 tons over 24,001 acres in West Fork (Forest Service, 1997). However, when presented in the standard format of tons per acre, it indicates a very low erosion rate of 0.02 tons per acre. This erosion rate is well below 1 ton per acre of minor sheet erosion. In this sandy landscape however, the stream pools had high fines and high sediment levels for poor rating that are, in part, attributed to high erosion. An alternative cause is extensive soil impact of 31 to 45 percent. The 1997 detrimental soil impacts surveys only recorded ease of shovel penetration, which is an indirect measure of soil compaction that varies with site moisture and strength of the sampler. Shovel penetration is a first approximation that is affirmed or rejected with diagnostic soil structure, plant root patterns, and plant growth values. The 1997 sampling did not record features such as soil plates, root-bound plants, or limited shoot growth that is associated with detrimental compaction and soil impacts. The soil impact interpretations may be due to the lack of American Society for Testing and Materials (ASTM) and Association of State Highway and Transportation Officials (AASHTO) tables and testing in the Soil Resource Inventory. Using standard geotechnical ASTM and AASHTO tables and interpretations, sandy soils have slight compressibility and slight cohesion. Therefore, compaction is a challenge on these soil textures and the 31 to 45 percent values appear to be statistical anomalies.

Yet to better understand compaction risk in the Toolbox the areas sampled in 1997 were revisited in 2002 and they showed vigorous plant growth. For soil conditions four harvest areas with sandy and sandy loam textures were sampled for the Silver Creek Watershed Analysis (Forest Service, 1997). To obtain values to compare to regional standards transects were sampled at two areas in 2002 using the method in this analysis. Vegetation conditions were also noted along transects. For example, Ponderosa pine poles had 12 to 18 inch spacing between branch whorls and ground vegetation composed of grasses and sedges similar to historic plant communities. No detrimental soil features were found in 2002. Looking at the

consistently wide whorls the areas have a 10 to 20 year vigorous growing tend of a favorable plant environs. So the 1997 soil impacts values seem in error relative to soil productivity. To our knowledge shovel penetration has not been correlated to plant growth, infiltration, or erosion aspect of soil productivity. As the revisited sites illustrate shovel penetration seems poorly related to soil-plant productivity.

The Silver Lake Watershed Assessment (Friedrichsen, 2003) is more focused. It better develops vegetation conditions and shows the amount of forested land that currently have canopy closure exceeding historic values. This assessment sets the stage for the complimentary loss in ground cover vegetation for nutrient decline in the semiarid forest. The assessment does not provide leaf area surface evaporation relationships that show exponential site drying with conifer density above historic norms. Still Friedrichsen's (2003) conifer density patterns in the assessment corresponded well to the fires tree mortality patterns found in forest vegetation surveys.

An alternative explanation for pool fine sediments comes to light given encroachment data from the on going riparian field guide survey. Gregg Riegel's Fremont data set indicates sod-binding sedge or willow root systems are being replaces by week-rooted pines, which may enhance steam bank erosion. So conifer density and encroachment may both dry wetland sites and they may facilitate erosion for two modes of wetland loss.

Burned Area Emergency Rehabilitation (BAER)

In wildfires, sandy soils with low surface areas often become water repellant, while clay soils with high surface areas tend not to become water repellant. Soils become water repellant as wildfires burn and coat soil surfaces with plant and fungus oils or waxes (DeBano et al., 1998). A shift from water absorbent to water-repellant soil conditions in catchments is a basis for a post fire emergency condition (DeBano et al., 1998). A catchment is a soil map unit scale areas of 20 to 100 acres. With extensive sandy soils in the Toolbox project area, a reduction in infiltration due to water repellant soil conditions was anticipated. However, the crown fire did not affect the soils as expected.

Burn severity is often confused with burn intensity. Burn severity describes the fire-caused damage to the soil, while burn intensity describes the nature of a fire in terms of its rate of energy release (DeBano, 1988). These are physical descriptions of the fires, rather than ecological effects. The severity ratings are based on the following standards (BAER Handbook, FSH 2509.13):

- High severity – More than 40 percent of the area exhibits soil features likely to significantly increase runoff and erosion (e.g., absence of duff layer, hydrophobic soils, soil discoloration).
- Moderate severity – Less than 40 percent of the area exhibits high severity indicators. Duff layers may be absent or mostly absent.
- Low severity – Duff layers are burned but intact. Unburned areas are intermingled with lightly burned areas.

Most burn soils sampled were water absorbent for a low burn severity in 74,673 acres and moderate severity in 11,311acres (Forest Service Staff, 2002). The 810-acre area in high severity with water-repellent soils was generally associated with lodgepole pine communities, especially where lodgepole pine encroached onto meadow. The BAER report for the Toolbox Complex lists a total burned area of 86,794 acres, with 51,284 acres on the Fremont NF, 8,015 acres in BLM Lakeview District and private holdings of 27,443 areas. (The acreage amounts differ slightly due to the inclusion of more portions of the Winter Fire in the BAER assessment. The actual acreage for the Toolbox project area is approximately 85,000 acres, including 48,000 acres of National Forest System lands). Overall, sandy soil water repellant response was less extensive than anticipated.

To assess post-fire risk, erosion was estimated with WEPP technology for landtypes grouped by capability areas (Forest Service Staff, 2002). The Water Erosion Prediction Project technology estimates dynamic erosion and runoff that incorporate fire effects, vegetation, soil, slope and local climate (WEPP, 2001). Background erosion rates were estimated at 0.01 to 0.05 ton per acre and runoff rates were estimated at 0.00 to 0.02 inches. These low values are similar to the values in the Silver Creek Ecosystem Analysis (Forest Service, 1997) when presented in the standard tons per acre format. Drainage scale post-fire erosion sediment transport was estimated at 0.09 ton per acre and runoff 0.04 inches in Duncan drainage overall. In the Silver drainage, the estimated post fire erosion is 0.06 ton per acre and runoff is 0.03 inches overall. Generally the erosion rates are below 1 ton per acre; however select water-repellant areas have an anticipated erosion rate of 1.72 tons per acre and runoff of 0.31 inches. Erosion and runoff risk are apt to be greatest directly after a fire.

As ground vegetation recovers, erosion risk and rates are likely to decline in a few years, where soils have low and moderate burn severity (Robichaud et al., 2000). Therefore, rapid native recovery is anticipated in the 74,673 acres with low severity and the 11,311acres with moderate severity. With erosion rates near background and rapid recovery likely, overall sediment risks are low. As with background sediment pulses, the fire effect sediment pulses are within the range that sustains native fluvial processes for gravel bar willow habitats, overbank meadow deposits, and basin forming processes.

On the other hand, tree mortality appeared more extensive than areas of water repellant soils during the burn area emergency assessment. Mortality was surveyed for recovery planning. In the Silver drainage, six times more area was found in the high class with 86 to 100 percent tree mortality than in the low class with 0 to 25 percent mortality. In the Duncan drainages, the high mortality class was three times more extensive than the low class. On the positive side, riparian habitats showed dramatic response with the mortality of pines that had encroached onto the wetlands. A flush of sedges and willows plants began recovering the wetlands. Thinned ponderosa pine forest sites or areas treated with prescribed fire that reestablishes forest gaps had ground fire characteristics. Low mortality was observed in areas with forest gaps and sagebrush grass vegetation patterns similar to historic eastside forest communities.

Emergency Treatments

Post-fire treatments on Toolbox Complex were developed following effectiveness and recovery guidelines (Forest Service Staff, 2002, Robichaud et al., 2000). Generally, sediment yields after fire decline as vegetation recovers in a year or two after a burn. A local recovery reference burn area exists in the 1996 Alder Ridge wildfire that occurred within the Silver fire boundary. The Silver and Alder burn patterns inter-fingered so the landscapes are composed of essentially the same soils, vegetation, and geomorphic elements. The 1996 Alder Ridge fire area shows extensive ground vegetation and grass recovery; therefore, this recovery is likely in the Silver Wildfire. With a timely grassy ground cover recovery likely, seeding was considered unnecessary with generally low burn severity on this low erosion tableland. On the other hand, on the extensive water repellant lodgepole pine communities in the adjacent Winter Fire, extensive areas were grass seeded.

The rocky riparian areas in the Soil Resource Inventory (SRI) land type 2 along streams and rim rock draws (Wenzel, 1979) presented a series of emergency treatment trade offs in light of effectiveness and recovery guidelines (Forest Service Staff, 2002, Robichaud et al., 2000). Encroaching conifers had displaced riparian plants and facilitated wildfire spread along rim rock draws. However, the extensive surface stones make most of the burned sites unsuitable for log terrace treatments and seeding is apt to compete with sedge and willow re-sprouting as the fire cooled. Sedge plants had begun to expand from their refuge along stream banks across floodplains to match the wet soil features. BAER team soil scientist and riparian specialist did not want to disrupt this overdue recovery process with post fire emergency stabilization treatments. So log terraces were limited to a few suitable areas and grass seeding was not applied. Yet follow-up treatments may be needed.

Long Term Treatment Considerations

Over the long term, topsoil recovery varies with the kind and the cover of plant species. The recovery plant succession drives the complementary soil detritus web for nutrient re-supply. On the other hand, ground cover loss in dense woodlands has yielded notable topsoil loss. To avert the soil loss in semiarid forest and rangelands West and Young, (2000) propose a soil productivity oriented early warning concept. West and Young (2000) identify the affects of conifer densities above historic norms as a “lignification,” which identifies habitat shifts by changes in soil biochemical pathways. With a shift to lignin, and away from carbohydrates, native bacterial microbial populations in semiarid forest and rangelands are less suited to processing detritus into soil humus and available nutrient for plant growth—so the soils erode. Toolbox project area faces “lignification” with a semiarid climate, canopy closure exceeding historic values (Friedrichsen, 2003) and the associated extensive tree mortality. The forest vegetation survey found 15,074 acres with tree mortality above 50 percent, while the high burn severity area was only 810 acres. So by area there is greater risk of “lignification” soil losses than erosion losses from burnt soil effects. And treatment actions that recovery historic forest densities, gaps, and ground cover avert the soil losses.

The Forest Plan presents a goal, for all resource activity, of maintaining or improving soil productivity. Yet the areas proposed for treatment in the Toolbox project face West and Young’s (2000) “lignification” affects with conifer densities above historic norms. Recall the shift to lignin, and away from carbohydrates in semiarid forest reduces the available of nutrient for plant growth—so soils are more apt to erode. On the other hand, long tern research support soil productivity gain due to accommodating ground cover in thrifty pine forest, which enhances nutrient detritus webs and tree growth (Busse et al. (1996).

Without a well-developed ground cover in the forest gaps the ponderosa pine trees are less apt to benefit from the frequent wildfires that are typical in the areas. A fire history study within the Toolbox Fire Complex showed wildfire occurred at 6

to 15 years for average 10-year intervals (Miller et al., 2001). Historic wildfires are characterized by low tree mortality. The extensive mortality in the Toolbox Fire Complex is a departure from historic wildfires conditions in eastside pine forest communities when wildfire were ground fires, and mature pine lived through wildfires with some scaring (Agee, 1993, Biswell, 1989, Miller et al., 2001). Historic (or native managed) Ponderosa pine forest had 60 to 70 percent "forest gaps" with ground vegetation of sagebrush grass and mixed shrub grass. Recommendations to (in the event of salvage) retain 50 percent of the standing dead trees (Beschta, R.L. et al., 1995) do not provide a historic or prior forest density context. Using historic vegetation context, Beschta et al.'s recommendation are apt to apply when the local forest have historic openings, rather than the current over-dense conditions. In any case recovering the ground cover limits "lignification" risk and recovers topsoil functions.

Analysis Area and Methods

The analysis area for soils encompasses all National Forest lands within the burned area of the Toolbox Fire Complex within:

Silver Creek Watershed –
(The following subwatersheds)
- Middle Silver Creek
- West Fork Silver Creek
- Upper Silver Creek
- Thompson Reservoir
- Benny Creek

Silver Lake Watershed –
(The following subwatersheds)
- Upper Duncan Creek
- East Duncan Creek
- Lower Duncan Creek

No portion of the Summer Lake Watershed, to the east of the area, is included in the analysis area. With minor exceptions, the adjacent 2002 Winter Fire occurred entirely within the Summer Lake Watershed, outside the analysis area.

Areas where salvage and fuels treatment recovery actions are proposed are grouped into seven cases studied based on recurring soil map units, eco-classes, and topographic slopes groups from the Forest resource surveys and databases. The cases are based on Alternative C, with 14,441 acres, which is the most extensive area proposed for actions. The cases are listed in Table3.96. Toolbox Fire Recovery Project area geographic soil information is based on the Soil Resource Inventory (SRI) in combination with plant associations, riparian types, (Hopkins, 1979, Riegel et al., 2002, Wenzel, 1979) and field samples to approaches the utility of a modern soil survey (Soil Survey Division Staff, 1993). The Soil Resource Inventory's limitation is visible in the Silver Creek Ecosystem Analysis (Forest Service, 1997) so the soil characteristics are supplemented by the South Lake County survey (Kienzle, 1999) abutting the Toolbox Fire Recovery Project. With WEPP technology, soil, sediment, and hydrologic functions can be better estimated. The seven cases in Table 3.97 will also be used to present sample findings.

Table 3.97 Case Studies Used to Assess Sediment Levels and Recovery Responses

Case Study	% of Proposed Salvage area*	Slope	Soil Characteristic	Ecoclasses	SRI Map Units
1	30%	0 to 15%	Loamy Texture	Ponderosa pine/fescue, with various sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	35, 37A, and 64 Capability 4
2	16%	0 to 15%	Loamy Sand Texture	Ponderosa pine/fescue, with various sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	88A, 85, 84, and 77A Capability 5
3	10%	0 to 15%	Stony Loamy Texture (rock content 50%)	Ponderosa pine/fescue, with various sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	30A, 350, and 36 Capability 2, 13
4	5%	0 to 30%	Stony Loamy Texture (rock content 50%)	Ponderosa pine/fescue with various sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	2 Capability 6
5	10%	0 to 30%	Loamy Texture	Ponderosa pine, white fir and aspen forest, with various ceanothus, manzanita and bitterbrush shrub combinations in ecoclasses: CP-S2-17, CW-H2-12, CP-S1-21	34B, 37B, and 41B Capability 6
6	7%	0 to 30%	Loamy Sand Texture	Ponderosa pine White fir and Aspen forest, with various ceanothus, manzanita and bitterbrush shrub combinations in ecoclasses: CP-S2-17, CW-H2-12, CP-S1-21	88B and 77B Capability 7
7	8%	0 to 15%	Loamy Texture	Lodgepole pine and ponderosa pine/fescue and sedge forest, ecoclass: CL-G3-15 (limited shrub component)	39 Capability 4

Two forest themes are pertinent for assessing soil productivity in the project area. The first is topsoil loss or loss in topsoil function due to canopy closure exceeding historic values (Friedrichsen, 2003) and the extensive tree mortality incurred in the Toolbox Complex wildfire. The areas face West and Young's (2000) "lignification" affects with conifer densities above historic norms. Recall the shift to lignin, and away from carbohydrates in semiarid forest reduces the available of nutrient for plant growth—so soils are more apt to erode. On the other hand, nutrient detritus webs and tree growth are supported by ground cover. Long term research by Busse et al. (1996) shows forest shrubs, grasses and forbs are key plant products needed to sustain humus "the store house for available nutrients, such as nitrogen." The study provides a time line of 12 to 20 years for nutrient re-supply that affects tree growth and soil productivity.

The second theme is soil water functions relative to soil compaction. A long-term study by Gomez et al. (2002) highlights the differences in cultivation effects. Compaction effects are not universal—said another way a one-size standard may not fit all soils or geologic terrains. In the long-tern study of Ponderosa pine seedlings and sapling growth in three contrasting textures: clayey, loamy, and sandy loam Gomez et al., (2002) found overall compaction effects on pine seedlings and sapling growth were detrimental in the clayey soil, insignificant or no effect in the loamy soil, and beneficial in the sandy loam soil. In the past most forest compaction studies have focused on clays soils but in this study soils are tested across a range of geotechnical soil conditions. So ASTM and AASHTO interpretations may be better compared to forest conditions. It helps to address questions about among site compaction values raised from the Silver Creek Ecosystem Analysis (Forest Service, 1997) for better integration among soil compaction, disturbance, and sediments.

Erosion and Sediment

The seven cases listed in Table3.96 and shown in Figures 3.25 and 3.26 are used to estimate sediment rates using WEPP technology. The seven cases will also be used to identify salvage harvest unit issues.

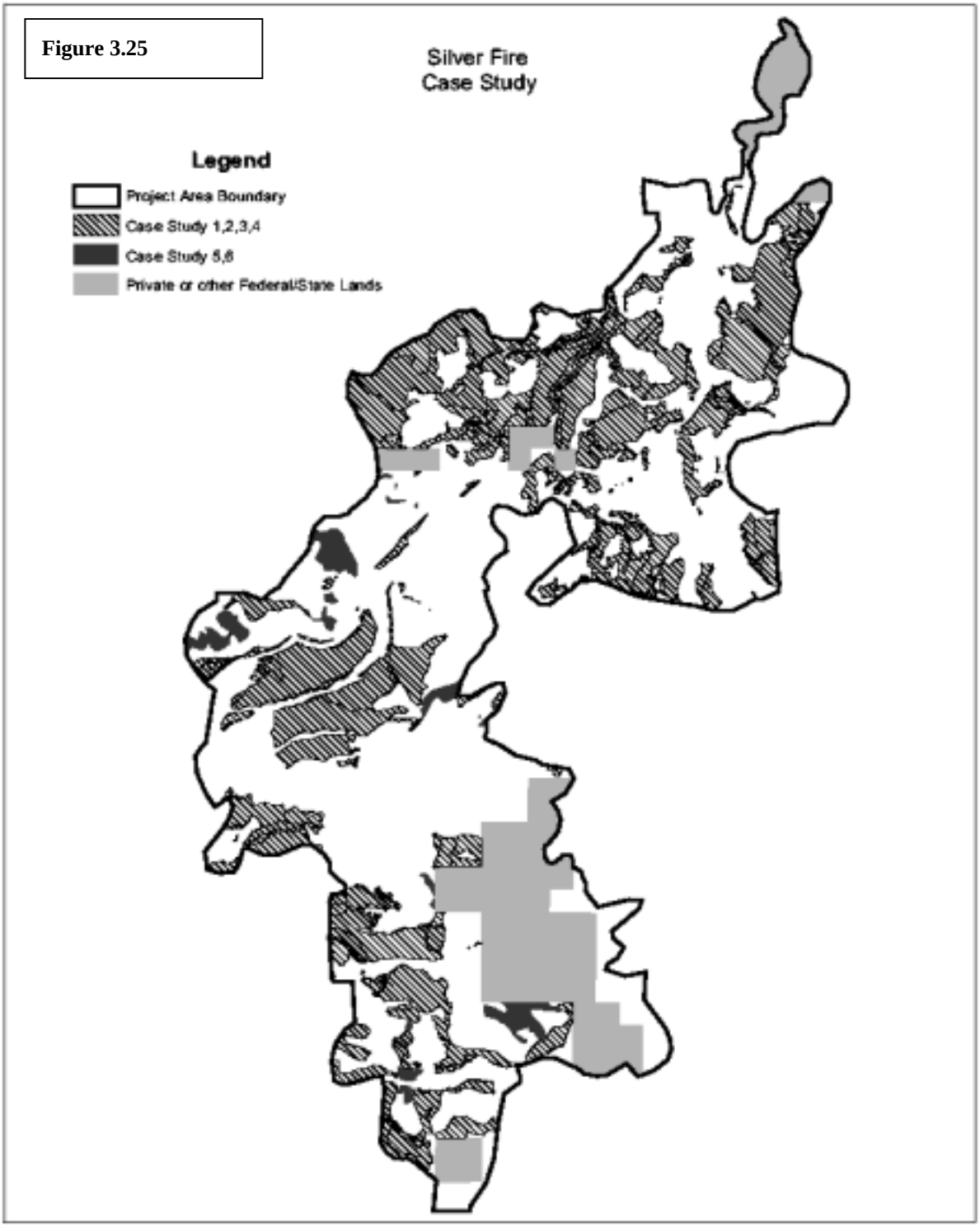
Figure 3.25
Silver Fire
Case Study
Legend
Project Area Boundary
Case Study 1,2,3,4
Case Study 5,6
Private or other Federal/State Lands

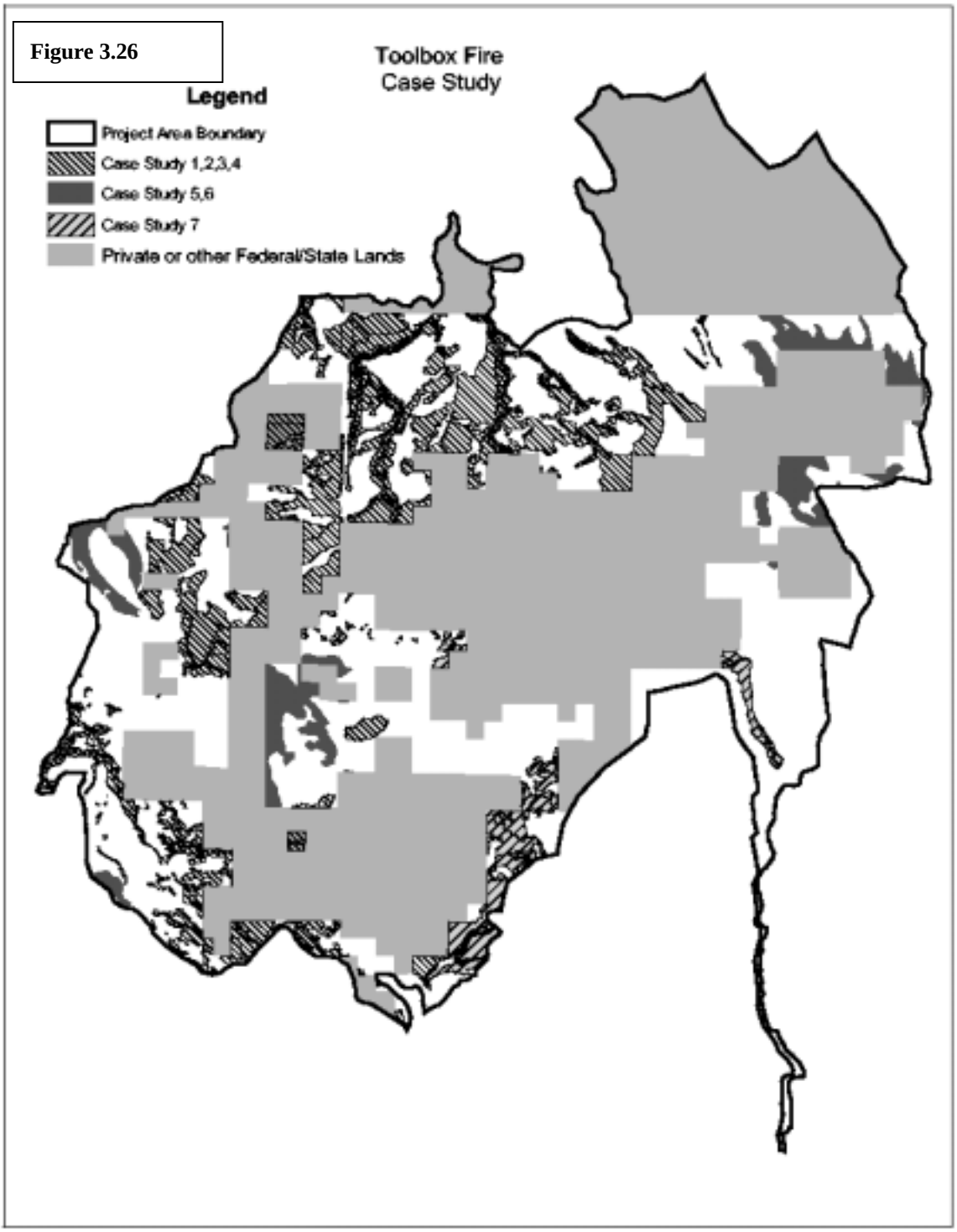
Figure 3.26
Toolbox Fire
Case Study
Legend
Project Area Boundary
Case Study 1,2,3,4
Case Study 5,6
Case Study 7
Private or other Federal/State Lands

Erosion by Case Study – Hill slope sediments were estimated with the Water Erosion Prediction Project technology (WEPP, 2001) for the cases in Table 3.97 (Forest Service, 1989, Hopkins, 1979, Wenzel, 1979). Proposed treatment areas in the action alternatives were grouped into seven case studies based on recurring eco-class, soil type, and slope patterns. Plausible scenarios for ground cover are used to generate values for initial recovery and ground based harvest.

Initial Recovery by Case Study—Sediment values were generated for each of the cases at two plausible checkpoints of recovery after fire. The first checkpoint scenario is a low severity burn in an overstocked forest, where the eco-class live ground cover is reduced to ½ of pre-fire potential. Low burn severity, in terms of soil water repellency, occurred on 85% of the fire. The second checkpoint occurs approximately 2 years after the wildfire, when live-ground-cover has recovered to ¾ of eco-class potential.

Erosion for Ground-Based Harvest by Case Study – Sediments begin with scenarios one and two, then introduce treatment scenarios three, four and five. The third checkpoint includes 15 percent of the area containing new skid trails, while ¾ of potential live ground cover is maintained over the remaining area. The fourth checkpoint represents full potential live ground cover recovery after logging, and the fifth checkpoint represents a reforested 5-year-old forest. The values are presented in Table 3.101 under "Existing Conditions" and Table 3.105 under "Direct and Indirect Effects."

To address long-term soil productivity the erosion estimates are compared to the T-factor of soil loss tolerances, which vary from 1 to 5 tons per acre (Soil Survey Division Staff. 1993). The T value of 1 ton per acre is a paper sheet thick layer of erosion that is tolerable for shallow soils, while a T of 5 tons is tolerable for deep soils.

Road Erosion – Given hydrologic connection roads convey water and sediment like channel networks. In the western Cascade Mountains roads may extend the stream network by 40 percent during a storm event (Wemple, 1994) for hydrologic and geomorphic effects similar to drainage density. Effectively, 40 percent of the road density can be added to the stream drainage density in estimating sediment transport. Caution is needed in applying Wemple's (1994) 40 percent finding in the western Cascades to the Toolbox Fire Recovery Project area, which is in the Great Basin. The 40 percent road to stream network may only occur during larger storm events in the Toolbox area.

The amount of road sediment was estimated using the Water Erosion Prediction Project (WEPP) Cross Drain Spacing and Sediment Yield Model (WEPP, 1999). Typically road characterize the Toolbox Fire Recovery Project area is a two percent grade native surface roads or graveled roads with 400 to 800 feet cross drain increments.

Forest Density and Soil Fertility

Indicators of favorable long-term soil productivity – In most of the project area the semiarid forest plant communities that sustained the soils are thrifty, single single-story LOS (Late/Old Structure) ponderosa pine stands, with well-developed grassy ground vegetation. Historic ponderosa pine forest had ample forest gaps, often 60 to 70 percent of the forest area. The ground vegetation in the forest gaps is essential for soil nutrient re-supply and sustaining forest growth (Busse et al. 1996). On the other hand, dense canopy limits competes with the soil humus re-supply conditions.

Soil productivity and recovery varies with the ground vegetation in the forest gaps. With ample gaps, historic fires in the ponderosa pine forest were generally ground fires, where mature pines lived through the fire with some scaring (Agee, 1993, Biswell, 1989, and Miller et al., 2001). Mortality would be low in the historic ponderosa pines architecture; a mortality class of 0 to 25 percent would be expected. Sites with 0-25% mortality have forest gaps and the ground vegetation for humus and nutrient re-supply within the historic fertility range.

Indicators of detrimental long-term soil productivity - Forest plant communities that depart from historic "forest gaps" limit soil humus re-supply conditions and contribute to extensive mortality during wildfires. Canopy closure exceeds historic values was identified as a problem in the Silver Lake Watershed Assessment (Friedrichsen, 2003). Assessment sets the stage for decline in soil productivity. Conifer mortality has been mapped in a forest vegetation survey (in GIS Layer in polygons "mort_f") for recovery planning. Generally mortality correspond the canopy density or lack of gaps as anticipated in Friedrichsen's (2003) Silver Lake Watershed Assessment.

A time line for "gap ground cover" formation and nutrient re-supply within the gaps can be estimated by comparing the Miller's et al., (2001) ten-year wildfire interval with Busse's et al. (1996) twenty-year nutrient humus enrichment intervals. A forest stand with 100 year old ponderosa pine in the "gap" has misses 10 gap clean outs cycles and it has displaces the ground vegetation for 5 nutrient re-supply cycles for chronic decline in humus.

Sites with 26 to 50 percent mortality have a decline in forest gaps, and ground vegetation that re-supplies soil humus. Alternately we could say a re-supply cycle has been missed. Sites with mortality of 51 to 85 percent or greater than 86 percent gave canopy densities that have excluded digestible ground vegetation detritus. In these sites several nutrient re-

supply cycles or their effective has been limited for chronic a nutrient decline. These forest sites with 100-year dense pole within the historic "gap" may have missed up to 5 humus recovery cycles. Hot burn areas inclusions within the lower mortality classes may have high enough tree densities to indicate chronic detrimental soil conditions.

Table 3.98 Post Fire Mortality as Indicator of Humus Re-Supply Conditions

Conditions		Definitions
Historic, 1_sl		0-25% and humus within historic fertility
Decline, 2_sl,		26-50% and humus decline from historic fertility
Chronic, 3_sl		51-85% and humus chronic decline from historic fertility--1
Chronic, 4_sl		86-100% and humus chronic decline from historic fertility--2

Compaction

The field protocol used to perform post-fire compaction surveys, accounts for two factors 1) evidence of equipment, and 2) evidence of soil compaction. A detailed protocol and field training is provided to the surveyors. Tables 3.98 and 3.99 display the factors identify by field crews and spot-checked by Forest soil scientist. The method is an adaptation of the Winema National Forest method (Forest Service, 2002a). Disturbance factors in are rated at six levels that vary from class 1, native cover and soil tilth condition; to class 6, traffic and compacted conditions. Tilth is a traditional word used to describe a soil structure and aroma associated with vigorous plant growth environs. Platy soil structure is traditionally associated with plow layers and foundation compaction.

As indicators of soil productivity the Winema method scale and features are consistent with 50 years of soil interpretations. Soil plates are a soil structures associated with root barriers and diminished plant growth environs (Veihmeyer and Hendrickson, 1948). The descriptions of platy layers in class 5 and 6 are similar to plow layers in crop fields; platy layers 5 to 10 cm (2 to 4 inches) thick have been shown to limit growth (Soil Survey Division Staff, 1993, Taylor, and Ashcroft, 1972, Veihmeyer, and Hendrickson, 1948). The description of plates at class 4 is too thin to be a plow layers in crop fields; platy layers less than 5 cm (2 inches) thick may or may not limit crop, range pasture, or forest growth.

Table 3.99 Evidence of Equipment

Evidence of Equipment Factors	Class
• Well developed forest understory and overstory, no stumps or skid trails	1
• Faint impressions of wheel tracks or slight depressions in vegetated forest understory • (Local equipment feature: old skid trails or landing beyond 10 meters, decayed saw stumps)	2
• Visible indications of past equipment operation in forest openings • (Local equipment feature: skid trails, landing or saw cut stumps within 10 meters)	3
• Wheel or crawler depressions or tracks evident • (Local equipment feature: bare skid trail or landing and saw cut stumps within 10 meters)	4
• Fresh wheel or crawler tracks, and fresh removal of forest vegetation • (Local equipment feature: actively used two-track road or recent skid trail or landing)	5
• Active road surface, no understory vegetation in road way • (Local equipment feature: maintained or graded native road)	6

Table 3.100 Evidence of Soil Compaction

Soil Compaction Factors	Class
• Well developed forest understory and overstory with granular surface soil structure • (Local soil feature: soft soil, garden like resistance to probing)	1
• Forest surface soil structure unaffected by past equipment operation • No evidence of platiness developing in surface soils • (Local soil feature: soft, slight resistance to probing)	2
• Soils show some signs of soil compression compaction • (Local soil feature: some resistance to probing; blocking structure with minor amounts or discontinuous plats, soil aggregates readily fall apart when shaken)	3
• Soils show evidence of compaction with firm footing and minimal duff or grass cover • (Local soil feature: moderate resistance to probing; moderate or strong platy structure continuous at about 30 cm (12 inches) depth thin plates that holds together when shaken)	4
• Soils provide firm to hard footing surface with limited plant cover • (Local soil feature: strong resistance to probing dry and some resistance moist; plate layers 5 to 10 cm (2 to 4 inches) thick about 30 cm depth, plates holds together when shaken)	5
• Soils provide a hard footing surface stunted or limited understory forest growth • (Local soil feature: Plates form at depth of less than 5cm)	6

Survey transects and samples were stratified by cases and capability areas map units with at leads five transects in common map areas. Transects are 400 meter long transects with 20 sample points, each 20 meters apart' were laid out on compass bearings. Disturbance factors were sampled at points along the survey transects. At each sample point a surveyor records a) evidence of equipment within a 10-meter radius of sample point, and b) evidence of soil compaction. A planting spade and ruler were used to determine underground soil structure tilth or platy layers, plate depth and thickness. The transect findings were then compiled to assess the relative rate of disturbance.

For the Toolbox analysis 1820 samples points on 91 transect locations on likely treatment areas are used to estimate soil conditions. Although, cases with loamy sand or the stony soils that resist compaction are common in the Toolbox area, textures in Table 3.97 alerted us to some possible compaction locations within proposed harvest units. Compaction surveys sampled all seven cases and ten capability areas for a wide range of conditions. Transects were distributed across recent logging, older logging and un-logged areas both inside and immediately outside the fire area. The complete data that was gathered during the post-fire compaction surveys is documented in the analysis file as "Toolbox Fire Recovery Project Transect Data" (Reba and Zamudio, 2002 and 2003). Additional transects were sampled in the Alder Ridge fire (burned in 1996, partial salvage harvest in 1997) within the Toolbox Complex boundary; and in a 2002 revisit of samples initially taken for the 1997 watershed/ecosystem analysis. Soil compaction census data in classes 5 and 6 are tallied for comparison to the detrimental soil condition limit of 20 percent in the Pacific Northwest Region (Forest Service, 1998).

Census data (hits) can be used to develop a probability distribution to present the finding in an objective way or for statistical test (Mendenhall and Scheaffer, 1973). The relative frequency of hits in high (5 & 6), moderate (3 & 4), and low (1 & 2) classes can be used to estimate recovery or potential problems. Changes in the proportions of hits in the moderate classes (3 & 4) aid in test Chi-Square estimates of recovery.

To assess project effects or recovery, hits in high (5 & 6), moderate (3 & 4), and low (1 & 2) classes may be compared over time or between evidence of equipment and soil compaction. The proportion of hits in the moderate effects: classes 3 and 4 are apt to aid estimating recovery or lingering problems. Few high value hits (5 and 6) indicate soil recovery or low treatment effect. Generally recovery is underway if soil compaction factors have lower value hits than evidence factors. In a recovering site the population distribution of compacted values of 5 and 6 are apt to shift to 3 and 4, with associated plant growth recovery.

Over time with plant root and humus recovery, compacted values are apt to shift to hits in classes 1 and 2 with garden like tilth. This recovery process is familiar to gardeners who have tended flowerbeds adjacent to new home foundations, where compaction occurred in home construction. Using 10 years of trend sampling the Forest soil scientist and riparian specialist has present workshops on the recovery processes with field examples from the Sierra Nevada and central Great Basin. Now trend studies that include soil quality are being implemented on the Fremont Winema National Forest.

Existing Condition

The Burn Area Emergency Report for the Toolbox Complex reports a total burned area of 86,794 acres, with 51,284 acres on the Fremont NF and 8,015 acres in BLM Lakeview District and private holdings of 27,443 areas (Forest Service Staff, 2002) (note: BAER took in slightly more of the Winter Fire, therefore the acreages are larger than considered in this EIS). The Toolbox BAER report found that most soils were water absorbent for a low burn severity rating on 74,673 acres and moderate severity rating on 11,311 acres. 810 acres were rated as high severity area, with water-repellent soils. These latter were generally associated with lodgepole pine communities, especially where lodgepole pine had encroached into meadows. Overall sandy soil water repellant response was less extensive than anticipated.

Conifer encroachment on to soils with wetland features were extensive in the Winter and Toolbox Complex, which is inconsistent with historic condition where conifers were limited to the well-drained margins of riparian ecosystems. Fifty to 70 year old conifers had encroached onto riparian soils, had displaced riparian specie and had resulted in fire-caused tree mortalities above 50 percent. Following the 2002 fires, sedge plants have began to expand along stream banks and across floodplains to match the wet soil features.

The Soil Resource Inventory survey information for the Toolbox project area shows sandy soils dominate the Silver Creek drainage in map unit 88A and in similar soils of Capability Area Five: Lava Tablelands with Ash and Pumice Mantles (Forest Service, 1989, Wenzel, 1979). The sandy soils are similar to the Mound soil series with a dry summer environ, ashy sandy loam deposits over stony clay loam subsoil of weathered basalt and andesite, and grass pine savanna (Forest Service, 1989, Kienzle, 1999, Wenzel, 1979). To the east in Duncan Creek drainages loamy soils dominate in map unit 37A and similar soils of Capability Area Four: Lava and Tuff Tablelands. The loamy soils are similar to Woodchopper and Roggers soil series with dry summer environs, loam over clay loam textures with shrink-swell clays weathered from basalt and andesite, and grass pine savanna. The relative soil fertility is moderate with a mix sandy ash and lava rock and grassy ground cover. Rocky soils in map unit 2 occur along fault trends rim rock draws and streams. The soils are similar to the Booth soil series with extensive surface stones.
Topsoil loss potential is listed the Soil Resource Inventories by static erosion classes yet erosion processes are dynamic processes that vary with the kind and cover of plant species. Considering the limitations of the Soil Resource Inventory, the Plant Associations of the Fremont National Forest (Hopkins, 1979) are essential for estimating changes in local plant condition. Hopkins' (1979) ground cover values provide reference condition for estimating effects that is trend down for topsoil loss or trend up for recovery. Similarly, Area Ecologist Gregg Riegel's (2002) on-going riparian field guide survey provides vital plant species and soil pattern for soil productivity estimates for wetlands. Riegel's Fremont data set has an odd yet common occurrence of ponderosa pine on Hydric Soil that had high water tabled features. Sites appear to be on a drying tend that corresponds to evaporation due to conifer density and encroachment for wetland loss.

With limited mining districts geologic surveys are limited, unlike most of the Basin and Range. Toolbox's catchments are Basin and Range terrain lava tablelands within the Great Basin (Orr and Orr, 1999). Yet sandy ash deposit from the adjacent Western Cascade terrain over the Basin and Range basement lava rocks effects soils water infiltration rates, nutrients, and sediment processes in Toolbox. The tablelands drained by Silver Creek have deposits of ash-fall tuff. Sediments from the Toolbox area drains into closed basins typical of Great Basin Physiographic Province. Tuffaceous deposits exposed within the West and North Forks of Silver Creek may be prone to post-fire slope in-stability. Foster Butte and Dead Indian Mountain in the center of Toolbox are cinder cones with several eruptive periods beginning in the Tertiary. Toolbox area has a fault fracture pattern in resistant volcanic bedrocks of Tertiary age basalts, andesite, and rhyolite, with minor quaternary alluvium and sedimentary rocks. Toolbox's tablelands dip to the northwest along north trending faults that dominating the catchment's geomorphology. For Basin and Range terrain the slope are gentile (Orr and Orr, 1999, Wenzel, 1979).

The fault line channel systems and linear subwatersheds in Toolbox are geomorphic indicators of a low geologic erosion rates. A linear basin has a geomorphic form that dissipates flood flows and yield low peak discharges (Strahler, 1964). Silver and Duncan Creek subwatersheds are linear with trellis main stems along faults. On the other hand, a typical stream basin is a pear shaped ovoid with treelike dendritic stream branches. As basins become round they concentrate flows for high peak flows. Toolbox's drainage patterns and density are controlled by the fault trends. The 86,794 acres (135.6 mi^2) burn area (BAER Report acreages) has 29 miles of perennial streams for drainage density of 0.2 mi/ mi^2 and including 121 miles of intermittent streams; the drainage density is approximately 1.1 mi/ mi^2. Drainage-densities, measured as a ratio of stream segment to basin area in mi/mi^2, is a topographic estimate of stream erosion forces balanced against basin resistance to erosion (Strahler, 1964). Ephemeral draws are generally not included in drainage patterns and density calculations because they are difficult to estimate. And in this semiarid climate named intermittent streams such as Squaw and Benny

Creeks are dry much of the summer, even after thunderstorm rain events. So some caution is needed in estimating geologic erosion.

Toolbox's drainage density of perennial and intermittent streams is 1.08 mi/ mi^2 using sub-shed areas in the recovery planning, which is very low compared to ratios over a wide range of geologic and climate types. Low values of 3 to 4 mi/mi^2 occur in resistant sandstone in Appalachia, mid values of 20 to 30 (mi/mi^2) occur in fractured weathered igneous rocks with dry summers in coastal southern California, and high values of 200 to 400 mi/mi^2 occur in badlands often barren of vegetation, as in South Dakota's Badlands National Park (Strahler, 1964). Toolbox's very low drainage-density is due in part to resistant bedrocks, permeable soils, and low relief.

Similarly, the Soil Resource Inventory erosion hazard rating is low for most of the Toolbox project area. The hazard rating applies to sites when all vegetation cover is removed as in road building (Wenzel in 1979). From the burn report the bare ground erosion hazard for the Toolbox and Sliver burn areas list 65,383 acres in low hazard, 14,003 acres in moderate, and 7,408 in high.

Erosion and Sediment

Post-fire erosion, sediment transport and rainfall runoff were estimated in the 2002 BAER Report using WEPP technology for landtypes grouped by capability areas (Forest Service Staff, 2002). Background erosion rates were estimated at 0.01 to 0.05 ton/acre and runoff rates were estimated at 0.00 to 0.02 inches. In the BAER report the default WEPP cover value of 85 percent was used for a low severity fire conditions. In most areas post-fire erosion rates are below 1 ton per acre that effect soil productivity (Soil Survey Division Staff. 1993). Drainage scale post fire erosion sediment transport was estimated at 0.09 ton/acre and runoff 0.04 inches in Duncan drainage overall (WEPP, 2001). In the Silver drainage the estimated post fire erosion is 0.06 ton/acre and runoff is 0.03 inches overall. The few water-repellant areas have an anticipated erosion rate of 1.72 ton/acre and runoff of 0.31 inches. Erosion rates and risk are apt to be greatest in runoff events directly after a fire.

With most soils in low and moderate burn severity, erosion risk and rates are apt to decline in a few years as ground vegetation recovers (Robichaud et al., 2000). Rapid native recovery is anticipated in the 74,673 acres with low severity and the 11,311acres with moderate severity. With a likely rapid recovery, overall sediment risks are low. Said another way, like background sediment pulses, the fire-effect sediment pulses are within the range that sustains native fluvial processes on hill slopes and along streams for gravel bar willow habitat deposits.

Toolbox project erosion and runoff estimates incorporate fire effects, vegetation, soil, slope and local climate for likely harvest area by cases and likely scenarios with the Water Erosion Prediction Project technology (WEPP, 2001). The ground cover values are based on Hopkins (1997) plant association ecoclasses. Water Erosion Prediction Project technology sediment values were generated for each of the cases at six plausible checkpoints of recovery using a local climate record for 50 years to reflect high intensity storm events. Average values for sediment production were calculated using Water Erosion Prediction Project (WEPP) technology, with the results presented in the table below.

In Table 3.101 the two checkpoint scenarios bracket current conditions. The first check point is the post fire condition. It is a low severity burn in an overstocked forest, where the eco-class live ground cover is reduced to ½ of pre-fire potential. The second checkpoint occurs approximately 2 years after the wildfire, where live ground cover has recovered to ¾ of eco-class potential. The long 2003 spring rainy season provided soil moisture conditions that contribute to seedbed response and rapid grass recovery. As current condition approach checkpoint 2 live ground vegetation recovery should be sufficient to limit the risk of a long-term decline in soil productivity with values well below soil loss tolerances of 1.00 to 5.00 tons per acre (Soil Survey Division Staff. 1993).

These two scenarios show soil erosion is a minor consideration in most of the likely harvest areas. Yet some erosion may occur in harvest units 130, 131, 133 and 134 associated with case study seven along Benny Creek drainage. Current or existing value is between 0.25 and 0.10 ton per acre. Granted the value is well below the lower tolerance limits of 1.00 tons per acre, yet it alerts us to areas that merit field checking.

Live Ground cover recovery and erosion scenarios presented in the following table are based on values in Hopkins (1979) Plant Association and likely recovery rates. Checkpoint 1 was the Existing Condition after the wildfire and the Current Condition is approaching Checkpoint 2. Erosion estimates are in tons per acre (t/ac) using WEPP Technology for Seven Case.

Table 3.101 Live Ground Cover Recovery and Erosion Rates – Checkpoints 1 and 2

Case Study	Ecoclasses	Checkpoint 1, Cover Values	Checkpoint 1, Erosion Rates	Checkpoint 2, Cover Values	Checkpoint 2, Erosion Rates
1	Ponderosa pine/fescue, with sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	40	0.09	63	0.00
2	Ponderosa pine/fescue, with sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	40	0.06	63	0.00
3	Ponderosa pine/fescue, with sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	40	0.19	63	0.00
4	Ponderosa pine/fescue, with sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	40	0.37	63	0.00
5	Ponderosa pine, white fir and aspen forest, with ceanothus, manzanita and bitterbrush shrub combinations in ecoclasses: CP-S2-17, CW-H2-12, CP-S1-21	65	0.20	83	0.00
6	Ponderosa pine, white fir and aspen forest, with ceanothus, manzanita and bitterbrush shrub combinations in ecoclasses: CP-S2-17, CW-H2-12, CP-S1-21	65	0.08	83	0.00
7	Lodgepole pine and ponderosa pine/fescue and sedge forest, ecoclass: CL-G3-15 (limited shrub component)	35	0.25	45	0.10

Roads –Current road density on National Forest Lands within the project area is 3.68 miles of open road per square mile. A subset of these roads has a hydrologic connection that conveys water and sediment to the streams. In the wet west side 40 percent of the roads may deliver sediment to streams, yet in the dry east side the effect may be more limited. The amount of road sediment was estimated using the Water Erosion Prediction Project (WEPP) Cross Drain Model (WEPP, 1999).

The typically road in the Toolbox Fire Recovery Project area is a two percent grade, native surface roads or graveled road with 400 to 800 feet cross drain increments. In a relatively dry east-side climate, native roads near streams (within 10 meters) yield an estimated 0.47 tons per mile to the stream and those with gravel surfaces yield an estimated 0.35 tons per mile. For comparison, with a wet west-side climate (North Bend, Oregon), which is closer to Wemple's (1994) conditions, the same road conditions would yield an estimated 17.5 tons per mile on graveled roads, a sediment value 50 times larger. Refer to the "Watershed and Fisheries" section of this chapter for a complete description of existing drainage and road densities.

Forest Density and Soil Fertility

Forest vegetation mortality was surveyed for recovery planning. In the Silver Fire Portion, 6 times more area was found in the high mortality class of 86 to 100 percent tree mortality than on area in the low mortality class of 0 to 25 percent. In the Duncan drainage the high mortality class was 3 times more extensive than the low class. Low mortality was observed in areas within forest gaps in forest vegetation surveys and in the BAER assessment. The mortality classed found in the forest vegetation surveys correspondence to dense forest areas where canopy closure closes-out the nutrient re-supply process. Mortality classes above 25 percent indicate dense forest areas where Busse like nutrient re-supply has declined.

Estimates for humus re-supply condition in Tables 3.101 and 3.102 (from Toolbox Planning Record GIS Layer in polygons "mort_f") are based on the time line for "gap ground cover" formation and nutrient re-supply within the gaps estimated by comparing the Miller's et al., (2001) ten year wildfire interval with Busse's et al. (1996) twenty year nutrient humus enrichment intervals. Sites with 0-25% mortality had canopy gaps within the historic range so nutrient re-supply is also apt to be within the historic range. Above 25% mortality, forest density conditions closeout humus re-supply cycles. The estimated re-supply condition is presented in Tables 3.101 and 3.102 and Figures 3.27 and 3.28.

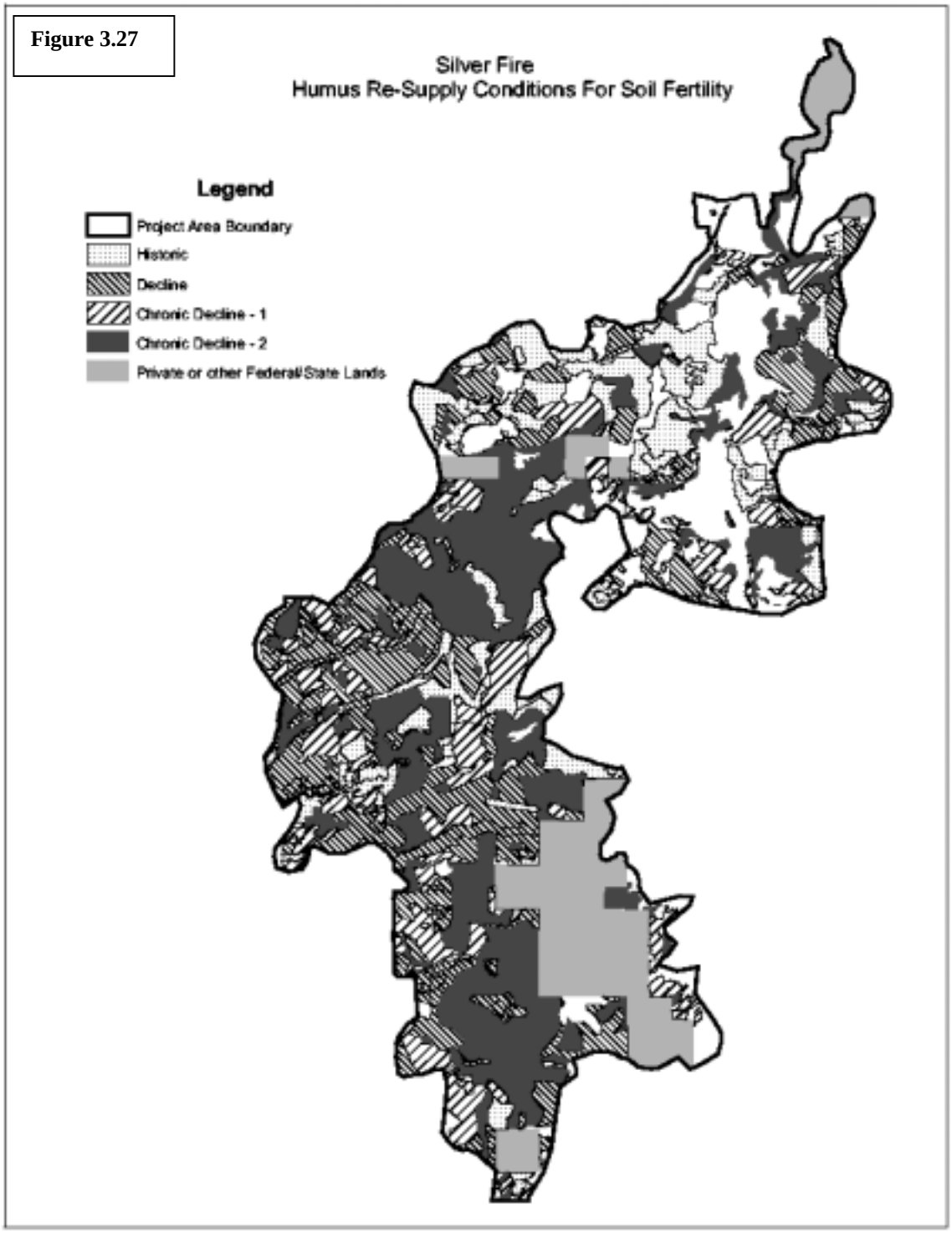
Figure 3.27
Silver Fire
Humus Re-Supply Conditions For Soil Fertility
Legend
Project Area Boundary
Historic
Decline
Chronic Decline - 1
Chronic Decline - 2
Private or other Federal/State Lands

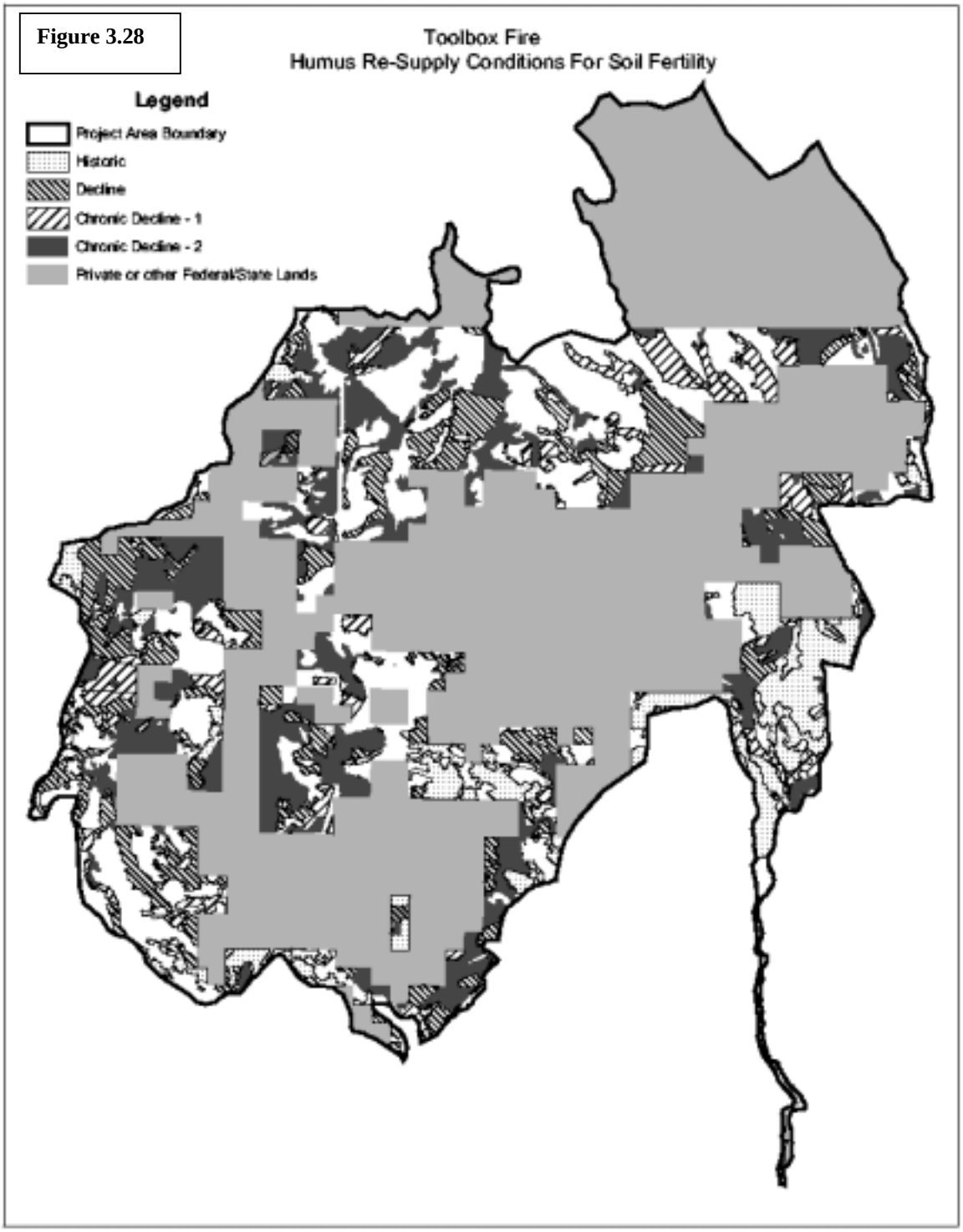
Figure 3.28
Toolbox Fire
Humus Re-Supply Conditions For Soil Fertility
Legend
Project Area Boundary
Historic
Decline
Chronic Decline - 1
Chronic Decline - 2
Private or other Federal/State Lands

A re-supply cycle may have been missed in sites with 26 to 50 percent mortality with a decline in forest gaps and ground vegetation. Several nutrient re-supply cycles may have been missed (or their effectiveness has been limited) for chronic nutrient decline in sites with mortality of 51 to 85 percent or greater than 86 percent mortality and dense canopies. For example forest sites with 100-year old dense pine poles within the "historic gap" may have missed 3 to 5 humus recovery cycles.

The extensive areas with high mortality and likely chronic humus decline shown in Tables 3.101 and 3.102 and Figures 3.27 and 3.28, illustrate a shift or shifting lands capability. Without gaps, low fertility is reinforced by the conifer's acid needle fall, their root structure, and biology. Hot burn and mortality areas included within the lower mortality classes may have high enough tree densities to indicate chronic detrimental soil conditions.

Table 3.102 Silver Fire Portion Mortality as Indicator of Humus Re-Supply Conditions

Conditions by acres		Definitions
860 acres		0-25% and humus within historic fertility
2,776 acres		26-50% and humus decline from historic fertility
2,068 acres		51-85% and humus chronic decline from historic fertility--1
5,436 acres		86-100% and humus chronic decline from historic fertility--2

Table 3.103 Toolbox Fire Portion Mortality as Indicator of Humus Re-Supply Conditions

Conditions by acres		Definitions
1,847 acres		0-25% and humus within historic fertility
2,658 acres		26-50% and humus decline from historic fertility
1,942 acres		51-85% and humus chronic decline from historic fertility
5,628 acres		86-100% and humus chronic decline from historic fertility

Compaction

Findings are based 1820 samples on 91 transects. Overall 1 percent of the samples had detrimental soil conditions with hits in classes 5 and 6. And 85 percent of the samples have tilth like soil classes of 3, 2 and 1. No transect or likely harvest area had detrimental soil compaction using the regional guidelines for detrimental soils (Forest Service. 1998). Chapter 2520, Pacific Northwest Supplement 2500-98-1 sets a soil disturbance criterion of 20 percent for detrimental soil condition in the Pacific Northwest Region (R6).

On site tours the clayey texture soil in the area was found to shrink about 10 percent, which is consistent with shrink swell clay. Similar landscapes in the adjacent South Lake County soil survey the clays have shrink-swell clays (Kienzle, 1999). Toolbox Fire Recovery Project area soils grade from a sandy volcanic ash deposit along Silver Creek to a loamy surface weathered from the basalt basement bedrock along Duncan Creek (Wenzel, 1979). Basalt rock often produces shrink-swell clays that recover with moisture recovery. So the less negative compaction findings may be due to shrink-swell soils as well as the sandy non-cohesive ash deposits.

The harvested areas used in the 1997 Watershed Analysis were recently found to have vigorous forest growth and favorable soil tilth—un-compacted by soil features or Pacific Northwest Region criteria. Similarly the recently burned and salvaged Alder Ridge area within the Toolbox project area has a grassy forest understory, like the historic forested rangeland for a mid or higher ecological status. Soil conditions are tilth-like with 95 percent of the samples in classes 1, 2, and 3.

The 2002 survey findings are consistent with ASTM and AASHTO tables and testing for sandy soils with slight compressibility and slight cohesion and shrink-swell cohesive soils. The findings are also consistent with the long-tern soil study by Gomez et al.'s (2002) of ponderosa pine seedlings and sapling growth in three contrasting textures. Gomez et al., (2002) found overall compaction effects on pine seedlings and sapling growth were detrimental in the clayey soil, insignificant or no effect in the loamy soil, and beneficial in the sandy loam soil. However, the Toolbox project area loam to clay loam soils had the ameliorating effects of shrink-swell clays.

To prepare for post treatment analysis such as Chi-Square transects were classified as moderate with samples along transects of > 40 percent hits of Class 3 and 4 soil compaction factors and low with transects of hits of Class 1 and 2 soil compaction factors with few hits of 3, 4, 5 or 5. Most transects were in low compaction conditions. The results from the extensive 2002 post-fire compaction surveys also describe the cumulative effects of past activities and events that have occurred in the area.

Environmental Consequences

Direct and Indirect Effects

Erosion and Sediment

Following a fire, sediment yields decline in a year or two, as ground vegetation recovers. A local time line recovery reference is the 1996 Alder Ridge wildfire that occurred within the Silver Fire portion of the Toolbox Complex. The 1996 Alder Ridge and the 2002 Toolbox Complex fires inter-meshed with a land composed of essentially the same soils, vegetation, and geomorphic elements. The 1996 Alder Ridge Fire, which was partially salvaged logged in 1997, now has well developed ground vegetation and grass recovery. It is a ground cover recovery that is likely to occur in the Silver Fire, with salvage. This example helps to frame erosion recovery scenarios by case studies.

Ground Cover Recovery and Erosion with Ground-based Harvest by Case Studies – The effected area is based on the largest area of proposed harvest (Alternative C) with 14,441 acres of salvage out of the areas burned on the Fremont National Forest in the Toolbox Complex. Other action alternatives have harvest areas that range down to 6,367 acres (Alternative D). Alternative A has no active recovery treatments. Salvage units were grouped into seven case studies based on recurring eco-class, soil type, and slope patterns. Each of these case studies was examined in relation to vegetative recovery at six plausible "checkpoints." For each checkpoint, sediment values are estimated using Water Erosion Prediction Project (WEPP) technology.

The following table starts with the current or existing condition then presents likely treatment and recovery. The first checkpoint scenario is a low severity burn in an overstocked forest, where the eco-class live ground cover is reduced to ½ of pre-fire potential. The second checkpoint occurs approximately 2 years after the wildfire, where the live ground cover has recovered to ¾ of eco-class potential. The third checkpoint includes treatment of 15 percent of the area with skid trails, while maintaining ¾ of potential live ground cover over the remaining area. The fourth checkpoint represents full potential live ground cover after logging, and the fifth checkpoint represents a reforested 5-year-old forest.

Using the 1996 Alder Ridge wildfire as a model, most of the sequence of recovery checkpoints presented in the table below may occur within six years. The long 2003 spring rainy season and the extension of the snowfall into late May is encouraging since it provides soil moisture conditions that contribute to seedbed response and rapid grass recovery.

Table 3.104 Live Ground Cover Recovery Sequence by Case Study

Case Study	Slope	Soil Characteristic	Ecoclasses	Live Ground Cover by Checkpoint (percent cover)				
				1	2	3	4	5
1	0 to 15%	Loamy Texture	Ponderosa pine/fescue, with various sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	40	63	63; 10 on Skid Trails	80	100
2	0 to 15%	Loamy Sand Texture	Ponderosa pine/fescue, with various sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	40	63	63; 10 on Skid Trails	80	100
3	0 to 15%	Stony Loamy Texture (rock content 50%)	Ponderosa pine/fescue, with various sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	40	63	63; 10 on Skid Trail	80	100
4	0 to 30%	Stony Loamy Texture (rock content 50%)	Ponderosa pine/fescue with various sagebrush and bitterbrush shrub combinations in ecoclasses: CP-S2-11, CP-S3-11, CP-C2-11	40	63	63; 10 on Skid Trail	80	100

Table 3.104 Live Ground Cover Recovery Sequence by Case Study (Continued)

Case Study	Slope	Soil Characteristic	Ecoclasses	Live Ground Cover by Checkpoint (percent cover)				
				1	2	3	4	5
5	0 to 30%	Loamy Texture	Ponderosa pine, white fir and aspen forest, with various ceanothus, manzanita and bitterbrush shrub combinations in ecoclasses: CP-S2-17, CW-H2-12, CP-S1-21	65	83	83; 10 on Skid Trail	100	
6	0 to 30%	Loamy Sand Texture	Ponderosa pine White fir and Aspen forest, with various ceanothus, manzanita and bitterbrush shrub combinations in ecoclasses: CP-S2-17, CW-H2-12, CP-S1-21	65	83	83; 10 on Skid Trail	100	100
7	0 to 15%	Loamy Texture	Lodgepole pine and ponderosa pine/fescue and sedge forest, ecoclass: CL-G3-15 (limited shrub component)	35	45	45; 10 on Skid Trail	55	100

Water Erosion Prediction Project technology sediment values were generated for each of the cases at six plausible checkpoints of recovery and treatment using a local climate record for 50 years to include high intensity storm events. Average values for sediment production were calculated using Water Erosion Prediction Project (WEPP) technology, with the results presented in the preceding table The checkpoint live cover values in the above table are less than the default 85 percent cover in WEPP for a low severity fire. But checkpoint live cover values reflect current dense forest conditions and provide relative differences for estimating sediment transport. Live cover values are based on grass and shrub cover values from plant associations (Hopkins, 1979). The estimates also provide context for estimating the effect of skid trails that are developed and used two years into live ground cover recovery.

Overall soil erosion and sediment transport are expected to be minimal for most of the proposed harvest units among all alternatives. For 6 of the 7 cases by checkpoint 2 live ground vegetation recovery is sufficient to limit the risk of a long-term decline in soil productivity. Sediment estimates in Table 3.104 show that the effects from skid trails at checkpoint 3 are expected to be well below soil loss tolerances of 1.00 to 5.00 tons per acre (Soil Survey Division Staff. 1993). Since all activities are prescribed in accordance with practices in the Fremont National Forest Soil Productivity Guide and Best Management Practices for timber and road (See Appendix C) soil erosion and sediment transport should be minor with all action alternatives. With likely live ground vegetation recovery two years after the wildfire, direct effect and cumulative effects, proportionate to area treated, are expected to be minor.

Table 3.105 Sediment Estimates in tons per acre (t/ac) using WEPP Technology for Seven Case Studies

Case	Checkpoint 1	Checkpoint 2	Checkpoint 3	Checkpoint 4	Checkpoint 5	Probability of Sediment Transport
	live cover of ½	live cover recovery to ¾	15 percent skid trail and ¾ live cover elsewhere	full live ground cover	reforested 5 year old forest	
Case 1, loam	0.09 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	0 %
Case 2, loamy sand	0.06 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	0 %
Case 3, stony loam	0.19 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	0 %
Case 4, stony loam	0.37 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	2 %
Case 5, loam	0.20 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	2 %
Case 6, loamy sand	0.08 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	0.00 t/ac	0 %
Case 7, loam	0.25 t/ac	0.10 t/ac	0.05 t/ac	0.00 t/ac	0.00 t/ac	14 %

As in the Existing Condition some erosion risk is associated with case study seven. Case 7 lodgepole pine ecoclass: CL-G3-15 with loam texture, SRI map unit 39, produces a 14 percent probability of sediment transport. The proposed harvest areas in case 7 are units: 130, 131, 133 and 134 in the Toolbox Fire Portion by road 3012. All four units are ground-based units. They vary in size by alternative and by amount of temporary road developed for access. The sediment transport value at checkpoint 3 (0.05 tons/acre) is near a background erosion condition. Yet these units are of sufficient size to allow WEPP technology to discern a difference between alternatives, as displayed in the following table of Sediment for Harvest Units 130, 131, 133 and 134 in tons per year (t/y) and for Temporary Roads.

Table 3.106 Sediment for Harvest Units 130, 131, 133 and 134 in tons per year (t/y) and for Temporary Roads

Alternatives	D	H	C	E	G	A
Acres Harvested	31	741	781	781	781	0
Erosion t/y	1.5	37.1	39.1	39.1	39.1	0
Temporary road miles	0	0.9	0.9	0.9	0.9	0
Native road t/y	0	0.002	0.002	0.002	0.002	0

In the field the estimated soil erosion appears to be a minor consideration compared to wetland loss. Harvest units 130, 131, 133 and 134 are mostly lodgepole pine thickets with high mortality and spotty ground cover up from the moist silver sagebrush and wet tufted hairgrass meadows. The aerial photographs shows the meadows are large enough that they could be mapped in association with the adjacent lodgepole pine community in the soil map unit. In the burnt thickets no sign of sheet or rill erosion were evident in walks across the units from the mid July 2003 thunderstorms. The site infiltration accommodated the rainfall and on July 25 the soil recharge average 30 to 40 cm. The meadows are well vegetated, which limit sediment transport to the seasonally dry Benny Creek. Yet the encroachment of lodgepole pine is diminishing the meadows. Lodgepole pine is crowding out dry meadow and moist meadow habitats and is now extending into the wet meadow habitats. The wind thrown pine show the hydric soil feature under the lodgepole. The wetland has diminished by 40 to 50 percent for a notable wetland loss.

The four units along Benny Creek illustrate the trade off among the geology and soil topics. There is an erosion risk and a forest density risk. Yet on balance treating the units, particularly 131 in would aid wetland recovery.

Indirect Erosion Effects--The development of ground cover by the treatments limits long-term erosion. So over the long term the action alternatives would benefit the development of ground vegetation that limits soil erosion and sediment transport. And Aspen enhancement projects and riparian planting, included in Alternatives C, D, G, and H would contribute to the healthy riparian conditions to limit sediment to the streams. This contribution would not occur with Alternatives A or E.

Roads Densities– Alternatives vary by road amelioration for less erosion risks by treatments. The current high road densities represent a societal demand for transport, yet without a very high standard of design and maintenance, roads accelerate and concentrate erosive forces. From the soil quality perspective, the treatment of roads differentiates the alternatives.

In Alternative A the existing road density of 3.68 mi/mi^2 would be present both before and after treatment. In high storm events like Wemple's (1994) wet season model yields 40 percent of road density that may contribute to the stream drainage density. The Toolbox Fire Recovery Project area stream drainage density of 1.08 mi/mi^2 is added to the road-affected drainage density to produce an effective channel density by alternatives in the following table. From a geomorphic perspective, including the road induced drainage-density values, the overall density values are within the low class 3 to 4 mi/mi^2 for modest sediment transport (Strahler, 1964), for all alternatives. However, Alternative A has twice the channel density, above the streams density of 1.08 mi/ mi^2 for perennial and intermittent streams, so there is a sustained road affect.

Table 3.107 Channel Drainage Densities as affected by Roads Densities

Alternatives	A	C	D	E	G	H
Road density	3.68	1.76	1.68	2.57	2.57	1.72
Road affect (40% or 0.4)	1.47	0.70	0.67	1.03	1.03	0.69
Effective channel density	2.55	1.78	1.75	2.11	2.11	1.77

Alternative A, the no action alternative has more than double the native drainage density of 1.08 mi/mi^2, so it presents the greatest storm sediment density transport risk. Alternatives E and G with intermediate amounts of road closure and decommissioning, begin to reduce the current sediment risks identified in the Silver Creek Watershed Analysis (Forest Service, 1997). Alternative E has more miles of road closure than decommissioning, so it is likely to have a slower long-term sediment reduction than Alternative G. From a geomorphic perspective, Alternatives D, H, and C make the greatest investment in sediment transport risk reduction, with effective channel densities that range from 1.75 to 1.78 mi/mi^2.

Road Erosion—Sediment was estimated using the project areas typical 2 percent grade native surfaced or graveled roads, with 400 to 800 feet cross drain increments, for an eastside climate. Native surfaced roads away from steams yield 0.0025 tons per mile. Gravel surfaced roads yield 0.00 tons per mile. Native surfaced roads near (within 10 meters) of streams yield 0.47 tons per mile to a stream, and gravel surfaces yield 0.35 tons per mile. Decommissioned road segments should result in a reduction down to background rates as they re-vegetate. Over the long-term, closed roads, which may re-vegetate more slowly, would eventually provide similar sediment reductions.

On a per acre basis the following table shows the sediment reductions by Alternative due to road reduction. Alternatives D, H, and C reduce sediment by 0.48 ton per acre each year; or up to 0.47 tons per acre above the typical 0.01 to 0.05 ton per acre background conditions by the Toolbox Fire Recovery Project.

Table 3.108 Sediment Reductions by Alternative Due to Road Decommissioning or Closure

Alternatives	A	C	D	E	G	H
Road miles decommissioned	0	69.0	71.6	14.6	71.6	71.6
Sediment reduction (tons/year)	0	0.4	0.4	0.2	0.4	0.4
Long-term sediment reduction – includes consideration for Road Closure (tons/year)	0	0.7	0.7	0.6	0.6	0.7

Indirect Soil Biology Effect-- Long-term recovery of soil biology habitats on former road surfaces is proportionate to road miles treated.

Forest Density and Soil Fertility

Conifer densities above historic norms negatively affect soil habitats and their functions (Biswell, 1989, West and Young, 2000). West and Young (2000) identify the shift in habitats as a "lignification," which identifies habitat shifts by changes in biochemical pathways to conditions are less suited to processing litter into humus and sustaining a rich forest soil life. Recovery is sustained by formation of gaps and ground cover vegetation within the forest.

From a soil site productivity and suitability perspective, the proposed alternatives can be compared by their gap ground cover recovery. There are 15,074 acres with tree mortality above 50 percent and 5,434 acres with tree mortality above 25 percent for 20,508 acres with a "lignification" risk or humus re-supply decline. Yet the alternatives treat a smaller area. The action alternatives range in size from Alternatives C (14,441 acres), Alternatives G (14,419 acres), H (13,031 acres), E (11,490 acres), to D (6,367 acres). Alternative A has no investment in recovering historic gaps, can be considered the maximum "lignifications" future course

Alternatives C and G treat approximately 28 percent of the National Forest in the burn and 70 percent of the area of "crown wildfire related mortality" in the Toolbox Complex. Preference for harvest has been skewed toward high density and high mortality areas. In general, the harvest areas correlate to areas with forest soil "lignification" risk or humus re-supply fertility problems. The direct effect of action alternatives is reduced "lignification" and to restore gaps, which sustain live ground cover recovery and promote a shift toward appropriate biochemical pathways for humus re-supply. So by area treated this soil loss aspect is reduced.

Reforestation, which is planned at a low density, is with consideration for droughty semiarid soils and sites. It is expected to approach historic densities, after an initial thinning.

Indirect Effects on Soil Biology –Treatments effect on ground cover has an indirect effect of on soil biology and habitat recovery. Two recovery processes are associated with the changes in soil biology forest soil loosening and plant dynamics (Coleman and Crossley, 1996, Lutz and Chandler 1948, Young and Clements, 2002). For example burrowing voles, such as *Microtus montanus*, population correspond to grassy bacterial habitats of eastern Oregon (Verts and Carraway, 1998). With Ponderosa pine density and encroachment onto meadow there is a loss in burrowing vole habitats. The small mammal's food of *Arthropods*, such as mites, *Mollusk,* such as snails, and *Annelida,* such as earthworms also loosens the soil as it process forest detritus (Coleman and Crossley, 1996, Lutz and Chandler 1948). Mites are known for processing poorly digestible *Abies,* fir needles through various life stages. Example plant dynamics occurs in granivore relationships between deer mice, *Permyscus maniculatus,* and bitterbrush, *Purshia,* seeds that shape plant community composition and structure by seed predation, dispersal and seedling recruitment (Young and Clements, 2002). In turn mule deer habitat is supported by deer mice's practices. So restoring the forest's historic sagebrush grass and mixed forest shrub grass ground cover helps to recover soil fauna, soil biology and supported habitats.

Alternative A has the least habitat recovery with no action or investment in developing historic forest gaps and ground cover habitats. Investment in gap ground cover varies from Alternative C, which recovers habitats in 14,441 acres to Alternatives G, H, E and D at 6,367 acres. By accommodating soil fauna that loosens forest soils the harvest areas conform to the site protection provision in the 1897 Organic Act and recovery for Watershed Protection and Management. Harvest areas meet the 1976 NFMA that provides for the diversity of plant and animal communities based on the suitability and capability of specific lands.

Indirect Effect on Potential Adverse Soil Heating - The risk reduction from subsequent high intensity wildfire and its accompanying potential negative impacts on soil fauna is proportionate to the areas treated by the actions included in the alternatives, and their contribution to recovery of historic conditions. Harvest and fuel treatments are expected to limit the fuel loads, including those contributed by large wood with long resident burning time, so that burn severity, in the event of future fires, should still be primarily in the low severity category. This would contrast favorable with the contiguous moderate burn severity that was observed in Toolbox Complex on some adjacent private industrial forestlands, which were characterized by limited gaps among more contiguous down wood. Alternatives G and C, with the greatest number of acres with harvest and post-harvest fuel treatments, best address this potential for indirect adverse effects from excessive soil heating and the associated risk of loss of soil fauna habitat.

Compaction

The 2002 post-fire survey findings, presented in the "Existing Condition" section, revealed that past activities have yielded well under 20 percent detrimental soil conditions for the Pacific Northwest Region. Overall 1.04 percent of transect hits occur in soil compaction factor classes 5 and 6 that correspond to growth limiting detrimental soil conditions. None of the 91 transects or treatment areas sampled had detrimental soil conditions.

The survey data are skewed to tilth condition with evidence of past harvest. The burn extended into past harvest areas scattered though out the project area. In the 91 transect the most common value is evidence of equipment class 3 that indicates past harvest. In the Silver Fire Portion transects evidence of equipment factor 3 occurs at 59 percent of the hit and 63 percent of the hits in the Toolbox transects. The complementary compaction factor at class 3 occurs at a lower rate. In the Silver transects compaction class 3 occurs at 42 percent of hit and 51 percent of the hits in the Toolbox transects. The overall skewed distribution with 83 percent of hit in compaction classes 2 and 3 for tilth conditions, indicate that timely recovery has occurred, or that this landscape has minimal compaction risk from ground-based, skid-trail logging.

A third of the 312 proposed harvest units (maximum in Alternative C) were sampled by the 91 transects. Transects were broadly distributed to cover the range of harvest habitats. Adjacent harvest areas occur on similar soils and plant association as the transected harvest area. Often adjacent harvest areas had similar past harvest history, so the adjacent areas are apt to behave in a similar manner today and in the future.

The past treatment histories were evident in tours to spot checked compaction values. Potential harvest areas were visited on north south routes along Forest Roads 28, 29, 018 along the west face of Foster Butte and Rd 2901. For example past harvest has occurred near Road 28 in proposed harvest units 222, 223, 224 and 225 where transects were sampled. The sandy ash adds a grit feel to the loamy soil in this area. Past harvest also occurred near road 2901 in proposed harvest units 151 and 152 where transects were sampled. Along this rim area the shrink swell soil are evident and were a topic in the compaction training sessions. In these and other past harvest areas the soils did not have growth-limiting compaction of detrimental soil conditions.

Examples of the likely effects of the proposed salvage harvest and post-salvage activities in the Toolbox project were systematically recorded by post-Toolbox Fire sampling within the 1996 Alder Ridge Fire (salvaged in `1997) and sampling in the revisited 1997 watershed analysis sites. The burned and salvaged Alder Ridge by Forest Road 27 have a grassy forest under-story like the historic forest and tilth like soil conditions with most hits in classes 1, 2, and 3. Proposed Toolbox salvage units 255, 256 in this area have a similar environ to Alder Ridge so these units are apt to respond in a similar way. To the west, salvage unit 251 had transect soil values dominated by classes 1 and 2, as did the adjacent revisited harvested unit in the 1997 Watershed Analysis that has vigorous forest growth and favorable soil tilth. Similarly in the Toolbox Fire portion, proposed salvage units 83 to 89 are adjacent to the revisited harvested unit from in the 1997 Watershed Analysis with vigorous forest growth. These and other harvest units apt to have limited or short-lived compaction effects due to shrink swell soils and sandy non-cohesive ash deposits.

There may be short-lived effects that vary by area treated. With Alternative C, at 14,441 acres the largest area treated it is the most likely to have short-term effects. As borne out by compaction monitoring this is clearly a compaction resistive landscape. The primary factor in recovery relate to ground cover. The ground cover species by number are the major floristic components of a forest. The better tilth under a grass ground cover, as compared to one characterized by pine needle mats is a topic that is need of more complete sample statistics to better understand this ground cover relationship.

Indirect Effects on Soil Productivity-- An indirect treatment effect in loamy sand soils may be to enhance pine growth, like Gomez et al., (2002) findings for beneficial compaction effects in sandy soils.

With the application of practices in the Fremont National Forest Soil Productivity Guide and timber and road Best Management Practices (See Appendix C) there is an expectation that the new activities, proposed in all action alternatives, would not produce detrimental soil conditions in excess of the 20 percent standard. For all action alternatives direct and cumulative effects on soil compaction in areas with proposed activity are expected to be limited or short-lived.

Cumulative Effects

Hill-slope Erosion--Ground cover loss in dense forest and woodlands yields topsoil loss. To avert the soil loss in semiarid forest and rangelands West and Young, (2000) identify the ill affects of conifer densities above historic norms as a "lignification," which are less suited to processing detritus into soil humus and available nutrient for plant growth—so the soils erode. The Toolbox project area faces "lignification" with a semiarid climate, canopy closure exceeding historic values (Friedrichsen, 2003) and the associated extensive tree mortality. The reduced ground cover was used to estimate erosion. The first of six checkpoints is a low severity burn in an overstocked forest, where the eco-class live ground cover is reduced to ½ of pre-fire potential. The second checkpoint occurs approximately 2 years after the wildfire, where live ground cover has recovered to ¾ of eco-class potential.

Water Erosion Prediction Project technology sediment values were generated for each of the cases at six plausible checkpoints of recovery and treatment. As current condition approach checkpoint 2 live ground vegetation recovery is

sufficient to limit erosion. The WEPP values are well below soil loss tolerances of 1.00 to 5.00 tons per acre (Soil Survey Division Staff. 1993). With most soils in low and moderate burn severity, erosion risk and rates are apt to decline in a few years as ground vegetation recovers (Robichaud et al., 2000). Rapid native recovery is anticipated in the 74,673 acres with low severity and the 11,311acres with moderate severity. Some erosion may occur in harvest units 130, 131, 133 and 134, yet the meadow systems are in a position to catch the sediment. Cumulatively the scenario shows soil erosion is a minor consideration in most of the likely harvest areas.

Cumulative Road Effects--The typically road in the Toolbox Fire Recovery Project area is a two percent grade, native surface roads or graveled road with 400 to 800 feet cross drain increments. In a relatively dry east-side climate, native roads near streams (within 10 meters) yield an estimated 0.47 tons per mile to the stream and those with gravel surfaces yield an estimated 0.35 tons per mile.

Alternative A sustains the road doubling of the streams density of 1.08 mi/ mi^2 for perennial and intermittent streams, so there is a sustained road affect. On the other hand there is a cumulative reduction in road effects and sediment with the action alternatives. The effects by action alternative vary proportionate to the miles of road closed and decommissioned. On a per acre basis Alternatives D, H, and C reduce sediment by 0.48 ton per acre each year for a hillslope saving up to 0.47 tons per acre above the 0.01 to 0.05 ton per acre background conditions. Cumulatively the action alternatives provide beneficial effect of road amelioration for less erosion.

Humus Re-Supply--The harvest areas with mortality classes above 25 percent correspondence to dense forest areas where Busse like nutrient re-supply has been limited for decline in soil productivity (Busse's et al.1996). High forest density conditions close out the humus re-supply cycle. Sites with 0-25% mortality typically had canopy gaps closer to the historic gap range, so nutrient re-supply is also apt to be within the historic range.

Nutrient re-supply cycle may have been missed in sites with 26 to 50 percent mortality with a decline in forest gaps and ground vegetation. The extensive areas with high mortality and likely chronic humus decline in Table 3.102 and 3.103 and Figures 3.27 and 3.28, illustrates a shift or shifting lands capability. Without gaps low fertility is reinforced by the conifers acid needle fall, their root structure, and biology. Cumulatively this dysfunction is alleviated by the wildfire and the proposed treatments that recover ground cover vegetation.

Soil Compaction—Current conditions are based on an extensive and intensive survey with 1820 samples on 91 transects. Overall 1 percent proposed harvest areas and transects sampled had detrimental soil conditions with hit in classes 5 and 6. Many prior harvest areas that burned were sampled, yet 85 percent of the samples have tilth-like soil classes of 3, 2 and 1. No transect or proposed harvest unit had detrimental soil compaction using the regional guidelines for detrimental soils (Forest Service. 1998). Chapter 2520, Pacific Northwest Supplement 2500-98-1 sets a soil disturbance criterion of 20 percent for detrimental soil condition in the Pacific Northwest Region (R6).

On site tours the clayey texture soil in the area was found to shrink about 10 percent, which is consistent with shrink swell clay. Similar landscapes in the adjacent South Lake County soil survey the clays have shrink-swell clays (Kienzle, 1999). Cumulatively less negative compaction findings may be due to shrink swell soils as well as the sandy non-cohesive ash deposits. Cumulatively new proposed harvest and fuels treatments are not apt to depart from the current conditions that have a harvest history. The Toolbox project area contains examples of recently burned (Alder Ridge Fire -1996), subsequently salvaged (Ridge Timber Sale -1997) that upon compaction testing (post-Toolbox Fire) exhibited acceptable conditions.

Since all activities would include the application of the practices detailed in the Fremont National Forest Soil Productivity Guide and timber and road Best Management Practices (See Appendix C), the expectation is that soil erosion and sediment transport would be minor with all action alternatives. With likely live ground vegetation recovery two years after the wildfire, direct effect and cumulative effects, proportionate to area treated, are expected to be minor.

Aspen enhancement projects and riparian planting, included in Alternatives C, D, G, and H would contribute to the healthy riparian conditions. This contribution would not occur with Alternatives A or E.

Reasonably foreseeable future actions that would occur in the specific areas that would experience direct or indirect effects on the soil resource are displayed in Appendix A, Tables A-14 through A-17. See the following Chapter 3 section (on Watershed and Fisheries), in which a subwatershed-by-subwatershed cumulative effects analysis is presented. This analysis includes consideration of specific past activities, indirect and direct effects of the Toolbox Fire Recovery Project, by alternative, and specific reasonably foreseeable future activities. The analysis synthesizes the expected cumulative

effects on a number of elements, including soils, to determine whether a restoration, maintenance or degradation would be expected to occur.

Forest Plan Consistency

For all alternatives, protection of soil resources and maintenance of long-term soil productivity will be accomplished in accordance with the Fremont National Forest Soil Productivity Guide and timber and road Best Management Practices. The project is consistent with the Forest Plan, Forest Service Manual Guidelines, R6 Soil Quality Standards, and other legal frameworks. Soil technical support has been provided for all project alternatives through the assessment of existing condition and environmental consequences for soil resources included in this document, consistent with the Forest Plan and Forest Service Manual Guidelines. Harvest activities and other activities within RHCAs would be in accordance with Fremont National Forest Land and Resource Management Plan (LRMP) Standards and Guidelines, as amended by the Inland Native Fish Strategy (INFISH). These specifically provide direction for: Category 1 – Fish Bearing Streams; Category 3 – Ponds, lakes, reservoirs, and wetlands greater than 1 acre; and Category 4 – Seasonally flowing or intermittent streams. There are no Category 2 streams in the project area. Judicious harvest and fuels within and adjacent to riparian habitat conservation areas RHCA is consistent with Executive Order 11990 for conservation of wetlands.

WATERSHED, FISHERIES, AND ROADS ANALYSIS

- Introduction
- Key Issue
- Purpose and Need
- Regulatory Framework
- Analysis Area and Methods
- Existing Condition
- Direct and Indirect Effects – Watershed
- Direct and Indirect Effects - Fisheries
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- Cumulative Watershed Effects
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- Cumulative Effects - Fisheries
- Forest Plan Consistency
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Introduction

This portion of Chapter 3 discusses existing conditions after the 2002 fires and the potential effects on watersheds, fisheries and roads as a result of the proposed management activities.

Each alternative is first considered as a complete entity, in terms of direct and indirect effects within the project area boundary. This is followed by a cumulative watershed effects analysis that considers, by subwatershed, the overall effect of: past activities on all ownerships, the Toolbox Alternatives on a subwatershed basis, and reasonably foreseeable future activities on all ownerships. Subwatersheds correspond to 6th field Hydrologic Unit Codes (HUC). A hydrologic unit code (HUC) is defines as an area of land upstream from a specific point on a stream (designated as the mouth) that defines a hydrologic boundary and includes all of the source areas that could contribute surface water runoff directly and indirectly to the designated outlet point.

The fisheries analysis focuses on the current condition and effects of the project on redband trout (*Oncorhynchus mykiss spp*.). Redband trout is the only native trout species found in the Toolbox Fire Recovery Project area. Bull trout (*Salvelinus confluentus*) a federally listed threatened species are not found in streams in the project area therefore, there are no priority watersheds in the project area. Other fish species that occur in the project area include non-native Eastern brook trout (*Salvelinus fontinallis*), sculpin (*Cottus spp*.), and speckled dace (*Rhinicythys osculus*.). The current aquatic condition information used in this analysis was obtained from the Silver Lake Watershed Assessment (SLWC, 2003), post-fire stream surveys for large woody debris and shade in fish bearing streams, and post-fire stream channel conditions surveys for major intermittent streams.

Because of the close relationship between watershed conditions and roads, this section also incorporates a discussion of the **Roads Analysis Process** that was used to generate road management strategies for each alternative. The Roads Analysis Process resulted in recommendations regarding each road that ranged from leaving the road open at its current maintenance

level, increasing the maintenance level, closing the road, or decommissioning the road. These recommendations were used to design the varying road management actions that are included in the alternatives.

Key Issue: Effects on Soils, Watersheds, and Aquatic Habitat

Issue Statement: The proposed salvage and connected actions, including temporary road construction, could potentially have adverse effects on water quality and timing of runoff, and cumulatively contribute to adverse effects on soils.

Measurement Indicators:

1. Watershed and Riparian Effects, by determining the effect (Restore; Maintain; Degrade) on the functionality of:
   - Uplands – Roads, Canopy, Soil
   - Riparian Vegetation and Bank Stability
   - Channel Condition - Pool frequency, Large Wood Frequency, Temperature, Fine Sediment and Fish Passage
2. Soils (See Geology, Geomorphology and Soils section of Chapter 3), including measures of:
   - Fertility
   - Sediment Risk (including the contribution of roads to sediment transport)
   - Compaction
3. Amount of Soil and Riparian Protection and Restoration Activity (miles or acres) and assessment of effects, including sediment reductions (tons/year) from Road Decommissioning
4. Attainment of INFISH Riparian Management Objectives – Yes or No

Purpose and Need

The purpose and need of this project includes six elements, one of which relates directly to Watershed and Fisheries:

- Restore riparian areas damaged by the Toolbox Fire Complex

Regulatory Framework

Watershed and Roads Analysis

The Fremont National Forest Land and Resource Management Plan (LRMP) (USDA 1989) provides direction regarding resource management activities and establishes management standards and guidelines. Direction pertaining to the water resources portion of the Toolbox Fire Recovery Project is discussed below.

The LRMP forest-wide standards for soils and watershed management are to:

- Maintain or improve soil productivity (p. 80).
- Keep soil erosion levels within tolerable limits (p.83).
- Monitor results and impacts of land management activities on soil productivity (p. 83).
- Protect water quality through implementation and enforcement, monitoring and evaluation, and modification of best management practices (BMPs). [Guidance regarding individual BMPs are described in General Water Quality Best Management Practices, Pacific Northwest Region, 1988] (p. 88)
- Assess the cumulative effects of activities on water quality or stream channels (p. 86).
- The Forest Plan sets the goal as "a safe and economical transportation system providing efficient access for the movement of people and materials" (p. 51).

LRMP Forest-wide standards that affect soil and watershed condition provide further detail:

- The transportation system will serve long-term multiple resource… (with)…the minimum system necessary to provide access for the activities authorized under management area direction" (p. 116).
- Overall density for roaded area of the Forest will not exceed 2.5 miles per square mile (p. 116).

- All system roads will be operated and maintained to protect the resources, perpetuate the intended road management objective, and promote safety (p. 116).
- Prescribed fire will be considered for use in meeting management objectives in areas where ecological studies show that fire has played a significant role in ecosystem development (p. 118).

The following LRMP Management Areas have further management goals and standards that pertain to water resources:

- MA 15 – Fish and wildlife habitat and water quality (p. 199) (Goal): Water bodies and courses, their riparian vegetation, and the immediately adjacent upland areas will be managed to maintain or improve water quality, fish habitat, recreation opportunities, and riparian habitat for dependent wildlife species. All project actions must be in compliance with the Inland Native Fish Strategy (INFISH). The Forest Plan amendment for INFISH (1995) amended the standards and guides by creating Riparian Habitat Conservation Areas (RHCAs) (See Chapter 1 of this EIS, "Forest Plan Management Areas"). Standards and guidelines:
    - Applicable state and federal water quality standards will be met.
    - Site-specific prescriptions will be required for all project activities that affect aquatic/riparian systems.
    - In cases of irresolvable conflict, soil, fish, water, and wildlife will receive preferential consideration.
    - Watershed, wildlife, and fisheries habitat rehabilitation and improvements will be required to meet goals for aquatic/riparian systems.

Soil Productivity Guide (SPG) (Fremont National Forest 2000). Goal: Consider soil impacts when planning all ground-disturbing management activities, implement sound soil conservation and management practices, monitor impacts of those practices, and maintain the productive potential of the lands. Standards and guidelines: see Geology, Geomorphology and Soils Section; (See Appendix C for complete text of Soil Productivity Guide).

Forest Service Manual 2500 – Watershed and Air Management (Chapter 2520 – Watershed Protection and Management). Objective: To meet direction in the National Forest Management Act of 1976 and other legal mandates. To manage National Forest System lands under ecosystem management principles without permanent impairment of land productivity and to maintain or improve soil and water quality.

Forest Service Manual 7700 - Transportation Analysis (7712.1 - Roads Analysis). If road management activities are planned, decisions are required to be informed by an interdisciplinary science-based roads analysis, if those activities would result in new road construction, changes in access, such as changes in current use, traffic patterns, and road standards, or where there may be adverse effects on soil and water resources, ecological processes, or biological communities.

Other regulatory or legal requirements that direct watershed management are:

- Section 208 of the Federal Water Pollution Control Act of 1972 specifically mandates identification and control of silvicultural related non-point sources of pollution.
- Clean Water Act, Section 303, 319, 404.
- Federal law required that streams, rivers, lakes and estuaries that appear on the 303(d) list be managed to meet water quality standards. A comprehensive watershed approach for protecting water quality includes developing TMDLs (total maximum daily loads) for both point and nonpoint sources. Department of Environmental Quality (DEQ) is committed to having federally approved TMDLs on all waterbodies listed on the 1998 303(d) list by the end of the year 2007. Two waterbodies within the project area are currently on the 303(d) list for temperature: West Fork Silver Creek (from mouth to Silver Creek Marsh) and Silver Creek (from mouth to Thompson Valley Reservoir).
- Section 319 of the Clean Water Act directs states to develop programs to control non-point source pollution and includes federal funding of assessment, planning and implementation phases.
- Section 404 of the Clean Water Act (CWA) established a program that regulates the discharge of dredged and fill material into water of the United States, including wetlands. Activities regulated under this program include fills for development, water resource projects (e.g., dams and levees), infrastructure development (e.g., highways and airports), and conversion of wetlands to uplands for farming and forestry.
- Best Management practices (BMPs) are the primary mechanism to enable the achievement of water quality standards. The Forest Service Nonpoint Source Management System consists of: Selection and design of BMPs based on site-specific conditions, technical, economic and institutional feasibility, and the water quality standards of those waters potentially impacted, the implementation and enforcement, monitoring to ensure compliance and

effectiveness, evaluation of monitoring, and adjustment of BMP standards and application. A complete list of BMPs refined for the Fremont National Forest can be found in Appendix C.

Fisheries

Forest-wide fisheries standards that apply to the project are contained within the Fremont National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service, 1989) as amended by The Inland Native Fish Strategy (USDA Forest Service, 1995: A-6 to A-13).

There are two Forest-wide fisheries/riparian standards in the Fremont National Forest LRMP that apply to this project:

1. Redband trout populations will be used as an indicator of fisheries habitat changes (USDA Forest Service, 1989: Appendix 1, pg. 77)

2. Protection and enhancement of riparian areas, Management Area 15, which emphasizes fish and wildlife habitat and water quality (USDA Forest Service, 1989: pg. 199-204). The INFISH amendment substantially modified the way in which MA 15 direction is implemented (See Chapter 1, "Forest Plan Management Areas").

Inland Native Fish Strategy

The Inland Native Fish Strategy (INFISH) was developed in 1995 as a response to the need for a management strategy that would protect inland native fish that were not already covered within the geographic scope of the Northwest Forest Plan or the Interim Strategies for Managing Anadromous Fish Producing Watersheds on Federal Lands in Eastern Oregon, Washington, Idaho, and Portions of California (PACFISH). This includes such species as bull trout, westslope cutthroat trout, and interior redband trout. This strategy provides direction to maintain and restore native fish habitat and populations in those geographic regions outside the range of anadromous fish. INFISH was designed to provide interim protection for fish habitat and populations until longer-term management strategies such as the Interior Columbia Basin Ecosystem Management Project (ICBEMP) and other federal recovery plans were developed (e.g. bull trout). INFISH is still in effect today because long-term plans have not been implemented.

INFISH provides Riparian Goals and Riparian Management Objectives (RMOs) describing quality fish habitat. The goals described within INFISH "….establish an expectation of the characteristics of healthy, functioning watersheds, riparian areas and associated fish habitats." The RMOs are habitat parameters that provide a basis for determining the state of stream function, and the attainability of riparian goals. Objectives for six environmental features are identified: pool frequency, water temperature, large woody debris, bank stability, lower bank angle, and width to depth ratio. These features are good indicators of ecosystem health, and quantifiable, and are subject to accurate repeatable measurements. INFISH specifies default numeric values for each of the RMOs (USDA Forest Service 1995: A-2 to A-4). The default RMOs for pool frequency, large woody debris, water temperature, and width to depth ratio would apply to all of the streams in the project area. The default RMOs for bank stability and lower bank angle do not apply to the project area because they are to be used in non-forested stream systems and there are no non-forested stream systems within the project area.

INFISH establishes Riparian Habitat Conservation Areas (RHCAs) around all streams, wetlands, water bodies, and landslide prone areas on the Fremont-Winema National Forests (USDA Forest Service, 1995: A-4 to A-6). RHCAs are portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines. Standard widths defining RHCA appear in the following table:

Table 3.109 RHCA Standard Widths, per Stream Side

Type of RHCA	Width, Each side of Stream
Category 1 - Fish bearing stream reaches	300
Category 2 - Perennial, non-fish bearing streams	Not found in project area
Category 3 - Ponds, lakes, wetlands, >1 acre	150
Category 4 - Seasonally flowing/ intermittent stream reaches	50

INFISH directs that site-specific widths may be increased where necessary to achieve riparian management goals and objectives, or decreased where interim widths are not needed to attain RMOs or avoid adverse effects.

Fourteen standards in the INFISH Decision Notice apply to this project. These include: TM-1 (a), RF-1, RF-2 (a-f), RF-3 (a-c), RF-4, RF-5, GM-1, FM-1, FM-4, RA-2, RA-4, RA-5, WR-1, and FW-1. The other INFISH standards and guidelines are outside the scope of this project. TM-1 prohibits timber harvest within RHCAs, except as follows TM-1 (a):

> Where catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, allow salvage and fuelwood cutting in RHCAs only where present and future large woody debris needs are met and where cutting would not retard or prevent attainment of other Riparian Management Objectives and where adverse effects can be avoided to inland native fish.

Project specific salvage designs within RHCAs, under TM-1a, were developed for the Toolbox Fire Recovery Project proposed action and then modified or applied in a varying fashion during the development of the action alternatives.

Interior Columbia Basin Ecosystem Management Project

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) was initiated by the USDA Forest Service and USDI Bureau of Land Management to develop and implement a coordinated, scientifically sound, broad-scale, ecosystem-based management strategy for lands they administer across parts of Idaho, Oregon, Montana, and Washington. This project was designed to replace existing management plans such as PACFISH, INFISH and the Eastside Screens.

The theme of ICBEMP is on restoring and maintaining ecosystems across the project area and providing for the social and economic needs of people, while reducing short- and long-term risks to natural resources from human and natural disturbances. The science that was used to develop the ICBEMP criteria for evaluating functionality of aquatic habitats will be used in this document, as it is considered the best available.

Endangered Species Act/Sensitive Fish Species

There are no fish species listed as either threatened or endangered under the Endangered Species Act of 1973 within the project area. Therefore, a biological assessment for affected fish species will not be required with this project.

In 1997, several groups petitioned the U.S. Fish and Wildlife Service to list redband trout in the Great Basin under the Endangered Species Act. On March 15, 2000, the U.S. Fish and Wildlife Service found Great Basin redband trout not warranted for listing at this time (USDI 2000). Reasons given for not listing included moderate to high numbers of redband trout as compared to state-wide averages, an improving trend in habitat conditions, the return of adfluvial populations in Goose Lake and Chewaucan River systems, and strong conservation efforts through various working groups and watershed councils.

Interior redband trout are a sensitive species on the Regional Foresters Sensitive Animal list (November 28, 2000). A Biological Evaluation has been prepared for this project and is available in the project files located at the Silver Lake Ranger District. The Biological Evaluation for fisheries addresses the direct, indirect, and cumulative effects of all alternatives on interior redband trout habitat, individuals, and populations.

Analysis Area and Methods

Watershed

Map 2 displays the analysis area, the hydrologic units and the streams discussed in this analysis.

The existing condition of the two fifth field watersheds was completed on two levels: the project area alone and for each of the eight 6th field subwatersheds involved in the analysis area. Several sources of information were used to arrive at the existing conditions: Geographical Information Systems (GIS), field inventories after the fire occurred, Burn Area Emergency Rehabilitation (BAER) report, and existing field inventories.

Field inventories were completed after the fire burned to measure the condition of soil compaction, stream channels, and roads. Soil compaction was inventoried using the methodology outlined in the Geology, Geomorphology and Soils section.

Ochoco Bottomline surveys for intermittent streams were completed on nine intermittent streams (Benny Creek, Hawk Creek, Graham Creek, Duncan Creek, East Duncan Creek, McCall Creek, Willow Creek, Indian Creek, and Strawberry Creek) within the project area. Information from these surveys includes: photographs of the stream, dominant and subdominant substrate material, slope, shade, large wood frequency and pool frequency. An assessment of the stream condition was completed in 2000 on the perennial streams of Silver Creek, the 5th field watershed. This inventory was the basis for the Silver Lake Watershed Assessment (Friedrichsen, 2003) and included all perennial streams within the analysis

area: Silver Creek, West Fork Silver Creek, North Fork Silver Creek and Guyer Creek. Field inventories, after the fires burned, were completed on sections of these streams affected by the fire.

The Burn Area Emergency Rehab (BAER) team analyzed the Toolbox and Silver Fires after the fires were contained on August 5, 2002. Results are detailed in the Geology, Geomorphology and Soils section.

Two documents that analyzed portions of the project area are available: Silver Lake Watershed Assessment (Friedrichsen, 2003) and Silver Creek Watershed Ecosystem Analysis at the Watershed Scale (USFS, 1997). However, both analyses are based on data collected before the Toolbox fire complex burned and more recent data has been collected. Both analyses utilize methodology that has since been improved or altered and neither analysis covers the entire project area. Several areas of concern cited in both analyses are consistent. For example, both documents cite roads as the highest producer of soil loss and both recommend the closure or decommissioning of roads as the most effective method for decreasing high road densities. Both documents suggest the [obliteration] decommissioning of roads within 300 feet of streams be the emphasis. Any specific road recommendations from the analyses were replaced by the recent Roads Analysis completed specifically for this project. Compacted soil in timber harvest units was identified as the largest soil impact (USFS, 1997) and recommendations to increased infiltration through subsoiling are expressed. Friedrichsen (2003) suggests there is a data gap with respect to the level of soil impacts that have occurred within each subwatershed and suggests further site-specific data collection is needed. The USFS (1997) analysis concluded that most subwatersheds have high disturbance levels on greater than 40 percent and as high as 73 percent of the subwatershed. The 1997 analysis used aerial photo interpretation to determine detrimental soil conditions and field verified these findings with four field transects. The data gathered to determine soil condition for the this analysis was all field generated data that was collected post fire, covered the entire project area, and consisted of 91 transects.

Existing information from field inventories was also used for the analysis. This includes surveys by the Oregon Department of Fish and Wildlife to determine fish presence and population estimates. A culvert inventory was completed between 1999 and 2002. Culvert and stream channel information in the vicinity of road crossings at three hundred and ninety-nine culverts across the Fremont National Forest were inventoried. The inventory information was used to determine if a given culvert was an impediment to fish passage or not. On some occasions, the information gathered was not enough to make a determination regarding fish passage. Temperature has been monitored on several perennial streams across the forest and seven-day average maximum temperatures are calculated for each year of record. Sediment was monitored at several perennial stream sites within the analysis area in 1996 and 2000. The Soil Resources Inventory (SRI) (Wenzel, 1979) was used to characterize soils found in the analysis area.

Water Erosion Prediction Program (WEPP) was used to determine a background erosion rate of 0.01 to 0.05 tons/acre. Directly after the fire, an erosion rate for Toolbox was calculated at 0.09 tons/acre and 0.06 tons/acre for Silver. Site soil erosion and sediment transport scenarios were run for various scenarios, based on eco-class, soil type, and slope patterns. The estimates provide context for the effect of skid trails two years into ground cover recovery or the sedimentation as a result of the commercial salvage operation.

In order to estimate the amount of sediment generated off of the roads within the analysis area, WEPP (Waters Erosion Prediction Project, 1999) Cross Drain Spacing and Sediment Yield Program (version 2.000) was used. A typical 2 percent grade on native or graveled roads with 400 to 800 feet cross drain increments with an eastside climate from Wallowa, Oregon was used to run the model. Roads away from streams yield 0.0025 tons per year per mile of native road and 0.00 tons per year per mile of gravel road. Roads near streams yield 0.47 tons per year per mile of native surfaced road and 0.35 tons per year per mile of gravel road. These values were used to generate relative differences between alternatives with respect to sediment generation from roads.

The Roads GIS layer was used as the basis of the Roads Analysis process. It was used to calculate the number and location of road crossings, the boundary and acres of each subwatershed, the capability area for the analysis of the soils, ownership of the land base, and several other factors.

Fisheries

The fisheries analysis focuses primarily on the Silver Fire portion of the project area. The Silver Fire portion contains all four fish bearing streams in the entirety of the Toolbox Fire Recovery project area. These streams are Silver Creek, West Fork Silver Creek, North Fork Silver Creek, and Guyer Creek. There are no fish bearing streams within the Toolbox fire area. Streams within the Toolbox Fire portion are intermittent in nature and flow in the early spring and drain into Thompson and Duncan Reservoirs. These streams may provide limited spawning habitat for redband trout during early spring runoff. Spawning may occur in these streams, particularly the lower mile of Benny and Duncan Creeks, however,

stream flows last for roughly 4 weeks and recede quickly thus exposing spawning gravels and killing any potentially incubating eggs.

Data Collection Methods

During the summer of 2000 stream survey crews and resource professionals gathered and summarized current condition information on fish bearing streams on a stream reach basis in support of the Silver Lake Watershed Assessment (SLWC 2003). The following was assessed:

- Dominant vegetation type
- Available shade
- Bank stability
- Large woody debris
- Pools
- Substrate composition
- Stream channel characteristics such as gradient, wetted width, bankfull width, bankfull depth, floodprone width were measured which aides in the delineation of Rosgen Channel Types.

Data collection on fish bearing streams in the post-fire period (fall of 2002) consisted of recounts of large woody debris in the affected stream reaches and measurements of shade using a solar pathfinder. Data collection on intermittent stream channels used the Ochoco Bottom Line survey method (Grover et al. 1992).

Management Indicator Species

These are species identified in the Fremont National Forest LRMP to represent the welfare of other species using the same habitat. The habitat requirements of the selected indicator species are presumed to represent those of a larger group of species. The Fremont National Forest LRMP designates redband trout as the management indicator species for assessing changes to fish habitat on the Fremont National Forest (USDA Forest Service 1989).

Key Parameters Used to Analyze Effects to Aquatic/Stream Channel Conditions

Redband trout production, growth, survival, and long-term population persistence depends on several key habitat characteristics. These characteristics include:

- Riparian Vegetation and Bank Stability
- Large Woody Debris
- Large Pools
- Spawning Gravel Fines/Substrate Composition
- Rosgen Channel Type
- Stream Temperature and Shade

Roads and Roads Analysis

Recommendations from the Roads Analysis Process were used to generate road management strategies for each alternative. Road analysis consists of six steps: Setting up the analysis, describing the situation, identifying issues, assessing benefits, problems, and risks, describing opportunities and setting priorities, and reporting. The information used to determine recommendations for Roads Analysis was augmented with field inventories of the roads within the project area. The field inventories noted several characteristics of the road. Most notably, the condition of the road and any unclassified roads that were encountered were inventoried. The recommendations regarding road management were made with a full compliment of resource specialists, including: soils, hydrology, fisheries, wildlife, cultural, silviculture, recreation, engineering, timber and fire. Each road was reviewed in a systematic manner by the roads analysis team. The engineer shared pertinent information found during the field inventory and a discussion ensued regarding the necessity of each road as it pertained to each resource.

The recommendations from the roads analysis were based on resource needs and benefits and the calculated road density was a result of those recommendations. The recommendations regarding each road ranged from leaving the road open at its current maintenance level, increasing the maintenance level, closing the road, or decommissioning the road. The situation where the current maintenance level was recommended to increase occurred only when the current maintenance level was not reflective of the condition or need for the road. A recommendation for closure of a road reflected the foreseeable need for intermittent use of that road. A recommendation to decommission a road reflected the road should be removed for

resource needs and the road was not necessary for other resource needs. The recommendations that came out of the roads analysis were then incorporated and/or modified into the action alternatives, consistent with the overall theme of a given alternative. See Appendix E for a complete listing of proposed road management actions by road and by alternative.

The need for either reconstruction or new classified road construction was considered by a timber sale planning process. This process provided information that was used as a part of the overall roads analysis. No new specified road construction was identified during timber sale planning. Several existing classified roads were identified during field inventories as having diminished cinder surfaces that would need additional surfacing or re-surfacing to enable timber haul. The analysis area for potential road reconstruction (re-surfacing) includes the existing transportation system that would be needed for the timber haul associated with the action alternatives. This includes consideration of roads both within the project area and outside of the area. In addition, potential material sources for surfacing materials are included in the analysis area. This includes three cinder pits that are currently developed:

- Rim Cinder Pit: NW, SE, Sec.34, T.29S., R.16E
- Thompson Cinder Pit: NW, Sec.24, T.30S., R.13E.
- 3004 Cinder Pit: NE, NE, Sec.5, T.31S., R.16E.

Short-term vs. Long-term

In the environmental consequences section, the terms “short-term” and “long-term” are used to predict the duration of effects. These terms can vary, depending on the resource parameter being considered. “Short-term” refers to any effects that would occur between the present time and up to between 2005 and the end of 2007 (depending on resource). “Long-term” refers to any effects that would occur starting in the years 2006 to 2008 (depending on resource parameter).

Existing Condition

The project area is located on the Silver Lake Ranger District of the Fremont-Winema National Forests. Local weather is largely influenced by the Cascade Mountains. The higher peaks of the subwatersheds of the analysis area lie to the east of the Cascade Mountain Range within view of Crater Lake National Park and Mount McLoughlin. This mountain range lifts and blocks the maritime air masses that move eastward from the Pacific Ocean, inducing rain and snow to fall on its slopes. The watershed stands in the shadow of the Cascade Range and receives leftover rain and snow and averages about 15-40 inches each year depending on elevation. The majority of precipitation falls as snow from October through March, with the highest elevations receiving the greatest depths. Winter temperatures typically drop below 0°F. Even during the summer, frost and snow may occur at these elevations. Convective thunderstorms provide rain in the spring and summer, although the summer months are relatively dry. Higher elevation areas have a progressively shorter growing season, being significantly shorter above 6,500 feet elevation where ponderosa pine becomes less common. Rain and snow are captured by juniper and sagebrush along the lower scabland plateaus, by ponderosa pine in the lower to middle elevations, and by white fir, Shasta red fir, mountain hemlock and lodgepole forests in the upper elevations. Some of this intercepted water evaporates, while the remainder soaks into the soil. The best infiltration occurs when needles and leaves cover the soil, slowing surface runoff and allowing the moisture to enter the ground.

The analysis area is comprised of eight 6th field watersheds or subwatersheds, which are part of two 5th field watersheds—Silver Creek (HUC 1712000502) and Silver Lake (HUC 1712000503). Ninety-three percent of the analysis area has a slope between 0 and 20 percent, while 7 percent of the analysis area has a slope greater than 20 percent. The few areas with steeper slopes occur along canyons of Silver, West Fork Silver, Duncan, and East Duncan and along peaks and ridges such as Foster Butte, etc. The elevation within the project area ranges from approximately 4500 ft to 5800 ft in the Silver Fire area and 5300 ft to 6700 ft in the Toolbox Fire area. The elevation within the eight subwatersheds ranges from 7680 at Yamsay Mountain to 4315 at Paulina Marsh.

The wildfires of 2002 burned approximately 110,000 acres on the Fremont National Forest. Eighty thousand acres burned within the Toolbox Fire Recovery project area and will be referred to as the Silver Fire and Toolbox Fire. The severity of both fires varied from unburned to high severity. Eight 6th field HUC subwatersheds that were affected by the fires will be analyzed for this project. They are shown in Table 3.110. A minor portion of the 6th field HUC 171200050208 (Bridge Creek) burned in the Silver Fire and HUC 171200051003 (Ana River) burned in the Toolbox Fire but these subwatersheds are not part of the project area and are not analyzed for this project.

In order to understand the common measurements used in this analysis, a discussion of the terms “mortality” (or level of mortality), “intensity” and severity” is useful. These terms, particularly severity and intensity have often been are used in different ways in different arenas. They are even sometimes used interchangeably; they are often confused. For example, the Toolbox Complex BAER Report (for the entire Toolbox Complex) indicated that 74,673 acres burned with low

severity, 11,311 acres with moderate severity and 810 acres with high severity. However the maps that accompanied the BAER Report instead displayed "burn intensity" and showed a very small area of high intensity (corresponding to the 810 acres of "high severity"). In all cases, the terms used in the BAER are related to the effect of the fire on the soils, specifically the water absorbency/repellency of the soils (correctly termed "severity"). Burn intensity describes the nature of a fire in terms of its rate of energy release. These are physical descriptions of the fires, rather than ecological effects. Silver Lake Ranger District and North Zone specialists in several disciplines worked to develop, update and ground-verify vegetative mortality maps of the burned areas. Any reference to "severity" of burn in any background documentation in the Toolbox Fire Recovery analysis file that is drawn from these maps should not be considered to be the same use of the term "severity" in the Toolbox Complex BAER Report.

Very high vegetative mortality was documented along 7.4 miles of fish bearing streams, moderate and high mortality along 9.8 miles, and low mortality along 5.7 miles.

Burn severity was determined by the BAER (Burn Area Emergency Rehabilitation) team and was based on soil condition and degree of hydrophobicity. Burn severity across the project area is dominated (85 percent of the project area) by low severity burn, approximately 14 percent was classified as moderate severity, and 1 percent classified as high severity. The majority of the high severity burned areas are located in West Fork Silver Creek (approximately 196 acres) and Lower Duncan Creek (approximately 402 acres).

Table 3-110 Hydrologic Unit Code and Associated Fire

FIRE NAME	6TH FIELD HUC NAME	6TH FIELD HUC NUMBER	Area (acres)
Toolbox	Benny Creek	171200050204	26,813
Toolbox	East Duncan Creek	171200050302	11,601
Toolbox	Lower Duncan Creek	171200050303	25,012
Silver/Toolbox	Middle Silver Creek	171200050209	38,828
Silver/Toolbox	Thompson Reservoir	171200050205	41,166
Toolbox	Upper Duncan Creek	171200050301	22,146
Silver/Toolbox	Upper Silver Creek	171200050206	16,276
Silver	West Fork Silver Creek	171200050207	24,001

The fires (Silver fire and Toolbox fire) make up approximately 44 percent of the eight subwatersheds included in this analysis. The fire burned greater than 50 percent of the subwatershed in East Duncan Creek, Lower Duncan Creek, and Upper Duncan Creek. Fortunately, the majority of the fires burned at low to moderate severity.

Table 3-111 Percent of each Subwatershed Burned and associated burn severity

SUBWATERSHEDS	HIGH SEVERITY	MODERATE SEVERITY	LOW SEVERITY	PERCENT OF SUBWATERSHED-BURNED
Benny Creek	0.2%	8.8%	38.9%	48%
East Duncan Creek	0.3%	12.9%	83.1%	96%
Lower Duncan Creek	1.6%	5.2%	48.9%	56%
Middle Silver Creek	0.0%	0.2%	4.1%	4%
Thompson Reservoir	0.1%	3.7%	16.2%	20%
Upper Duncan Creek	0.1%	12.4%	67.5%	80%
Upper Silver Creek	0.4%	1.9%	31.4%	34%
West Fork Silver Creek	0.8%	5.8%	33.8%	40%

Land ownership for each of the subwatersheds is a matrix of Forest Service owned land, UST (United States Timberland), and other private holdings. National Forest system lands comprise approximately 58 percent of the project area, UST owns approximately 29 percent, and 13 percent is owned by other private holdings. The table below summarizes the miles of riparian area burned, by vegetative mortality level, along fish bearing and surveyed intermittent streams within the project area.

Table 3.112 Miles of Riparian Area Burned on National Forest System Lands within the Silver Fire Portion

Stream	Miles in Area	Low Mortality	Moderate and High Mortality	Very High Mortality	Percent of Stream Miles Burned at Moderate to Very High Mortality
Silver Creek	9.3	3.8	3.3	2.2	59
WFK Silver Creek	9.4	1.9	2.5	5.0	80
NFK Silver Creek	2.3	0.0	2.1	0.2	100
Guyer Creek	1.9	0.0	1.9	0.0	100
Strawberry Creek	3.4	0.6	1.8	1.0	82
Indian Creek	1.7	0.5	0.0	1.2	71
Totals	**28.0**	**6.8**	**11.6**	**9.6**	

Data used to describe the current stream channel conditions on the four fish bearing streams was collected in the summer of 2000 and fall of 2002. Stream functionality calls are made based on whether habitat objectives are being met. Habitat is compared to INFISH Riparian Management Objectives (USDA 1995). Other habitat elements such as water temperature, riparian vegetation, bank stability, and fine sediment were established by examination of the scientific literature and/or obtained through monitoring of natural or near natural streams on the Fremont National Forest.

Designated Beneficial Water Uses

The waters associated with this project area are for the beneficial use of fisheries, terrestrial wildlife, livestock and road watering. Downstream uses are similar with the addition of agricultural irrigation. There are no surface water supply sources within the project area. Water quality is currently maintained through the application of Best Management Practices (BMPs) for controlling nonpoint sources of pollution to surface water.

303(d) Listed Waters

Forest Service temperature monitoring data was provided to the Oregon Department of Environmental Quality (DEQ). Streams that did not meet State of Oregon water quality standards were submitted by DEQ to the Environmental Protection Agency (EPA) for inclusion in the EPA 303(d) list. Stream temperatures are out of compliance with the State standards for rearing habitat when any maximum 7-day temperature average exceeds 17.8°C. There are two locations that are on the 303(d) list that are part of the analysis area. Silver Creek from the mouth to Thompson Valley Reservoir (Record ID 665, Segment ID 42A-SILV0) and West Fork Silver Creek from the mouth to Silver Creek Marsh (Record ID 666, Segment ID 42A-SIWF0) were found to have 7-day average daily maximum temperatures that exceed the temperature standard. Silver Creek is monitored with a temperature sensor at an elevation of 4530 and West Fork Silver Creek has two monitoring sites at elevations of 4460 and 4740, respectively.

Figure 3.29

Silver Creek and West Fork Silver Creek
Segments on 303d List

Table 3-113 Recorded 7-day Average Daily Maximum Temperature at 303(d) Monitoring Sites.

STREAM	ELEVATION	7-DAY AVERAGE DAILY MAXIMUM TEMPERATURE (°C)									
		1992	1993	1994	1995	1996	1997	1998	1999	2000	2002
SILVER CREEK	4530		22.8				24.1	23.9		24.4	26.2
WEST FORK SILVER CREEK	4460			27.0	21.2	21.8	21.4	21.1		23.8	
WEST FORK SILVER CREEK	4740	27.0	21.0	27.0	22.6	22.6	22.0	21.6	21.0	27.6	

Temperature

The following table lists the maximum 7-day average temperatures that have been recorded in the streams within the analysis area. These sites are not official monitoring sites for the 303(d) list.

Table 3-114 Temperature Monitoring Sites

SITE	ELEVATION	1993	1994	1995	1996	1997	1998	1999	2000	2002
INSIDE FIRE BOUNDARY										
NORTH FORK SILVER CREEK	5050	12.7	15.4	12.3	12.9	12.5	13.0	12.3	14.3	17.4
WEST FORK SILVER CREEK	5050	13.1	16.4	12.8	13.8	13.3	13.2	12.4	15.3	17.8
All temperatures give in degrees Celsius										

Sediment Monitoring

Several sites within the project area are long-term sampling sites for fine sediment in channel substrate. These sites were inventories last in 2001, before that in 1996 and sampled again after the fires in May 2003. Typically the fine sediment information is generated with bulk samples of spawning gravel. The sample is acquired through the insertion of a cylinder into the streambed and extracting the gravel from the cylinder. Five samples were taken at each site, at pool tail crests or other areas that provided suitable spawning gravels. The samples were then dried and passed through a series of nested sieves to determine the percent of fines less than 6.4 mm (see following table). In 2003, one sample at two of the four sites was taken of the percent fines on West Fork Silver Creek.

Table 3-115 Percent Fines less than 6.4 mm within Project Area.

STREAM	ELEVATION	PERCENT FINES LESS THAN 6.4 mm		
		1996	2001	2003
WEST FORK SILVER CREEK	4850	41	35	32
WEST FORK SILVER CREEK	4740	26	25	NA
WEST FORK SILVER CREEK	4460	31	15	30
SILVER CREEK	4720	36	NA	NA

Road System

Historically, the Fremont National Forest emphasized timber management. A large road system was constructed to gain access to timber and other forest resources. Timber sale revenue paid for the majority of the road construction and maintenance. In the past decade however, timber harvest has declined. This change in forest management has reduced the operating budget and the ability to maintain an extensive road system. The Toolbox Fire Recovery Project proposes quantities of timber haul over the existing road system that far surpass levels that have occurred in the past decade, or more. The existing road system proposed for reconstruction includes Maintenance Level-2 roads consisting of native surfaces. Included in this road system are arterial haul roads with diminished cinder surfaces.

Environmental Consequences

Additional Background

Forest Canopy

Removal of forest cover can increase water yield and is generally proportional to the amount of live vegetation and tree canopy removed from a site. The removal of canopy reduces the amount of evapotranspirational draft and increases openings, which enhances snowmelt (Troendle, 1982). Generally, 20 to 30 percent of a watershed must be harvested before a significant change in flow can be detected (Troendle and Leaf, 1981). However, the removal of the canopy from the analysis area has already occurred as a result of the wildfire. The action alternatives remove only dead trees (with the exception of noncommercial thinning), which are no longer functioning as canopy.

Fire Effects on Watershed Function and Aquatics

The effect fire has on watershed function is widely variable but generally predictable. The elements of watershed function that are affected by fire that are focused upon are soil and water. Changes in soil and water regimes are most significant where fire has a large-scale impact on the vegetation and soil properties of the ecosystem (Swanson, 1981 in Agee, 1993). On the other hand, with fires of low severity or those that affect a small part of a large watershed (Bethlalmy, 1974 in Agee, 1993), it is difficult to detect changes in soil and water regimes (Beschta, 1990; McNabb and Swanson, 1990).

Swanson (1981 in Agee, 1993) utilizes a flow chart that considers vegetation, soil properties, hillslope hydrology, hillslope geomorphic processes and channel response. The degree to which the effect on each of the elements occurs is a function of the scale of the fire impact. After a fire occurs the vegetation typically results in reduced root strength, reduced ground cover, reduced leaf area and evapotranspiration, reduces standing biomass, and increased blowdown. Evapotranspiration is the collective term for evaporation from soils, plant surfaces, and water bodies, together with water losses through plant leaves. Depending on the severity of the fire the soil typically illustrates an increase in hydrophobicity (water repellency of the soil caused by the coating of soil particles by hydrophobic organic substances from plant decomposition or fungi (Agee, 1993)), which may result in increased overland flow. The reduction in ground cover and reduced root strength may increase surface erosion. The reduction of litter layer and soil organic matter may increase overland flow and increase surface erosion. An increase in surface erosion may result in aggradation of the channel. The reduction in ground cover and reduced litter layer may result in reduced thermal insulation that may result in an increased depth of freeze-thaw cycles that may ultimately increase freeze-thaw soil movement. The reduction in evapotranspiration and the reduction in standing biomass may increase the amount of water available to the soil that could result in more frequent shallow, rapid soil mass movement.

Wildfires can also have an affect on the nutrient cycle in aquatic systems. Usually there is an initial nutrient pulse after a wildfire. This is followed by a gradual decrease in nutrient loss from the watershed because of the high recovery of net photosynthetic rates of terrestrial vegetation. Low nutrient concentrations in the stream 5-10 years after the fire are expected to contribute to the decline in autochthonous production (Minshall, Brock, and Varley 1989). Enhanced light levels will increase primary production for 10-20 years. There are two major factors affecting the pattern of dissolved nutrient concentrations in streams: 1) water borne transport, and 2) biotic uptake and release. Nutrient increases are usually small or of a short duration after a fire and their effects on fish populations and food resources are negligible in most cases. Robichaud et al. (1993) observed relatively little sediment transport and minimal nutrient losses following a low intensity burn in northern Idaho, however, nutrient spikes following fire are most common during storm events in the autumn and after the summer period of maximum algal production and fish growth.

The response of aquatic macroinvertebrates to fire depends on the degree of sedimentation, streambed movement, and changes in riparian and upland vegetation. The first year following a fire, increased stream flows, streambed erosion, and/or high-suspended sediment concentrations, could cause significant invertebrate drift from streams draining the burned area. Deposition of fine sediments has the potential to alter habitat thus influencing species density and composition. Rinne (1996) states that aquatic macroinvertebrate densities did not change immediately following a fire, however after runoff events population densities decreased. Rinne (1996) also observed that in the year following a fire aquatic macroinvertebrate diversity was reduced by 25 percent to 70 percent.

Fire can alter the quantity, quality, and use of salmonid habitat via the alteration of water temperatures, sedimentation rates, riparian vegetation, nutrient availability, food sources, and woody debris (McMahon and deCalesta 1990). The greatest potential of fire to harm salmonid populations are those species which spawn and rear in small to medium sized streams draining forested watersheds. Thus, riparian zones and fish populations are strongly influenced by fire and associated forest management activities occurring in the watershed. Siltation of streambeds has been widely documented as adversely

affecting salmonid populations in a variety of ways, including reducing embryo survival, fry emergence, and limiting the abundance of aquatic macroinvertebrates. Increased inputs of fine sediment were found to cause mortality in Yellowstone cutthroat trout two years after large wildfires occurred (Bozek and Young 1994). After large wildfires on the Boise National Forest, rainbow and bull trout densities were lower in some reaches and higher than pre-fire conditions in other reaches (Reiman et al. 1997). The effects of fire on fish and aquatic resources may depend on multiple factors that include: the scale and severity of fire; existing watershed and riparian condition; the connectedness of habitats that provide for potential refugia and re-colonization; and the potential for the full range of life history expression (Reiman et al. 1997).

Water temperature is a major factor affecting salmonid survival, distribution, production, and species composition in the Pacific Northwest. The most direct effect of fire along streams is the potential to increase stream temperatures to lethal levels during burning. The loss of riparian and upland vegetation from a fire can cause and elevation in stream temperatures for several years following a fire. Stream temperatures will gradually return to normal as re-vegetation of the riparian area occurs thus providing shade to the stream. Summer water temperatures will increase as a loss of shade from a fire, which results in an increase in primary and secondary production (McMahon and deCalesta 1990). Salmonid use in burned areas during the summer will be elevated as a result. Warmer stream temperatures will usually occur in the winter and spring, which can have a negative impact on salmonids such as altering the timing of fry emergence, smolt outmigration, and upstream migrations of adults.

The most significant, long-term impact to fish habitat following a fire is the loss of woody debris both in the stream channel and riparian areas. Because of this, stream channels become simpler and less stable and lose habitat complexity important for providing a diversity of stream velocities and cover types used as feeding and resting sites by salmonids and other aquatic organisms.

Water Quality and Quantity

Water quality criteria developed under section 304(a) of the Clean Water Act are based on data and scientific judgments on the relationship between pollutant concentrations and environmental and human health effects. The criteria are intended to "…accurately reflect the latest scientific knowledge…on the kind and extent of all identifiable effects on health and welfare including, but not limited to, plankton, fish, shellfish, wildlife, plant life…which may be expected from the presence of pollutants in any body of water…" (Environmental Protection Agency, 2002)

The reduction of forest vegetation from a wildfire or removal of trees reduces evapotranspiration and causes an increase in annual water yield. Initial increases in water yield on the east side of the Cascades are approximately 3 to 5 acre-inches. Overall the increases are generally proportional to the annual precipitation. For the action alternatives of this project, however, there would be no increase in water yield because the project would not remove green trees.

Snow dynamics are expected to be altered by the fire through the increase in the number of openings created by the fire and subsequently by salvage harvest. An increase in snow accumulation is expected as a result of increased openings. The openings created by the fire and salvage harvest will be mostly small and irregularly sized openings. Brooks et al. (1991, p. 277) reports that water yield increases are usually slight with small and irregularly sized openings.

Overland Flow and Runoff

Overland flow occurs rarely in a mature, unburned forest due to interception by the forest canopy, evapotranspiration, forest floor litter and decomposing organic matter. The factors that limit overland flow in a mature forest change after a moderate to severe wildland fire. More precipitation finds it way to the soil due to the reduction in standing biomass, leaf area, and evapotranspiration. Where fire severity is high and soils have become predominantly hydrophobic, water sheds off of the soil surface. The increase in hydrophobicity coupled with a decrease in ground cover affect the rate of overland flow and eventually becomes runoff and is delivered to streams.

A study of a 564-ha catchment located on the east slope of the Cascades in north central Washington burned in 1970 (Helvey, 1980). Runoff and sedimentation were measured from the catchment for 7 years after the fire. The author concluded that runoff from the burned catchment during subsequent years was much greater than the measured values before the fire due to a much reduced transpiration loss from the burned watersheds and the change in vegetation characteristics.

The annual water yield coming off of subwatershed can be significantly increased after a fire due to reduced ground cover, reduced evapotranspiration, and increased hydrophobicity. This effect is proportional to the amount of watershed area burned and to annual precipitation (Beschta, 1990). Therefore a wildfire that burned at low to moderate severity in an area with limited annual precipitation will experience fewer changes in overland flow as a result of the fire.

Stream Flows and Channel Response

One must consider the impact of a precipitation event that follows a moderate to high severity fire. The impacts of such an event can be far-reaching (Minshall et al., 1998). As discussed earlier, a severely burned forest can result in increased overland flow that can result in sheet, rill, and gully erosion of the burned area. In the extreme scenario, overland flow picks up sediment of varying sizes and eventually picks up debris. This debris torrent picks up velocity and cuts channels, at times scouring to bedrock, causing wide and deep gullies. The result is an increase in the amount of sediment in the channel that is eventually transported downstream or deposited in low gradient areas. Eventually the sediment will form new channels and stabilize.

Generally, in areas with limited topographical relief and minimal annual precipitation, like the Fremont National Forest, the effect of increased overland flow is seen in the form of increased sedimentation. The amount of sedimentation was estimated through the use of WEPP and found to be minor..

Direct and Indirect Effects-Watershed

The following table illustrates the alternatives and how they vary with respect to items of particular watershed concern. The open road density and open and closed road density are based on the project area. The open and closed road density includes not only those roads that will remain open but those that will be closed as well. Although the roads are not being used they still function differently than an unroaded space or a decommissioned road. The miles of road to be decommissioned under each alternative are shown along with the number of roads to be decommissioned within 300 feet of an intermittent or perennial stream (as recommended in USFS, 1997 and Friedrichsen, 2003).

Table 3.116 Activities by Alternative within Project Area.

PROJECT AREA	ALT. A	ALT. C	ALT. D	ALT. E	ALT. G	ALT. H
TOTAL COMMERCIAL SALVAGE (acres)	0	14,441	6,367	11,490	14,419	13,031
GROUND BASED COMMERCIAL SALVAGE (acres)	0	13,971	6,007	11,183	13,970	13,031
AERIAL COMMERCIAL SALVAGE (acres)	0	470	360	307	449	0
OPEN ROAD DENSITY (mi/mi^2)	3.68	1.76	1.68	2.57	2.57	1.72
OPEN & CLOSED ROAD DENSITY (mi/mi^2)	3.68	2.75	2.71	3.48	2.71	2.71
CLOSE ROADS (mi)	0.0	72.9	75.5	67.4	10.4	72.9
DECOMMISSION ROADS (mi)	0.0	69.0	71.6	14.6	71.6	71.6
DECOMMISSION ROADS WITHIN 300’ of STREAMS (mi)	0.0	9.94	10.28	5.89	10.28	10.28
OPEN ROADS (mi)	271.0	129.1	123.9	189.0	189.0	126.5
SEDIMENT SAVINGS from ROAD ACTIONS (ton/yr)	0.0	0.7	0.7	0.6	0.6	0.7
SEDIMENT LOSS from ROAD ACTIONS (ton/yr)	1.4	0.6	0.6	0.8	0.8	0.6

Alternative A

The no action alternative serves as a baseline for comparison of the expected effects of all of the other alternatives. There would be no commercial salvage, no acres of fuels treatment or fuels reduction, no prescribed fire, no active closure or decommissioning of any portion of the road system, no active soil or riparian improvement projects, and no reforestation.

This alternative incorporates some of the recommendations of Beschta et al., (1995). There would be no "immediate intervention on the post-fire landscape" and species would be allowed to naturally regenerate. There would be no salvage logging under this alternative and therefore no salvage logging in sensitive areas. The logging of sensitive areas is often associated with accelerated erosion and soil compaction (Beschta et al., 1995).

There would be fewer opportunities to actively reduce sediment yields through improvement of drainage on roads and closure and decommissioning of roads. Within the eight subwatersheds there are 1,012 miles of road within the eight subwatersheds that are affected by this project. Within the project area there are 440 miles of road, of which 271 are located on Forest Service land. Currently the road density within the project area and on Forest Service land is 3.68 miles of road per square mile of land base. The direction in the Forest Plan is to "not exceed 2.5 miles per square mile of open road". Recommendations developed during the USFWS (1998) analysis for watersheds functioning appropriately are road densities below 1.0 mi/mi^2. Road closure and/or decommission within subwatersheds is the recommended action in which to reduce road densities that exceed this value. Under the no action alternative there would be no miles of new temporary road or any re-opening of unclassified roads. The lack of temporary roads and the lack of re-opening unclassified roads would reduce the temporary increase in road miles, road density, and potential sediment production from the additional miles of road. However, the long-term impact from the high road density would be a chronic problem for the analysis area. The WEPP derived model, Cross Drain Spacing and Sediment Yield Program, yielded a sediment loss due to the road system within the analysis area of 1.4 tons/yr.

The ground disturbing activities associated with commercial salvage logging, road reconstruction and fuels treatment would not take place under this alternative. The minimal ground disturbance associated with planting and a low-severity prescribed burn would also not take place under this alternative.

The no action alternative would have little to no affect on stream temperature in the planning area.

The riparian improvement projects that are aimed at rehabilitating key areas of the analysis area would not be implemented under this alternative and a passive approach to protection and restoration would be implemented. Under this alternative, several streams would continue to lack large wood material and cover the material provides. Areas within the riparian zones that do not revegetate would be left bare. This type of mineral soil exposure would add to sedimentation problems within the stream system. Aspen enhancement projects would not be implemented and conifer encroachment into meadows and riparian areas would continue to plague the landscape. The drainage improvement at road 2917413, located within the riparian habitat conservation area, would not be implemented and excessive sedimentation from this recreational access road would continue.

Common Information All Action Alternatives

Commercial salvage harvest would occur to some degree in all action alternatives. Any harvest activity would strictly follow the Best Management Practices set forth in Appendix C. Surface erosion from a logging operation is associated with the disturbance associated with the operation and not simply the cutting of the timber. In this case, the effect of the loss of the timber as canopy has already occurred as a result of the fire. The effects of disrupted soil structure, removal of protective cover, increased raindrop impact, and reduces soil infiltration rates are all associated with the ground disturbance associated with the harvest of timber (Megahan, 1980) or in this case the commercial salvage of timber and reduction of fuels. The impact from traditional logging systems is understood to cause more severe soil surface disturbance and consequent erosion than helicopter and skyline operations (Klock, 1975). Excessive fine sediment alters aquatic habitats by decreasing stream stability. Stream stability is defined as "allowing the stream to develop a stable dimension, pattern, and profile such that, over time, channel features are maintained and the stream system neither aggrades nor degrades. For a stream to be stable it must be able to consistently transport its sediment load, both in size and type, associated with local deposition and scour" (Rosgen 1996). Increased sediment fills pool habitats and spawning gravel interstices, and increases streambank erosion, and stream channel width/depth ratios. These factors combined, result in less habitat complexity and a reduction in fish and other aquatic species production capacity of a given watershed.

In the event of significant increases in sediment yields to stream channels, streams may exceed their natural ability to carry the sediment load. This may result in sediment depositions, especially in lower gradient reaches of a stream as point and mid-channel bars, which will lead to wider, shallower and less stable channels. This can result in bank erosion and bed scour, which further increases the sediment load in the stream. These events can be activated by initial direct introduction of sediment from outside the channel and/or increases in water yields that result in channel erosion.

In order to better understand the probability of sedimentation and sediment transport as a function of the removal of the material, Water Erosion Prediction Project (WEPP) was used to determine a background erosion rates. Directly after the

fire took place, an erosion rate for Toolbox was calculated at 0.09 tons/acre and for Silver an erosion rate of 0.06 tons/acre. A background erosion rate of 0.01 to 0.05 tons/acre was calculated. Site soil erosion and sediment transport scenarios were run for various cases, based on eco-class, soil type, and slope patterns and cases that track the post-fire conditions. More specifically, the estimates provide context for the effect of skid trails two years into ground cover recovery. Six of the seven cases showed no sediment estimated with WEPP technology as a result of skid trails two years into ground cover recovery. One case shows 14 percent probability of treatment sediment from four specific units. The amount of sediment predicted from these units is within background erosion rates. Overall, the modeling exercise concluded that soil erosion generated from salvage harvest is apt to be minor in all action alternatives. However, the number of roads within the analysis area makes it a key issue when considering effects of treatment.

The number of roads within the analysis area after treatment would have an effect on the sediment loss. The information generated from Cross Drain (WEPP, 1999) was used to compare the level of roading in each alternative. The sediment estimate from the miles of road that are planned for closure or decommissioning is considered sediment savings while the miles of road planned to remain open is considered sediment loss. The actions associated with closure or decommission would be short-term increases in sediment but provide for a long-term sediment savings.

Compaction is not expected to increase as a result of the activity beyond pre-activity levels. Compaction is directly related to soil type, soil moisture at the time of operation, the type of equipment used, the number of passes made and ground cover. Obviously, the soil type will not be altered as a function of land management and ground cover is expected to substantially recover before any harvest activity takes place. All commercial activity on the landscape would strictly follow BMPs and the Soil Productivity Guide (SPG), both can be found in Appendix C. There will be short-term effects from some of the best management practices but the long-term benefits will outweigh the short-term effects. The short-term effects from BMPs include but are not limited to sedimentation from the closure and/or decommissioning of temporary and re-opened unclassified roads and landings and the construction of drainage precautions on skid trails. Research on the Foothills Fire Salvage concluded that when BMPs and soil and water protection measures were correctly implement, no accelerated soil erosion and sediment delivery to stream channels was identified over a three year period (Maloney and Thornton, 1995). Maloney and Thornton (1995) go on to warn that potential for adverse effects is possible if there is not strict adherence to BMPs and soil and water protection measures.

Salvage logging within RHCAs occurs in every action alternative by varying degrees. Alternatives with more acres of RHCA harvest represent a higher risk of sedimentation than those with fewer acres of RHCA harvest. The number of acres is given under each alternative description. Alternative D and H include salvage harvest only in roadside hazard areas. Roadside hazard corridors within RHCAs would have the following mitigating measures. Individual tree marking would occur where necessary, line-pulling distances would be minimized, no mechanized ground-based skidding equipment would be allowed in the first 150 feet of the stream channel on RHCA 1 and within 50 feet of the stream channel on RHCA 3 and RHCA 4. Alternatives C, E and G include roadside hazard areas in addition to more acres within RHCAs. Typically, RHCA 1 widths are 300 feet slope distance on each side of the active stream channel. Harvest of this area would occur in the outer 100 feet of the RHCA. No mechanized ground-based equipment would be allowed within the entire width of RHCAs except at existing classified road crossings. It is expected that the harvest in the outer 100 feet of the RHCA would be far enough away from the stream to allow for limited amounts of sediment that would reach the stream channel and would have little to no affect on the amount of stream-side shade and therefore is not expected to affect stream temperature. RHCA 3 (ponds, lakes, reservoirs, and wetlands greater than 1 acre) widths are typically 150 feet slope distance on each side of the active stream channel.

Salvage harvest would occur in the outer 75 feet of the RHCA 3 and is expected to be far enough away from the stream to allow for limited amounts of sediment that would reach the stream channel or aquatic habitat. RHCA 3 harvest would have some affect on the amount of stream-side shade but is not expected to affect stream temperature. RHCA 4 (seasonally flowing or intermittent streams) widths are typically 50 feet slope distance on each side of the active stream channel. Salvage harvest would be allowed within RHCA 4 and may allow for the recovery of riparian vegetation with conifer uplands versus the conifer dominated riparian vegetation on several intermittent streams within the project area. RHCA 4 harvest would affect the amount of stream-side shade and may cause short term increases in temperature. In some instances, it has been found that once conifer overstory communities are replaced with scrub-shrub or riparian vegetation dominated communities with conifer uplands, the stream have slightly lower summer water temperatures, lower width-to-depth ratios and more undercut banks (Liquori and Jackson, 2001). Overall, salvage harvest is expected to generate minor amounts of sedimentation. However, the harvest within the RHCAs has the most likely probability of having adverse affects on stream condition of any of the salvage harvest because of the proximity of the ground-disturbing event to the stream channel or aquatic habitat.

The reconstruction of roads would consist of surfacing or resurfacing of several miles of road. This activity would include ground disturbance of pre-existing rock sources. Short-term increases in sediment from surfacing or resurfacing sections of road that contribute sediment to streams would occur. Culvert backfill at Road 2800505 would mitigate a chronic sediment source into Graham Creek with short-term increases of sediment at the creek but long-term savings of sedimentation at this site. All action alternatives except Alternative E incorporate a drainage improvement project on Road 2917413.

Small diameter coarse woody debris would be left onsite after commercial salvage, and fuel treatment and reduction. This material helps to capture and hold eroded materials. Monitoring on the Boise National Forest on units harvested following high severity fire showed that fire salvage logging could help reduce surface soil erosion and sediment delivery by increasing ground cover and storage areas with logging slash (Maloney and Thornton, 1995). All ground disturbing activities would follow the Best Management Practices, found in Appendix C.

Low-severity burns, where much of the organic matter comprising the forest floor may remain following burning, are generally insignificant with regard to hydrologic and water quality variables. The severity of the burn, the proportion of the watershed burned, and the relative proximity of the burned area to the stream channel all strongly influence the hydrologic response to burning. Measurable hydrologic responses that occur after burning are typically greatest within the first year or two and decay toward pre-fire levels (Beschta, 1990).

Reforestation should shorten the length of time to hydrologic recovery compared to natural regeneration. It is expected that planted trees would reach maturity sooner and may reduce the amount of time for root systems to effectively stabilize soil. Conifer planting within portions of the RHCAs associated with the Toolbox Fire Recovery Project would help to accelerate the recovery of shade producing vegetation within RHCAs. This is a key element in accelerating restoration of aquatic habitat conditions within the burned area.

Aquatic habitat conditions within all potentially affected fish bearing stream reaches would see improvements in large wood, number of pools and number of deep pools from both natural recruitment of dead and dying trees and proposed aquatic habitat restoration projects. In headwater areas above the fire, instream habitat is expected to remain static or improve over time.

In-channel habitat conditions, particularly fine sediment levels within spawning substrates, within Silver Creek and West Fork Silver Creek, North Fork Silver Creek, and Guyer Creek would remain static or decline over the next few years as problem roads within the project area continue to deliver sediment to these streams. After project completion, improvements for sediment in these streams should improve as roads are improved and/or decommissioned.

Grazing standards implemented on the Yamsay Mt., Foster Butte, and Winter Rim Allotments are designed to maintain healthy range conditions while achieving full utilization of allocated forage (USDA Forest Service 1989). Management of these allotments in 2003 would include deferment of grazing until vegetation seed-set. Implementation of these standards is a key element in improving in upland vegetative condition. This would aid in the maintenance of stream channel conditions across the affected sub-watersheds.

Alternative C

Alternative C places an emphasis on providing wood products while contributing to the long-term development of LOS. This alternative is a modified version of the proposal that was presented to the public in November 2002 during scoping as the Proposed Action. Alternative C would result in a road density of 1.76 mi/mi^2, 14,441 acres of commercial salvage and fuels treatment and reduction, 16 miles of temporary road development, re-opening of 21.4 miles of unclassified roads and reforestation of 34,000 acres that experienced loss of stocking due to fire and includes soil and riparian restoration projects.

After implementation of the activities associated with this alternative is complete, there would be 129 miles of open road. These roads were calculated to erode 0.6 tons of sediment per year. Sediment savings from the closure and decommissioning of classified roads of 72.9 miles and 69.0 miles, respectively, would be 0.7 tons/yr. Alternative C would close 6 miles and decommission 9.94 miles of road segments within 300 feet of an intermittent or perennial stream. Of the six miles that would be closed, approximately 0.4 miles are within 50 feet of an intermittent or perennial stream. Of the 9.94 miles to be decommissioned, approximately 2.53 miles are within 50 feet of an intermittent or perennial stream. The level of closure and decommissioning planned under this alternative would generate short-term pulse of sediment, especially at roads near streams. However, the long-term savings of sedimentation outweighs the initial losses expected during the active closure and decommissioning. The resultant open road density would be 1.76 mi/mi^2. The density of open roads, plus roads that would be closed (but not decommissioned), would be 2.75 mi/mi^2. Under this alternative all

roads within the former reservation would remain open and all other recommendations from the Roads Analysis would be followed.

The number of acres of commercial salvage under this alternative is the largest of all of the alternatives. More than 90 percent of the salvage harvest would be done with ground-based equipment on sideslopes less than 30 percent. The modeling of salvage harvest illustrated there would be minor soil erosion and sediment transport under all Alternatives. The only units with slight probability of sedimentation are Units 130, 131, 133, and 134 and equal a total of 781 acres.

Alternative C calls for the largest number of acres of harvest within riparian habitat conservation areas (RHCA). RHCA 1, RHCA 3 and RHCA 4 have 37 acres, 448 acres and 147 acres, respectively under this alternative. There are 15 acres, 186 acres, and 132 acres of RHCA 1, RHCA 3 and RHCA 4, respectively, within roadside hazard corridors. Harvest operation effects include disrupting soil structure, removal of protective cover and increased raindrop impact (Megahan, 1980). Salvage harvest would be allowed within RHCA 4 and may allow for the recovery of riparian vegetation with conifer uplands versus the conifer dominated riparian vegetation on several intermittent streams within the project area. In some instances, it has been found that once conifer overstory communities are replaced with scrub-shrub or riparian vegetation dominated communities with conifer uplands, the stream have slightly lower summer water temperatures, lower width-to-depth ratios and more undercut banks (Liquori and Jackson, 2001). Overall, salvage harvest is expected to generate minor amounts of sedimentation. However, the harvest within the RHCAs has the most likely probability of having adverse affect on stream condition of any of the salvage harvest in this project because of the proximity of the ground-disturbing event to the stream channel or aquatic habitat. This alternative includes the highest number of acres of RHCA harvest and represents the highest risk of sedimentation compared to the other alternatives with respect to RHCA harvest.

Roads needed to commercially salvage the units under this alternative are 16.0 miles of temporary roads and 21.4 miles of re-opened unclassified roads. The addition of 37.4 miles of road to the current 270.1 miles of road would result in a temporary open road density of 4.2 mi/mi^2 or a functioning at unacceptable risk for road density (USFWS, 1998). This road density would be short lived and all road construction may not occur at the same time. The BMPs state that any temporary road will be used for only one season, they will be obliterated [decommissioned] with subsoiling and drainage structures will be installed. Newly re-opened unclassified roads will be treated in the same fashion after use associated with salvage harvest. Therefore, the additional roads associated with the salvage harvest operation would increase the road density but it would be short-term.

Fuels reduction would occur via underburning, broadcast burning, jackpot burning, low ground pressure machine piling and burning, grapple or hand piling and burning, thinning of dead trees, slash buster, or other methods. All of the fuels treatment would occur within salvage units along with some additional whole tree yarding and yarding with tops attached. Again, these activities are apt to generate minor soil erosion but would reduce the fuel loading in an area that is expected to exceed 20 tons of fuel per acre within 15 years if no action is taken. This reduction in fuels would allow for a higher probability of a low-severity fire in the future which has generally insignificant affects with regard to hydrologic and water-quality variables (Beschta, 1990). Prescribed fire would occur primarily outside of the harvest units and is expected to be a low-severity burn.

Planting and site preparation for reforestation should allow for accelerated watershed recovery.

The riparian improvement projects are aimed at rehabilitating key areas of the analysis area. Under this alternative, 9.6 miles of stream would have additional large wood placed and the resultant cover the material provides. Areas within the riparian zones that do not revegetate on their own would be planted with native species. This action would allow for natural recovery before immediate intervention (Beschta et al., 1995). Aspen enhancement projects would be implemented and conifer encroachment into meadows and riparian areas would begin to be controlled. The drainage improvement at road 2917413, located within the riparian habitat conservation area, would be implemented and excessive sedimentation from this recreation access road would be mitigated.

Alternative D

Alternative D emphasizes the maintenance of water quality through the limitation of several activities. Alternative D would result in a road density of 1.68 mi/mi^2, 6,367 acres of commercial salvage and fuels treatment and reduction, no new temporary road development, re-opening 5.7 miles of unclassified roads and reforestation of 34,000 acres that experienced loss of stocking due to fire and includes soil and riparian restoration projects.

After implementation of the activities associated with this alternative is complete, there would be 123.9 miles of open road. These roads were calculated to erode 0.6 tons of sediment per year. Sediment savings from the closure and

decommissioning of classified roads of 75.5 miles and 71.6 miles, respectively, would be 0.7 tons/yr. Alternative D would close 6 miles and decommission 10.28 miles of road segments within 300 feet of an intermittent or perennial stream. Of the six miles that would be closed, approximately 0.4 miles are within 50 feet of an intermittent or perennial stream. Of the 9.94 miles to be decommissioned, approximately 2.53 miles are within 50 feet of an intermittent or perennial stream. The level of closure and decommissioning planned under this alternative would generate a short-term pulse of sediment, especially at roads near streams. However, the long-term savings of sedimentation outweighs the initial losses expected during the active closure and decommissioning. The resultant open road density would be 1.68 mi/mi^2 and is the lowest road density among all alternatives. The density of open roads, plus roads that would be closed (but not decommissioned), would be 2.71 mi/mi^2. This alternative follows all recommendations taken from the Roads Analysis.

The number of acres of commercial salvage under this alternative is the smallest of all of the alternatives. More than 90 percent of the salvage harvest would be done with ground-based equipment on mild slopes. The modeling of salvage harvest illustrated there would be minor soil erosion and sediment transport under all alternatives. The only units with slight probability of sedimentation are Units 131and 134. These units equal a total of 31 acres compared to over 700 acres for the other action alternatives. Alternative D calls for the smallest number of acres of harvest within riparian habitat conservation areas (RHCA). RHCA 1, RHCA 3 and RHCA 4 have 15 acres, 186 acres and 15 acres, respectively under this alternative. All of these acres are within a roadside hazard corridor that crosses the RHCA. Roadside hazard corridors within RHCAs would have the following mitigating measures. Individual tree marking would occur where necessary, line-pulling distances would be minimized, no mechanized ground-based skidding equipment would be allowed in the first 150 feet of the stream channel on RHCA 1 and within 50 feet of the stream channel on RHCA 3 and RHCA 4. Harvest operation effects include disrupting soil structure, removal of protective cover and increased raindrop impact (Megahan, 1980). The most potential for sedimentation from salvage harvest exists with RHCA salvage harvest. However, the roadside hazard must be mitigated and the operating constraints for the harvest would mitigate adverse impacts from the harvest operation within RHCAs.

Roads needed to commercially salvage the units under this alternative are 5.7 miles of re-opened unclassified roads. There would be no new temporary road construction under this alternative. The addition of 5.7 miles of road to the current 270.1 miles of road would result in a temporary open road density of 3.7 mi/mi^2 or a functioning at unacceptable risk for road density (USFWS, 1998). This road density would be short lived and all road construction may not occur at the same time. Newly re-opened unclassified roads would be decommissioned after use associated with salvage harvest in accordance with BMPs. Therefore, the additional roads associated with the salvage harvest operation would increase the road density slightly but it would be short-term.

Fuels reduction methods would be the same as Alternative C (see Alternative C.)

Planting and site preparation for reforestation should allow for accelerated watershed recovery.

The riparian improvement projects would be the same as Alternative C (see Alternative C).

Alternative E

Alternative E emphasizes economic efficiency with regard to commercial salvage and limits the reduction of road density. The implementation of Alternative E would result in a road density of 2.57 mi/mi^2, 11,490 acres of commercial salvage and fuels treatment and reduction, 15.8 miles of temporary road development, re-opening 13.3 miles of unclassified roads and reforestation of 34,000 acres that experienced loss of stocking due to fire and does not include soil and riparian restoration projects.

After implementation of the activities associated with this alternative is complete, there would be 189 miles of open road. These roads were calculated to erode 0.8 tons of sediment per year. Sediment savings from the closure and decommissioning of classified roads of 67.4 miles and 14.6 miles, respectively, would be 0.6 tons/yr. Alternative E would close 8 miles and decommission 5.89 miles of road segments within 300 feet of an intermittent or perennial stream. Of the eight miles that would be closed, approximately 1.22 miles are within 50 feet of an intermittent or perennial stream. Of the 5.89 miles to be decommissioned, approximately 1.62 miles are within 50 feet of an intermittent or perennial stream. The level of closure and decommissioning planned under this alternative would generate short-term pulse of sediment, especially at roads near streams. However, the long-term savings of sedimentation outweighs the initial losses expected during the active closure and decommissioning. The resultant open road density would be 2.57 mi/mi^2. The density of open roads, plus roads that would be closed (but not decommissioned), would be 3.48 mi/mi^2. This alternative has the highest open and closed road density of all alternatives because there is very little road decommissioning under this alternative. The only road decommissioning that would occur under this alternative are those roads that have riparian

health as the primary beneficiary of the road action. Roads within the former reservation will remain open except any roads within the former reservation that were recommended for decommissioning would be decommissioned under this alternative. Roads outside of the former reservation would follow the Road analysis recommendations when the benefiting resource was riparian health. Any roads outside of the former reservation that were recommended for decommissioning under the Roads Analysis would now be closed and those recommended for closure would remain open.

The number of acres of commercial salvage under this alternative is the third largest of all of the alternatives. More than 90 percent of the salvage harvest would be done with ground-based equipment on sideslopes less than 30 percent. The modeling of salvage harvest illustrated there would be minor soil erosion and sediment transport under all Alternatives. The only units with slight probability of sedimentation are Units 130, 131, 133, and 134 and equal a total of 781 acres. Alternative E calls for the second highest number of acres of harvest within riparian habitat conservation areas (RHCA). RHCA 1, RHCA 3 and RHCA 4 have 4 acres, 204 acres and 108 acres, respectively under this alternative. There are 15 acres, 186 acres, and 15 acres of RHCA 1, RHCA 2 and RHCA 3, respectively, within roadside hazard corridors. Harvest operation effects include disrupting soil structure, removal of protective cover and increased raindrop impact (Megahan, 1980). Salvage harvest would be allowed within RHCA 4 and may allow for the recovery of riparian vegetation with conifer uplands versus the conifer dominated riparian vegetation on several intermittent streams within the project area.

In some instances, it has been found that once conifer overstory communities are replaced with scrub-shrub or riparian vegetation dominated communities with conifer uplands, the stream have slightly lower summer water temperatures, lower width-to-depth ratios and more undercut banks (Liquori and Jackson, 2001). However, this would occur to a lesser extent than Alternative C due to fewer acres being treated within RHCA. Overall, salvage harvest is expected to generate minor amounts of sedimentation. However, the harvest within the RHCAs has the most likely probability of having adverse affect on stream condition of any of the salvage harvest in this project because of the proximity of the ground-disturbing event to the stream channel or aquatic habitat. This alternative includes the second highest number of acres of RHCA harvest. The number of acres is reduced from Alternative C. The number of RHCA 1 salvage harvest outside of roadside hazard removal is reduced to 4 acres compared to 37 acres in Alternative C. For this alternative, RHCA 3 salvage harvest outside of roadside hazard removal is at 204 acres compared to 448 acres in Alternatives C and G. The reduction in the minimum number of acres in all RHCA categories reduces the risk compared to Alternative C but is high compared to all other alternatives.

Roads needed to commercially salvage the units under this alternative are 13.3 miles of temporary roads and 15.8 miles of re-opened unclassified roads. The addition of 29.1 miles of road to the current 270.1 miles of road would result in a temporary open road density of 4.07 mi/mi^2 or a functioning at unacceptable risk for road density (USFWS, 1998). This road density would be short lived and all road construction may not occur at the same time. The BMPs state that any temporary road will be used for only one season, they will be obliterated [decommissioned] with subsoiling and drainage structures will be installed. Newly re-opened unclassified roads will be treated in the same fashion after use associated with salvage harvest. Therefore, the additional roads associated with the salvage harvest operation would increase the road density but it would be short-term.

Fuels reduction would occur via underburning, broadcast burning, jackpot burning, low ground pressure machine piling and burning, grapple or hand piling and burning, thinning of dead trees, slash buster, or other methods. All of the fuels treatment would occur within salvage units along with some additional whole tree yarding and yarding with tops attached. Again, these activities are apt to generate minor soil erosion but would reduce the fuel loading in an area that is expected to exceed 20 tons of fuel per acre within 15 years if no action is taken. This reduction in fuels would allow for a higher probability of a low-severity fire in the future which has generally insignificant affects with regard to hydrologic and water-quality variables (Beschta, 1990).

Planting and site preparation for reforestation should allow for accelerated watershed recovery.

The riparian improvement projects that are aimed at rehabilitating key areas of the analysis area would not be implemented under this alternative and a passive approach to protection and restoration would be implemented. Under this alternative, several streams would continue to lack large wood material and the cover the material provides. Areas within the riparian zones that do not revegetate would be left bare and allowed to naturally recovery at the temporal scale involved with ecosystem evolution (Beschta et al., 1995). This type of mineral soil exposure would add to sedimentation problems within the stream system. Aspen enhancement projects would not be implemented and conifer encroachment into meadows and riparian areas would continue to plague the landscape. The drainage improvement at road 2917413, located within the riparian habitat conservation area, would not be implemented and excessive sedimentation from this recreational access road would continue.

Alternative G

Alternative G places an emphasis on using active management to achieve post-fire recovery, particularly in response to the purpose and need to develop a long-term sustainable forest that is maintainable by re-introduction of fire, while providing recovery of some merchantable. It focuses on fuels reduction and long-term fire suppression effectiveness, partially through a limit to the reduction of road density. The implementation of Alternative G would result in a road density of 2.57 mi/mi^2, 14,419 acres of commercial salvage and fuels treatment and reduction, 21.4 miles of temporary road development, re-opening 16.0 miles of unclassified roads and reforestation of 34,000 acres that experienced loss of stocking due to fire and does include soil and riparian restoration projects.

After implementation of the activities associated with this alternative is complete, there would be 189 miles of open road. These roads were calculated to erode 0.8 tons of sediment per year. Sediment savings from the closure and decommissioning of classified roads of 10.4 miles and 71.6 miles, respectively, would be 0.6 tons/yr. Alternative G would close 3.6 miles and decommission 10.28 miles of road segments within 300 feet of an intermittent or perennial stream. Of the 3.6 miles that would be closed, approximately 0.3 miles are within 50 feet of an intermittent or perennial stream. Of the 10.28 miles to be decommissioned, approximately 2.53 miles are within 50 feet of an intermittent or perennial stream. The level of closure and decommissioning planned under this alternative would generate short-term pulse of sediment, especially at roads near streams. However, the long-term savings of sedimentation outweighs the initial losses expected during active closure and decommissioning. The resultant open road density would be 2.57 mi/mi^2. The density of open roads, plus roads that would be closed (but not decommissioned), would be 2.71 mi/mi^2. Roads within the former reservation will remain open with the exception of any roads within the former reservation that were recommended for decommissioning would be decommissioned under this alternative. Roads outside of the former reservation would follow the Road analysis recommendations when the benefiting resource was riparian health or the recommendation was to decommission a road. The remaining roads that are outside of the former reservation would remain open.

The number of acres of commercial salvage under this alternative is the second largest of all of the alternatives. More than 90 percent of the salvage harvest would be done with ground-based equipment on sideslopes less than 30 percent. The modeling of salvage harvest illustrated there would be minor soil erosion and sediment transport under all Alternatives. The only units with slight probability of sedimentation are Units 130, 131, 133, and 134 and equal 781 acres.

Alternative G calls for the third highest number of acres of harvest within riparian habitat conservation areas (RHCA). RHCA 1, RHCA 3 and RHCA 4 have 15 acres, 448 acres and 147 acres, respectively under this alternative. There are 15 acres, 186 acres, and 15 acres of RHCA 1, RHCA 2 and RHCA 3, respectively, within roadside hazard corridors. Harvest operation effects include disrupting soil structure, removal of protective cover and increased raindrop impact (Megahan, 1980). Salvage harvest would be allowed within RHCA 4 and may allow for the recovery of riparian vegetation with conifer uplands versus the conifer dominated riparian vegetation on several intermittent streams within the project area. In some instances, it has been found that once conifer overstory communities are replaced with scrub-shrub or riparian vegetation dominated communities with conifer uplands, the stream have slightly lower summer water temperatures, lower width-to-depth ratios and more undercut banks (Liquori and Jackson, 2001). Overall, salvage harvest is expected to generate minor amounts of sedimentation. However, the harvest within the RHCAs has the most likely probability of having adverse affect on stream condition of any of the salvage harvest in this project because of the proximity of the ground-disturbing event to the stream channel or aquatic habitat. This alternative includes the second highest number of acres of RHCA harvest. This alternative is similar to Alternative C for RHCA harvest except it has no acres outside of roadside hazard within RHCA 1. Overall, this alternative represents the third highest risk of sedimentation from RHCA salvage harvest compared to the other alternatives. The minimum number of acres in RHCA 1 salvage reduces the risk to perennial streams for sedimentation from RHCA harvest compared to Alternative C and E.

Roads needed to commercially salvage the units under this alternative are 16.0 miles of temporary roads and 21.4 miles of re-opened unclassified roads. The addition of 37.4 miles of road to the current 270.1 miles of road would result in a temporary open road density of 4.18 mi/mi^2 or a functioning at unacceptable risk for road density (USFWS, 1998). This road density would be short lived and all road construction may not occur at the same time. The BMPs state that any temporary road will be used for only one season, they will be obliterated [decommissioned] with subsoiling and drainage structures will be installed. Newly re-opened unclassified roads will be treated in the same fashion after use associated with salvage harvest. Therefore, the additional roads associated with the salvage harvest operation would increase the road density but it would be short-term.

Fuels reduction would occur via underburning, broadcast burning, jackpot burning, low ground pressure machine piling and burning, grapple or hand piling and burning, thinning of dead trees, slash buster, or other methods. The majority of the

fuels treatment would occur within salvage units along with some additional whole tree yarding and yarding with tops attached. Additional treatment outside of salvage units would occur in this alternative only. Treatment within a quarter mile of private land would take place for a total of 5,596 acres. The total amount of acres planned for fuels treatment are apt to generate minor soil erosion but would reduce the fuel loading in an area that is expected to exceed 20 tons of fuel per acre within 15 years if no action is taken. This reduction in fuels would allow for a higher probability of a low-severity fire in the future which has generally insignificant affects with regard to hydrologic and water-quality variables (Beschta, 1990). Prescribed fire would occur primarily outside of the harvest units and is expected to be a low-severity burn.

Planting and site preparation for reforestation should allow for accelerated watershed recovery.

The riparian improvement projects would be the same as Alternative C (see Alternative C).

Alternative H

Alternative H focuses on wildlife habitats and on contributing to the long-term development of LOS while providing recovery of some merchantable. It was developed through the modification of Alternative C in response to several key issues. The implementation of Alternative H would result in a road density of 1.72 mi/mi^2, 13,031 acres of commercial salvage and fuels treatment and reduction, 14.9 miles of temporary road development, re-opening 19.7 miles of unclassified roads and reforestation of 34,000 acres that experienced loss of stocking due to fire and does include soil and riparian restoration projects.

After implementation of the activities associated with this alternative is complete, there would be 126.5 miles of open road. These roads were calculated to erode 0.7 tons of sediment per year. Sediment savings from the closure and decommissioning of classified roads of 72.9 miles and 71.6 miles, respectively, would be 0.6 tons/yr. Alternative H would close 6.0 miles and decommission 10.28 miles of road segments within 300 feet of an intermittent or perennial stream. Of the 6.0 miles that would be closed, approximately 0.4 miles are within 50 feet of an intermittent or perennial stream. Of the 10.28 miles to be decommissioned, approximately 2.53 miles are within 50 feet of an intermittent or perennial stream. The level of closure and decommissioning planned under this alternative would generate short-term pulse of sediment, especially at roads near streams. However, the long-term savings of sedimentation outweighs the initial losses expected during active closure and decommissioning. The resultant open road density would be 1.72 mi/mi^2. The density of open roads, plus roads that would be closed (but not decommissioned), would be 2.71 mi/mi^2. Roads within the former reservation will remain open with the exception of any roads within the former reservation that were recommended for decommissioning would be decommissioned under this alternative. All other recommendations from the Road Analysis would be followed under this alternative.

The number of acres of commercial salvage under this alternative is the third largest of all of the alternatives. More than 90 percent of the salvage harvest would be done with ground-based equipment on sideslopes less than 30 percent. The modeling of salvage harvest illustrated there would be minor soil erosion and sediment transport under all Alternatives. The only units with slight probability of sedimentation are Units 130, 131, 133, and 134 and equals 741 acres. Alternative H calls for the minimum number of acres of harvest within riparian habitat conservation areas (RHCA), only those within roadside hazard corridors. There are 15 acres, 186 acres, and 15 acres of RHCA 1, RHCA 2 and RHCA 3, respectively, within roadside hazard corridors. Within roadside hazard corridors individual tree marking would occur where necessary, line-pulling distances would be minimized, no mechanized ground-based skidding equipment would be allowed in the first 150 feet of the stream channel on RHCA 1 and within 50 feet of the stream channel on RHCA 3 and RHCA 4. Harvest operation effects include disrupting soil structure, removal of protective cover and increased raindrop impact (Megahan, 1980). The most potential for sedimentation from salvage harvest exists with RHCA salvage harvest. However, the roadside hazard must be mitigated and the operating constraints for the harvest would mitigate adverse impacts from the harvest operation within RHCAs.

Roads needed to commercially salvage the units under this alternative are 14.9 miles of temporary roads and 19.7 miles of re-opened unclassified roads. The addition of 34.6 miles of road to the current 270.1 miles of road would result in a temporary open road density of 4.14 mi/mi^2 or a functioning at unacceptable risk for road density (USFWS, 1998). This road density would be short lived and all road construction may not occur at the same time. The BMPs state that any temporary road will be used for only one season, they will be obliterated [decommissioned] with subsoiling and drainage structures will be installed. Newly re-opened unclassified roads will be treated in the same fashion after use associated with salvage harvest. Therefore, the additional roads associated with the salvage harvest operation would increase the road density but it would be short-term.

Fuels reduction methods would be the same as Alternative C (see Alternative C.)

Planting and site preparation for reforestation should allow for accelerated watershed recovery.

The riparian improvement projects would be the same as Alternative C (see Alternative C).

Action Alternative Summary-Watershed

The primary concern with any salvage activity from a watershed perspective is water quality and sedimentation. The elements of primary consideration therefore are the number of acres salvaged and the road management activity for each alternative. The salvage activity for each alternative are apt to generate short-term minor amounts of transportable sediment (See Geology, Geomorphology and Soils section of Chapter 3). The units of concern fro sedimentation total approximately 750 acres for Alternatives C, E, G, and H, 31 acres for Alternative D and zero acres of concern in Alternative A.

The amount of road within the analysis area is excessive to proper watershed function and would continue to cause problems within the watershed if not managed properly. Under Alternative A no road management activity is planned and the road density remains high. Alternative E and G would each reduce road densities to 2.57 mi/mi^2 and Alternatives C, D, and H would result in the lowest densities, approximately 1.7 mi/mi^2. The differences between the alternatives become clearer when one considers the open road density for each alternative, when combined with the closed (but . Alternative E has an open and closed road density of 3.48 mi/mi^2 while the other action alternatives (C, D, G, and H) have densities of approximately 2.7 mi/mi^2. Further investigation of the miles of road to be closed and decommissioned illustrates that Alternatives C, D, and H close approximately 70 miles and decommission approximately 70 miles. Alternative E decommissions only 14.6 miles and closes 67.4 miles while Alternative G closes 10.4 miles and decommissions 71.6 miles. Overall, Alternative D, H, and C are the most aggressive with the road treatments they call for and will have more of a long-term benefit than Alternatives G and E. Alternative G decommissions nearly the same number of roads as Alternative D, H, and C but closes only 10 miles of road. Alternative E uses road closure as its primary tool for road treatment and includes the decommissioning of only 14.6 miles of road.

Direct and Indirect Effects-Fisheries

Effects of the 2002 fires, followed by the proposed activities in relation to soils and watershed hydrology (amount of flow, timing of flow, and water quality) have been discussed elsewhere in Chapter 3. This section will discuss the effects of each alternative on aquatic habitat in potentially affected stream channels and will document compliance with the INFISH riparian management objectives. Effects to sensitive fish will also be discussed. Differences between the five action alternatives on aquatic habitat are expected to be none or minimal, so the following disclosure of effects is common to all action alternatives.

Quantitative indicators have been identified and are the primary basis to evaluate the effects of the different alternatives on fisheries resources and aquatic habitats. These indicators include: Sediment yield from roads and proposed harvest (tons per year), road density (miles per square mile), road miles within 300 feet of stream channels, and the amount of harvest within RHCAs (acres).

Although not a habitat characteristic, the affect of road location and densities on aquatic habitat, in particular sediment delivery to streams is well documented. The effects analysis will consider how the alternatives change road densities within the affected watersheds and RHCAs and how those changes could affect interior redband trout production, growth, recruitment, and survival. The estimated sediment yield for each alternative provides a varying degree of long-term benefits from road sediment reduction when compared to baseline conditions. Because these differences are relative, it is difficult to state to what degree the greater percentage reductions in road sediment would benefit aquatic habitat. However, it is expected that over the long-term, sediment reduction from road closures and decommissioning would help improve spawning habitat and pool quality for each alternative. These reductions in combination with proposed aquatic habitat restoration, should contribute to a gradual improvement in redband trout production capability in fish bearing streams within the project.

Riparian timber harvest removes shade-providing vegetation on streams, which increases maximum water temperatures in summer and changes the year-round temperature regime of a stream (Beschta et al. 1987). Riparian timber harvest also reduces large woody debris recruitment to the stream channel, which reduces hiding cover, habitat complexity, pool formation, and substrate trapping. Redband trout prefer complex habitats associated with accumulations of large woody debris.

Alternatives have been grouped based on similarity of proposed harvest within RHCA, proposed Soil and Riparian Protection/Restoration projects, and to a lesser degree Road Management characteristics.

Past Activities (see also Appendix A)

Timber Management

The eight-subwatersheds in which the Silver and Toolbox Fires occurred have been extensively harvested and roaded for timber access over the past 50 years, on both National Forest and private lands (Appendix A, Tables A-2, A-6 and A-13). No monitoring has occurred to document the affect of timber harvest operation on redband trout on the Fremont National Forest. However, the effects of timber harvest operations on aquatic habitats and fisheries resources are well documented (Meehan 1991). It is assumed that effects on redband trout from timber harvest and road construction operations has been substantial because riparian areas have had some level of harvest, the amount of road construction has resulted in elevated sediment in spawning substrates and culverts have been installed that did not allow fish passage.

Road and Trail Maintenance

Sediment produced by road and trail maintenance in the Silver and Toolbox Fire portions is likely insignificant. Annual maintenance has long-term benefits for fisheries resources and aquatic habitats by preventing larger inputs of sediment to stream channels in the event of culvert failures and other events.

Developed Recreation Sites – Maintenance and Use

Campgrounds and trailheads concentrate anglers and cause increased impacts to riparian vegetation thus potentially increasing inputs of sediment to stream channels. These sites include: Bunyard Crossing, Silver Creek Marsh Campground, and the Fremont National Recreation Trail.

Dispersed Recreation- Hunting and Fishing

Angling activity is moderate on Silver Creek at Bunyard Crossing and at Auger Valley (on Silver Creek) and light elsewhere in the drainage. Moderate amounts of angling occur on West Fork Silver Creek at the Road 2917 crossing and at Silver Creek Marsh Campground, with light amounts occurring throughout the rest of the drainage. Both of these locations have large dispersed camping sites within the riparian area. Light amounts of angling occur throughout the North Fork Silver Creek and Guyer Creek drainages. Impacts to riparian vegetation and vegetative ground cover are occurring at dispersed campsites with potential inputs of sediment into stream channels.

Diversions and Reservoirs

There are three reservoirs in or downstream of the project area: Thompson Reservoir (Silver Creek), Diversion Reservoir (West Fork Silver & Silver Creek) and Duncan Reservoir (Duncan Creek). These reservoirs are for irrigation and recreation, with irrigation water having the priority. The main diversion point, which is unscreened, for the stored water occurs on Silver Creek just downstream of the Silver Fire boundary. The majority of the stream flow for Silver Creek is the result of water releases from Thompson Reservoir during irrigation season. During non-irrigation season, Silver Creek has a minimal volume of stream flow. Redband trout either becoming trapped in residual pools and die, or they migrate downstream to the Diversion Reservoir and winter over until irrigation flows are released the following spring.

Fish Stocking

Past stocking of streams by the Oregon Department of Fish and Wildlife has allowed hatchery rainbow trout and non-native Eastern brook trout to invade and out-compete native trout in some reaches, especially in areas that have less than optimum aquatic habitat conditions. In addition, introgression of native redband trout and hatchery rainbow trout has likely occurred. In about 1998, the Oregon Department of Fish and Wildlife discontinued stocking of streams in the Silver Lake watershed.

Livestock Grazing

Three grazing allotments were active in the project area on the Fremont National Forest prior to the fires in the Toolbox and Silver Fire portions: Yamsay, Foster Butte, Winter Rim. None of these allotments have had a significant impact on fisheries resources and aquatic habitats in the burned area. This is due to adjustments in management plans, which resulted in reducing impacts to riparian vegetation, streambank stability, or sediment inputs to fish-bearing streams. Grazing histories on National Forest, as well as on BLM and private lands are summarized in Appendix A, Table A-8. On the Forest, the 2002 fires are unlikely to alter future grazing patterns to the extent that significant, new damage to aquatic habitats would occur. None of the active allotments (Yamsay, Foster Butte, Winter Rim) were having a significant negative effect on fisheries resources or aquatic habitats prior to the fire.

Fire Suppression and Prescribed Fire

As evidenced by the 2002 fire, 50 plus years of successful fire suppression has allowed the subwatersheds in the Silver and Toolbox Fire portions to become more vulnerable to high mortality fire as fuels continued to accumulate. This is evidenced

by the high percentage of moderate and high mortality burning that occurred along streams and riparian areas within the project area. In recent years, prescribed fire has been applied to several areas throughout the Silver and Toolbox Fire portions (See Appendix A, Table A-3). No monitoring has occurred to document the affect of prescribed fire on redband trout on the Fremont National Forest. However, it is assumed that effects are insignificant because riparian areas have generally been unburned and the low intensity nature of the fires on the upland slopes has not generated any observed erosion or sediment input into fish bearing streams.

2002 Fires – Retardant Drops

Approximately 120,000 gallons of retardant were used during suppression of the Toolbox Complex. The primary area that received retardant was the Indian Mountain communications site within the Toolbox Fire area, in the Lower Duncan Creek subwatershed. Retardant was also used on the Silver Fire in and around Silver Creek, West Fork Silver Creek and Thompson Reservoir.

Overall, the majority of the drops were concentrated on the communications site, with other drops occurring along ridgelines, upper slopes, and adjacent to other natural fire barriers such as meadows, roads, and rock outcrops that were considerable distances away from RHCAs. Two instances occurred where retardant entered RHCAs and fish bearing streams. One location was on Silver Creek downstream from Bunyard Crossing and the other was on West Fork Silver Creek upstream from the Diversion Reservoir. No fish kill was observed in either occurrence, as it appeared that only a minor amount of retardant entered the streams. Accidental releases of retardant into streams have caused fish kills (see several authors in Gresswell 1999). Norris et al. (1991) demonstrated that direct application of retardant onto the stream surface was the primary source of retardant contamination in streams. They also found that only minor amounts of retardant entered streams from riparian areas and that relatively narrow, untreated riparian strips as small as three meters wide virtually eliminated retardant from entering streams (Norris et al. 1991). It is unlikely that the retardant drops had a significant effect on redband trout.

2002 Fire – Firelines (Dozer and Hand)

Approximately 203 miles of dozer line and 3 miles of hand line were constructed during the Toolbox Complex Fire. With few exceptions, dozer line was not constructed within RHCAs. Only one dozer line crossed a fish-bearing stream (West Fork Silver Creek) while another dozer line was put in along an intermittent stream (Indian Creek). Dozer lines on the Fremont National Forest were re-contoured, water-barred, and covered with slash in the fall of 2002. The majority of the dozer lines were rehabilitated with an excavator under the direction of a Forest Service resource advisor. The 3 miles of hand line had the soil raked back into the prism, were water-barred, and covered with slash if available. There was one instance where a dozer line is known to have contributed direct sediment inputs to a fish-bearing stream. This occurred on West Fork Silver Creek, near the crossing of the 3038 Road, on the west boundary of the Silver Fire.

2002 Fire – BAER Projects

One relief culvert was installed on West Fork Silver Creek at Road 27. These culverts were installed because several areas upstream of Road 27 experienced high and very high burn severities, which created the potential for increased water yield and debris flows. The relief culverts were installed at the high flow elevation of the existing culvert to alleviate any potential increased stream flows. The sediment into West Fork Silver Creek from these installations occurred as short pulses during and immediately following the installation process. Another relief culvert was constructed at the 2914 Road crossing of Duncan Creek, an intermittent stream, to alleviate likely increased stream flows during spring runoff. Over 15 miles of road within the project area had drainage ditches cleaned out for proper drainage of water during periods of increased water yields. Log erosion barriers and/or rice wattle treatments were used on 13 acres within the project area. It is unlikely that BAER treatments had a significant effect on redband trout or aquatic habitats in the project area.

2002 Fire – Natural Effects

The natural effects of the Toolbox Complex fires on watersheds and aquatics are described elsewhere in the Fisheries Section and in the Watershed section.

Personal Use Firewood and Christmas Tree Cutting

Firewood and Christmas tree cutting and are not currently causing any known problems for fisheries, aquatic habitat, or stream channel conditions in the Silver or Toolbox Fire portions.

Culvert Replacements and Road Decommissioning

Three culverts on fish bearing streams have been replaced in recent years in order to provide improved fish passage (See Appendix A, Table A-9). These culverts are on West Fork Silver Creek, North Fork Silver Creek, and Guyer Creek.

Approximately 60 miles of road have been decommissioned in the West Fork Silver Creek, Upper Silver Creek, Thompson Reservoir and Upper Silver Creek subwatersheds between 1995 and 2001. These actions have improved aquatic habitat conditions for fisheries resources and overall hydrologic function of these watersheds. Any sediment input to these streams because of these projects is considered to have an insignificant effect on redband trout because of the short duration, minimal quantities and low risk of entering fish habitat because of mitigation measures and Forest BMPs.

Present Activities

Private Timber Management

On private lands, the "present" is defined in this section as being the time from the control of the fires in 2002 until reforestation activities are complete, which is estimated to be in 2005. The reason this time frame was chosen was that it includes activities primarily precipitated by the Tool Box and Silver Fires. United States Timberlands (UST), the owner of the largest areas of private land, primarily within the Toolbox Fire portion, began salvage logging operations as soon as the fires were controlled (See Appendix A, Table A-13). They plan to salvage approximately 16,000 acres as long as there is a market for small timber. Both dead and alive timber is being harvested to make the logging operations economically viable. The majority of the salvage acreage was logged in 2002 and the remainder will be logged in 2003 depending on markets. Approximately 2,000 acres of plantation burned sufficiently to require replanting. UST plans to plant approximately 18,000 acres (10,000 from salvage, 6,000 from logging prior to the fires, and 2,000 from burned plantations) of clear-cut and partial cut units to meet or exceed State stocking density requirements.

Livestock Grazing

In three pastures of the Foster Butte Allotment, numbers have been reduced and dates have been adjusted for the upcoming grazing season as a response to the Toolbox fire. The one pasture in the Buck Creek Allotment that has burned acreage will be rested, as scheduled prior to the fire. The Guyer Riparian pasture fence was completed this past fall and a two pasture system will incorporate deferment and early season use. Numbers will stay at 100 head. Grazing in the other allotments and/or pastures will not change in 2003. None of the active allotments (Yamsay, Foster Butte, Winter Rim) were having a significant negative effect on fisheries resources or aquatic habitats prior to the fire, and the most likely scenario following the fire is that riparian impacts would remain relatively constant. On BLM allotments grazing in 2003 and beyond will continue as permitted in all but the Dead Indian-Duncan Allotment. Pastures within the fire-affected subwatersheds will be rested in 2003 and 2004. These BLM Allotments are scheduled for Rangeland Health Assessments and any changes identified will be determined at that time.

Personal Use Firewood and Christmas Tree Cutting

These activities generally occur at least 300 feet from live streams, springs, or seeps. Firewood and Christmas tree cutting and are currently not causing problems for fisheries, aquatic habitat, or stream channel conditions in the Silver or Toolbox Fire portions.

Reasonably Foreseeable Future Activities

517 East Forest Recovery Project/Triad Restoration Project

This project proposes a variety of treatments to restore the landscape to more historic conditions. These treatments include reintroduction of fire where fire historically played a role, commercial and pre-commercial thinnings, aspen enhancements, and large woody debris additions to Silver Creek, Benny Creek, and Squaw Creek. Any sediment input to these streams because of this project is predicted to have an insignificant effect on redband trout because of the minimal quantities and low risk of entering fish habitat because of riparian buffers, mitigation measures, and Forest BMPs.

West Fork Silver Creek Watershed Restoration/Enhancement Project

This project proposes a variety of treatments to restore the landscape to more historic conditions. These treatments include reintroduction of fire where fire historically played a role, commercial and pre-commercial thinnings, aspen enhancements, and large woody debris additions to West Fork Silver Creek, riparian vegetation enhancement, various aspen treatments, and beaver reintroductions. Any sediment input to these streams because of this project is predicted to have an insignificant effect on redband trout because of the minimal quantities and low risk of entering fish habitat because of riparian buffers, mitigation measures, and Forest BMPs.

Windmill Restoration Project

This project proposes a variety of non-commercial treatments to restore the landscape to more historic conditions. These treatments include reintroduction of fire where fire historically played a role, pre-commercial thinnings, aspen enhancements, and large woody debris additions to Duncan Creek and East Duncan Creek. Any sediment input to these

streams because of this project is predicted to have no effect on redband trout because this species does not occur in these streams, which are intermittent.

Private Timber Management

The reasonably foreseeable future is defined, for the purposes of this report, as being the time period following the completion of reforestation to about 30 years into the future. On industrial forestland, once reforestation is complete no additional investments or harvests are planned in the foreseeable future. The stands will be free to grow naturally. Advanced regeneration may grow to the minimum merchantable size for saw logs before the majority of the trees in the even aged plantations attain saw log size. On non-industrial forestland it is expected the landowners would occasionally conduct light partial harvests. Harvests are not scheduled.

Livestock Grazing

Beyond this grazing season, numbers, systems and seasons of use in the Foster Butte, Sycan and Winter Rim Allotments will be considered under a NEPA process. The Yamsay Mt and Buck Creek allotment will continue to be managed within the terms and conditions of the grazing permits currently issued. They are scheduled to be part of NEPA analysis in 2007. BLM Allotments are scheduled for Rangeland Health Assessments and any changes identified will be determined at that time. Decisions on grazing beyond 2004 will be made based on monitoring of the pastures in the next couple of years.

Road and Trail Maintenance

Sediment produced by road and trail maintenance in the Silver and Toolbox Fire portions is insignificant. Annual maintenance benefits fisheries resources by preventing larger inputs of sediment to stream channels.

Personal Use Firewood and Christmas Tree Cutting

These activities generally occur at least 300 feet from live streams, springs, or seeps. Firewood and Christmas tree cutting and are currently not causing problems for fisheries, aquatic habitat, or stream channel conditions in the Silver or Toolbox Fire portions.

Alternative A

Sediment Yield

Under Alternative A, sediment inputs from roads would continue to occur in streams within the Silver Fire portion. Fire-derived sediment increases in Silver Creek, West Fork Silver Creek, North Fork Silver Creek, and Guyer Creek are likely to be small because only 1.3 percent of the Silver Fire area burned at a high severity (BAER Report) and 14.5 percent at moderate severity. The majority of fire-derived sediments are expected in the West Fork Silver Creek drainage, which experienced a higher percentage of moderate to very high mortality burn. Fire derived sediment inputs would be highest in 2003-2005 and should return to near pre-fire levels by 2006 as natural vegetation returns. Sediment produced by road maintenance would be minor because of existing Forest mitigation measures and BMPs. Sediment delivery predictions from roads were estimated to be 4.1 tons per year under Alternative A for the Silver Fire portion.

Road Density/Locations

Under Alternative A, existing road densities and miles of open roads within Category 1 and Category 4 RHCAs would remain unchanged as no road closures or decommissions would occur. Current road maintenance activities would continue. Therefore, road conditions on the landscape would continue to exert stress on drainages within the project and their native trout populations by delivering fine sediment to instream habitats and by increasing the drainage network.

RHCA Harvest

No harvest in Riparian Habitat Conservation Areas would occur under this alternative. No commercial salvage would occur with RHCAs within roadside hazard corridors.

Aquatic Habitat Condition

Wildfire has eliminated the protective vegetation on slopes and along stream channels and can alter surface soil layers, increasing water yield and surface erosion. In the case of the Silver Fire portion of the Toolbox Complex, 84.2 percent of the area experienced low severity fire, 14.5 percent was moderate, and 1.3 percent high (USDA Forest Service 2002-BAER Report). Approximately 800 acres in the entire Toolbox Fire Complex exhibited hydrophobic conditions. Storm events up to 50 years were modeled using the Watershed Erosion Prediction Project (WEPP) model. There were only slight increases in water yield predicted under any storm event.

Numerous roads within the analysis area have been identified as having minimal cross drainage with the sediment routed to the streams in several locations. Under Alternative A, minimal maintenance of the road system would occur, no decommissioning would take place and reconstruction activities, including drainage improvements would likely not take place. Fine sediment levels would increase in affected stream channels.

Silver Creek and West Fork Silver Creek have exhibited late summer water temperatures that exceed State of Oregon standards. Other perennial streams within the analysis area (North Fork Silver Creek and Guyer Creek) fall within the acceptable limits for water temperature. Portions of all perennial streams were burned and mortality of shade producing shrubs and trees did occur. The loss of shade, while minimal overall, will increase solar radiation and some increase in stream temperature will occur. Given the limited extent and magnitude of overstory loss adjacent to perennial streams, changes in stream temperature will be negligible. All alternatives will have identical effects to stream temperature, which is immeasurable increases in the short-term, followed by decreases in the long-term as overstory vegetation within the RHCAs is regenerated.

Fire can also affect nutrient availability and subsequent nutrient loading of streams. Nutrients from the forest floor can be redistributed by leaching of the ash layer and soil, and transported to the stream by surface erosion, soil mass movement, or solution transport (Swanson 1991). Increased nutrient loading (primarily nitrate-nitrogen and phosphorous) to streams is usually seen following burns where fire induced changes in soils results in increased flows. The cause of this increase is believed to be from increased flows that displace volatized material or organic detritus from upslope areas adjacent to the channel. No measurable increase in water yield and minimal increases of fine sediment are predicted from the Silver Fire within the Toolbox Complex. Fire induced loading to all potentially affected streams is expected to be minimal.

Large woody debris is lacking throughout several reaches of the streams in the analysis area. Within the burned area, recruitment of large wood to the channel over several decades is anticipated as burned overstory trees die and fall in the floodplain and active stream channel. Overall, within the burned area all streams will see an increase in large woody debris under Alternative A.

Alternatives C and E

Sediment Yield

Alternatives C and E are predicted to deliver (respectively) 3.7 and 3.8 tons of sediment per year to streams in the Silver Fire portion. This delivery is sediment produced by roads within the project area. The amount of sediment yield due to harvest activities is expected to be minimal, as documented within the Geology, Geomorphology and Soils section of this EIS. Sediment inputs from roads are likely to occur over a 2-4 year period with the largest pulses of sediment occurring during storms, runoff, and high flow periods in 2003-04 and to a lesser degree in 2005-06.

Table 3.117 Estimates of Sediment Yield from Roads for the Silver Fire portion

Alternative	Baseline Condition Sediment Yield (Tons/yr)	Road Decommission/Closure Reductions in Sediment Yield (Tons/yr)	Open Road Sediment Yield (tons/yr)	Percent Reduction from Baseline Condition
C	4.1	0.4	3.7	9.8
E	4.1	0.4	3.8	7.3

Significant increases in sediment yield, that exceed the streams natural ability to carry the sediment load, resulting in sediment depositions, wider, shallower and less stable channels, bank erosion and bed scour, are not expected with Alternatives C and E due to riparian protection measures and adherence to Forest BMPs.

Road Density/Location

Road density, miles of new temporary road, and miles of re-opened road were calculated both for the entire Toolbox Fire Recovery Project area and for each of the subwatersheds (See Watershed section of Chapter 3 for discussions). Road data for Category 1 RHCAs applies only to the Silver Fire portion, as there are no Category 1 RHCAs in the Toolbox Fire portion.

Road miles in the Silver Fire portion within 300 feet of fish bearing stream channels currently total 3.05 miles; and 16.38 miles within 300 feet of intermittent streams. The following table displays proposed closure and decommissioning, within

Category 1 and 4 RHCAs, by alternative, with the resulting miles of open road. Maintaining a buffer between the road and stream channel provides a filter that minimizes the introduction of fine sediment into the stream channel. Studies have shown a buffer distance of roughly one site-potential tree would effectively remove sediment in most situations (FEMAT 1993). The number of road miles within 300 feet of perennial and intermittent stream channels were identified from GIS road and stream layers for the project area.

Table 3.118 Road Management within RHCAs for the Silver Fire Portion

Alternative	Miles of Road within 300 feet of Streams		Miles of Proposed Closed Road		Miles of Proposed Decommissioned Road		Miles of Open Road	
	C1	C4	C1	C4	C1	C4	C1	C4
C	3.05	16.38	0.02	2.60	1.90	4.11	1.15	12.27
E	3.05	16.38	0.07	2.83	1.21	3.31	1.84	13.07

Alternatives C and E would be considered to be **functioning appropriately but at risk** for road densities within the project area. The open road reductions within 300 feet of fish bearing streams and intermittent streams are displayed in the above table. Sediment inputs from roads into stream channels are expected to be minor given the low number of road miles within 300 feet of stream channels and the implementation of riparian protection measures and BMPs.

RHCA Harvest

Other than roadside hazard corridor harvest (which is included in all action alternatives), in the Silver Fire portion, 22 acres of Category 1 RHCA harvest are proposed in Alternative C; 4 acres are proposed in Alternative E. Harvest in roadside hazard corridor, within RHCAs, would add 15 acres of Category 1 RHCA harvest to both alternatives.

The following table displays RHCA harvest for all categories in the Silver Fire portion:

Table 3.119 Proposed RHCA for Alternative C and E for the Silver Fire portion

Alternative	RHCA Harvest in Units by Category (Acres)			
	C1	C1 Roadside Hazard	C3*	C4*
C	22	15	127	45
E	4	15	99	45

*Roadside Hazard in C3 and C4 were not calculated by fire portion. For the project area as a whole there would be an additional 186 acres of harvest in C3 and 15 acres in C4, in roadside hazard corridors, with all action alternatives.

In these two alternatives, harvest units within Category 1 RHCA are either reserved for helicopter yarding (with exceptions that would allow "line-pulling" from equipment outside the RHCA) and placed in the outer 100 foot of a typical 300-foot RHCA; or in the case of roadside hazard corridors are equipment-restricted. See Chapter 2 for a complete description of resource protection and mitigation measures that apply to RHCA harvest. Specifically, see "Alternative Descriptions; Actions Common to All Fully Analyzed Action Alternatives" for the design of harvest within all category of RHCAs *outside of* roadside hazard corridors; see Chapter 2 "Mitigation and Resource Protection Measures; Aquatics and Soils; Roadside Hazard RHCA Units" for measures that would apply to harvest *within* roadside hazard corridors.

With Alternatives C and E, harvest would occur within Categories 1, 3, and 4 RHCAs. Under the alternative designs some harvest would occur as near as 200 feet from fish bearing streams. Studies show that non-channelized sediment flow rarely travels more than 300 feet and that riparian buffers of 200-300 feet are generally effective at protecting streams from sediment from non-channelized flow (Ketcheson and Megahan 1990, Burroughs and King, 1989). Therefore, the potential for sedimentation into these streams would be greater with harvest occurring at 200 feet of fish bearing streams as opposed to 300 feet.

Harvest would also occur within the entire 50-foot RHCA width along intermittent streams (though no mechanized ground based equipment would be permitted within the entire RHCA width), thus increasing the potential for sediment transport to downstream fish bearing streams. In addition, the harvest would decrease future large wood recruitment to riparian areas, though between 20 and 80 trees per mile of stream would be retained, including all green trees and sufficient dead trees to provide long-term attainment of INFISH Riparian Management Objectives. Large down woody material in riparian areas provides several functions including trapping of sediment transported by rill or sheet erosion, microclimates for the

establishment of deciduous and coniferous tree species, and protection and stabilization of streambanks and riparian areas during high flow events.

Riparian vegetation and bank stability

Silver Creek, West Fork Silver Creek (except Reach 5), North Fork Silver Creek, and Guyer Creek are all **functioning appropriately** for riparian vegetation and bank stability. Reach 5 of West Fork Silver Creek is **functioning appropriately but at risk** due to a high abundance of grass and the lack of willow in the older age classes and its slightly low bank stability values. Strawberry and Indian Creeks are **functioning appropriately** for bank stability.

When streams are lined with riparian vegetation such as sedges, willows, and dogwood, streambanks are typically highly stable, resulting in a stream channel that is less susceptible to alteration during high flow events. Under Alternatives C and E, no significant increases in water yield or sedimentation are predicted. Riparian vegetation and bank stability will improve as natural vegetation recovers over time in areas that experienced moderate and high burn intensities.

Large woody debris

Silver Creek, in all reaches in the project area, is **functioning appropriately but at risk** for meeting INFISH standards for large wood. However, only Reaches 5 and 6 are considered to have this rating using ICBEMP numbers for natural and near natural streams while Reaches 7 and 8 are considered to be **functioning appropriately**. West Fork Silver Creek is **functioning appropriately** for meeting INFISH standards and natural and near natural conditions as described in ICBEMP. Only Reach 6 of West Fork Silver Creek is considered to be **functioning appropriately but at risk**. North Fork Silver Creek and Guyer Creek are both **functioning appropriately** for large wood while Strawberry Creek is **functioning appropriately but at risk** and Indian Creek is **functioning at unacceptable risk** using ICBEMP criteria.

Under Alternatives C and E, some harvest would occur within RHCAs (in the area between 200 feet and 300 feet from the stream along fish bearing streams). As fire affected trees within the RHCAs die they will provide an important source of wood to the affected stream channels, riparian areas, and adjacent slopes. Large woody debris within affected stream reaches is expected to continue trending toward attainment of desired future condition objectives. The amount of large wood entering fish bearing streams in the Silver Fire portion is expected to increase by an estimated 50 pieces over the next 20 years, which will be sufficient to move to a functional condition. Implementation of the aquatic habitat restoration projects (9.6 miles of large woody debris placement in the Silver Fire portion) would improve the number of pieces of large woody debris in fish bearing streams and therefore improve aquatic habitat conditions for redband trout and other aquatic species.

Pools

The numbers of pools in all potentially affected stream reaches meet objectives and are considered to be **functioning appropriately**. However, the number of large pools, those greater than 2.6 feet in depth, were found to be deficient in all surveyed stream reaches, with the exception of Reaches 4, 5, and 6 of West Fork Silver Creek, and are considered to be **functioning appropriately but at risk** for Silver and West Fork Silver Creeks. North Fork Silver Creek and Guyer Creek are considered to be **functioning at unacceptable risk** for large pools. Factors believed to be affecting formation of large, deep pools are the low numbers of large woody debris and the filling of pools from upstream sediment sources.

Under Alternatives C and E, RHCAs have been established on all streams with some harvest occurring in the outer edges and with specific guidelines (see RHCA Harvest above). No change is expected in the number of pools or large pools, as a result of salvage, with either of these alternatives. Implementation of the aquatic habitat restoration projects would improve the number of large pools in fish bearing streams and therefore improve aquatic habitat conditions for redband trout and other aquatic species.

Spawning gravel fines/substrate composition

The major cause of sedimentation to streams is from roads in most watersheds. No new specified road construction will occur with this project. Project area wide, approximately 16.0 miles (Alternative C) and 13.3 miles (Alternative E) of temporary road would be constructed using the Forest Road Best Management Practices (BMPs). No temporary road would be constructed within RHCAs. Given the physical separation of temporary road construction from spawning areas (greater than 300 feet in all cases) and the BMPs in place, the amount of fine sediment in spawning gravels is not expected to change as a result of temporary road construction. Under Alternatives C and E, improvements (cross drainage, rolling dips etc.) would be made to the roads within the project area, which is expected to slightly decrease the amount of fine sediment in spawning gravels.

Salvage activities proposed under Alternatives C and E are not expected to add significantly to fine sediment entering fish bearing streams. In addition, salvage in Category 1 RHCAs would be via helicopter to minimize soil disturbance and compaction. If any project-generated sediment were to reach fish bearing streams, it is expected that it would be short-term in nature, and at an immeasurable, negligible level. The use of timber BMPs, close adherence to the Soil Productivity Guide, and protective measures in RHCAs would prevent most sediment from reaching stream channels. Road related activities (road maintenance and construction of temporary road) would also have minimal effect as long as road BMPs are followed.

Rosgen channel types

Silver Creek, West Fork Silver Creek (except Reach 5), North Fork Silver Creek, and Guyer Creek are all **functioning appropriately** for predicted Rosgen Channel Types. Although Reach 5 of West Fork Silver Creek has stream channels that are similar to the stream type expected, segments of the reach have bankfull width-to-depth ratios that are slightly greater than expected, therefore the reach is considered to be **functioning appropriately but at risk**. Wildfire, followed by commercial salvage and associated road building, can increase water yield and accelerated erosion. These changes can have a dramatic effect to channels downstream depending on the magnitude of the change and the condition and type of stream channels affected. Under Alternatives C and E, little increase in water yield or sediment yield is predicted and therefore no changes in channel types are expected to occur.

Stream temperature and shade

Under Alternatives C and E, water temperature will continue to exceed state water quality standards in Silver Creek and West Fork Silver Creek and temperatures may increase with the loss of overstory vegetation from fire-induced mortality. Water temperatures for North Fork Silver Creek and Guyer Creek are expected to remain unchanged.

Alternative D, G, and H

Sediment Yield

Alternatives D, G, and H are predicted to deliver (respectively) 3.7, 3.8, and 3.7 tons of sediment per year to streams in the Silver Fire portion. This delivery is sediment produced by roads within the project area. The amount of sediment yield because of harvest activities is expected to be minimal, as documented within the Geology, Geomorphology and Soils section of this EIS. Sediment inputs from roads are likely to occur over a 2-4 year period with the largest pulses of sediment occurring during storms, runoff, and high flow periods in 2003-04 and to a lesser degree in 2005-06.

Table 3.120 Estimates of Sediment Yield from Roads for the Silver Fire portion

Alternative	Baseline Condition Sediment Yield (Tons/yr)	Road Decommission/Closure Reductions in Sediment Yield (Tons/yr)	Open Road Sediment Yield (tons/yr)	Percent Reduction from Baseline Condition
D	4.1	0.4	3.7	9.8
G	4.1	0.4	3.8	7.3
H	4.1	0.4	3.7	9.8

Significant increases in sediment yield, that exceed the streams natural ability to carry the sediment load, resulting in sediment depositions, wider, shallower and less stable channels, bank erosion and bed scour, are not expected with Alternatives D, G, and H due to riparian protection measures and adherence to Forest BMPs.

Road Density/Location

Road density, miles of new temporary road, and miles of re-opened road were calculated both for the entire Toolbox Fire Recovery Project area and for each of the subwatersheds (See Watershed section of Chapter 3 for discussions). Road data for Category 1 RHCAs applies only to the Silver Fire portion, as there are no Category 1 RHCAs in the Toolbox Fire portion.

Road miles within 300 feet of fish bearing stream channels currently total 3.05 miles; and 16.38 miles within 300 feet of intermittent streams. The following table displays proposed closure and decommissioning, within Category 1 and 4 RHCAs, by alternative, with the resulting miles of open road. Maintaining a buffer between the road and stream channel provides a filter that minimizes the introduction of fine sediment into the stream channel. Studies have shown a buffer

distance of roughly one site-potential tree would effectively remove sediment in most situations (FEMAT 1993). The number of road miles within 300 feet of perennial and intermittent stream channels were identified from GIS road and stream layers for the project area.

Table 3.121 Road Management within RHCAs for the Silver Fire Portion

Alternative	Miles of Road within 300 feet of Streams		Miles of Proposed Closed Road		Miles of Proposed Decommissioned Road		Miles of Open Road	
	C1	C4	C1	C4	C1	C4	C1	C4
D	3.05	16.38	0.02	2.35	1.90	4.45	1.15	11.93
G	3.05	16.38	0.00	1.69	1.90	4.45	1.15	11.93
H	3.05	16.38	0.02	2.35	1.90	4.45	1.15	11.93

Alternatives D and H would be considered to be **functioning appropriately** for road densities within the project area while Alternative G would be **functioning appropriately but at risk for road densities**. The open road reductions within 300 feet of fish bearing streams and intermittent streams are displayed in the above table. Sediment inputs from roads into stream channels are expected to be minor given the low number of road miles within 300 feet of stream channels and the implementation of riparian protection measures and BMPs.

RHCA Harvest

Other than roadside hazard corridors (which are included in all action alternatives), in the Silver Fire portion, no Category 1 RHCA harvest is proposed in Alternatives D, G and H. Harvest in roadside hazard corridor, within RHCAs, would add 15 acres of Category 1 RHCA harvest to each of the alternatives.

The following table displays RHCA harvest for all categories in the Silver Fire portion

Table 3.122 Proposed RHCA for Alternative C and E for the Silver Fire portion

Alternative	RHCA Harvest in Units by Category (Acres)			
	C1	C1 Roadside Hazard	C3*	C4*
D	0	15	0	0
G	0	15	132	45
H	0	15	0	0

*Roadside Hazard in C3 and C4 were not calculated by fire portion. For the project area as a whole there would be an additional 186 acres of harvest in C3 and 15 acres in C4, in roadside hazard corridors, with all action alternatives.

In these alternatives, harvest units within Category 1 RHCA are all in roadside hazard corridors and are equipment-restricted. See Chapter 2 for a complete description of resource protection and mitigation measures that apply to RHCA harvest. Specifically, see "Alternative Descriptions; Actions Common to All Fully Analyzed Action Alternatives" for the design of harvest within all category of RHCAs *outside of* roadside hazard corridors; see Chapter 2 "Mitigation and Resource Protection Measures; Aquatics and Soils; Roadside Hazard RHCA Units" for measures that would apply to harvest *within* roadside hazard corridors.

With Alternative G harvest would occur within Categories 3 and 4 RHCAs. Harvest would occur within the entire 50-foot RHCA width along intermittent streams (though no mechanized ground based equipment would be permitted within the entire RHCA width), thus increasing the potential for sediment transport to downstream fish bearing streams. In addition, the harvest would decrease future large wood recruitment to riparian areas, though between 20 and 80 trees per mile of stream would be retained, including all green trees and sufficient dead trees to provide long-term attainment of INFISH Riparian Management Objectives. Large down woody material in riparian areas provides several functions including trapping of sediment transported by rill or sheet erosion, microclimates for the establishment of deciduous and coniferous tree species, and protection and stabilization of streambanks and riparian areas during high flow events.

Under Alternatives D and H, limited harvest within roadside hazard corridors within RHCAs would still occur (as it would with all action alternatives). Any harvest within RHCAs increases the potential for sediment transport to downstream fish bearing streams. In addition, the harvest would decrease future large wood recruitment to riparian areas, though between

20 and 80 trees per mile of stream would be retained, including all green trees and sufficient dead trees to provide long-term attainment of INFISH Riparian Management Objectives.

Riparian vegetation and bank stability

Same effects as Alternatives C and G (see previous section)

Large woody debris

Silver Creek, in all reaches in the project area, is **functioning appropriately but at risk** for meeting INFISH standards for large wood. However, only Reaches 5 and 6 are considered to have this rating using ICBEMP numbers for natural and near natural streams while Reaches 7 and 8 are considered to be **functioning appropriately**. West Fork Silver Creek is **functioning appropriately** for meeting INFISH standards and natural and near natural conditions as described in ICBEMP. Only Reach 6 of West Fork Silver Creek is considered to be **functioning appropriately but at risk**. North Fork Silver Creek and Guyer Creek are both **functioning appropriately** for large wood while Strawberry Creek is **functioning appropriately but at risk** and Indian Creek is **functioning at unacceptable risk** using ICBEMP criteria.

Under Alternatives D, G, and H, harvest would not occur within Category 1 RHCAs, but would occur in (Alternative G) Category 3 and 4 RHCAs. All action alternatives include limited roadside hazard corridor RHCA harvest. As fire affected trees within the RHCAs die they will provide an important source of wood to the affected stream channels, riparian areas, and adjacent slopes. Large woody debris within affected stream reaches is expected to continue trending toward attainment of desired future condition objectives. The amount of large wood entering fish bearing streams in the Silver Fire portion is expected to increase by an estimated 50 pieces over the next 20 years, which will be sufficient to move to a functional condition. Implementation of the aquatic habitat restoration projects (9.6 miles of large woody debris placement in the Silver Fire portion) would improve the number of pieces of large woody debris in fish bearing streams and therefore improve aquatic habitat conditions for redband trout and other aquatic species.

Pools

The numbers of pools in all potentially affected stream reaches meet objectives and are considered to be **functioning appropriately**. However, the number of large pools, those greater than 2.6 feet in depth, were found to be deficient in all surveyed stream reaches, with the exception of Reaches 4, 5, and 6 of West Fork Silver Creek, and are considered to be **functioning appropriately but at risk** for Silver and West Fork Silver Creeks. North Fork Silver Creek and Guyer Creek are considered to be **functioning at unacceptable risk** for large pools. Factors believed to be affecting formation of large, deep pools are the low numbers of large woody debris and the filling of pools from upstream sediment sources.

Under Alternatives D, G, and H, RHCAs have been established on all streams with some harvest occurring in the outer edges of Category 3 (Alternative G) and within Category 4 RHCAs (Alternative G) and in roadside hazard corridors (all action alternatives), within specific guidelines (see RHCA Harvest above). No change is expected in the number of pools or large pools, as a result of salvage, with these alternatives. Implementation of the aquatic habitat restoration projects would improve the number of large pools in fish bearing streams and therefore improve aquatic habitat conditions for redband trout and other aquatic species.

Spawning gravel fines/substrate composition

The major cause of sedimentation to streams is from roads in most watersheds. No new specified road construction will occur with this project. Project area wide, approximately 16.0 miles (Alternative G) and 14.9 miles (Alternative H) of temporary road would be constructed using the Forest Road Best Management Practices (BMPs). Alternative D has no temporary road construction. No temporary road would be constructed within RHCAs. Given the physical separation of temporary road construction from spawning areas (greater than 300 feet in all cases) and the BMPs in place, the amount of fine sediment in spawning gravels is not expected to change as a result of temporary road construction. Under Alternatives D, G and H, improvements (cross drainage, rolling dips etc.) would be made to the roads within the project area, which is expected to slightly decrease the amount of fine sediment in spawning gravels.

Salvage activities proposed under Alternatives D, G, and H are not expected to add significantly to fine sediment entering fish bearing streams. In addition, no salvage would occur in Category 1 RHCAs. If any project-generated sediment were to reach fish bearing streams, it is expected that it would be short-term in nature, and at an immeasurable, negligible level. The use of timber BMPs, close adherence to the Soil Productivity Guide, and protective measures in RHCAs would prevent most sediment from reaching stream channels. Road related activities (road maintenance and construction of temporary road) would also have minimal effect as long as road BMPs are followed.

Rosgen channel types

Silver Creek, West Fork Silver Creek (except Reach 5), North Fork Silver Creek, and Guyer Creek are all **functioning appropriately** for predicted Rosgen Channel Types. Although Reach 5 of West Fork Silver Creek has stream channels that are similar to the stream type expected, segments of the reach have bankfull width-to-depth ratios that are slightly greater than expected, therefore the reach is considered to be **functioning appropriately but at risk**. Wildfire, followed by commercial salvage and associated road building, can increase water yield and accelerated erosion. These changes can have a dramatic effect to channels downstream depending on the magnitude of the change and the condition and type of stream channels affected. Under Alternatives D, G and H, little increase in water yield or sediment yield is predicted and therefore no changes in channel types are expected to occur.

Stream temperature and shade

Under Alternatives D, G, and H, water temperature will continue to exceed state water quality standards in Silver Creek and West Fork Silver Creek and temperatures may increase with the loss of overstory vegetation from fire-induced mortality. Water temperatures for North Fork Silver Creek and Guyer Creek are expected to remain unchanged.

Direct, Indirect, and Cumulative Effects-Road Reconstruction

Alternative A

There would be no known adverse short term or long-term effects from not implementing road reconstruction.

Effects Common to the Action Alternatives

Road reconstruction would place a surface course layer of cinders on the Maintenance Level-2 roads to provide a durable aggregate surface for timber haul and prevent subgrade deformation while reducing possible roadway soil erosion. The arterial haul roads would be resurfaced with additional cinders to increase the overall roadway surface depth to accommodate timber haul.

Road reconstruction would increase the level of safety for the Public and Forest Service when using these roads during timber sale haul. Reconstruction would use cinders from Forest Service pits, which would utilize and decrease the future availability of the minerals.

Cumulative Watershed Effects

Cumulative watershed effects (CWEs) are defined in the Code of Federal Regulations 40 Section 1508.7 as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. CWEs in watersheds are measurable impacts on physical watershed conditions resulting from the combined effects of a variety of forest management activities. These activities include timber, range, recreations, road management, and all other forest uses. Each forest use or management activity has an individual impact on watershed systems, that when collectively evaluated with other impacts, may have an unanticipated impact larger than the individual impact. The elements that are considered in the cumulative watershed effects analysis are roads, soils, canopy, riparian vegetation, channel, pools, large wood, temperature, sediment, and fish passage. Each of these elements is assigned a functionality rating. These elements are combined with the overall condition of the uplands, riparian area, and stream channels. The findings from this information are tempered with the subwatershed sensitivity, uncertainty, and risk and result in an overall functionality of each subwatershed.

Analysis Methods

An overall rating of each subwatershed in the project area will be made using a synthesis of the uplands, riparian, and channel condition information. The uplands information consists of the roads, canopy, and soils. The riparian information consists of the bank stability values and riparian vegetation. The channel condition information consists of pool frequency, large wood frequency, temperature, fine sediment, and fish passage. The uplands, riparian and channel information for each subwatershed will then be considered for each alternative. Consideration of each alternative as it pertains to each subwatershed will then be explored. The information regarding each alternative coupled with past, present and future activity, the inherent subwatershed sensitivity and the degree of uncertainty or risk involved with the project alternatives will be evaluated.

Subwatershed Sensitivity – Analysis Methods

The degree to which a watershed or subwatershed responds to a management activity or a natural disaster is considered when determining the inherent watershed or watershed sensitivity. Existing conditions and the inherent sensitivity allow one to more clearly understand how a subwatershed may react to any proposed activity on the subwatershed. For the purposes of this analysis, the inherent sensitivity of each 6th field watershed or subwatershed in the planning area will be analyzed. The sensitivity of each subwatershed was determined through the analysis of several elements. These elements are the hydrologic soil group, mass wasting hazard, precipitation amounts, rain-on-snow potential zones, drainage density, watershed relief ratio, and mean basin elevation.

Subwatershed Sensitivity – Hydrologic Soil Group

The soils that make up each subwatershed were broken into hydrologic soil groups that indicate the general infiltration and water movement ability of the soil and bedrock materials. Generally, hydrologic soil groups C and D are rather likely to generate stream flow. Hydrologic soil group A is made up of soils having high infiltration rates, when thoroughly wetted, these soils consists chiefly of deep, well to excessively drained sands and/or gravel. These soils have a high rate of water transmission and would result in a low runoff potential. Hydrologic soil group B is characterized by soils with moderate infiltration rates when thoroughly wetted, these soils consist chiefly of moderately deep to deep, moderately well to well-drained soils, with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission. The soils in hydrologic group C have a slow rate of water transmission and are characterized by slow infiltration rates when thoroughly wetted. Group C consists of (1) soils with a layer that impedes the downward movement of water or (2) soils with moderately fine to fine texture and a slow infiltration rate. Hydrologic soil group D is characterized by soils with a very slow rate of water transmission and very slow infiltration rates when thoroughly wetted. Group D consists of (1) clay soils with high swelling potential, (2) soils with a high permanent water table, (3) soils with clay pan or clay layer at or near the surface, and (4) shallow soils over nearly impervious materials. The percent of the subwatershed area that consists of soil group C and D were reported, as they are streamflow generation areas.

The different soil groups are given an index factor that weighs their relative contribution to surface runoff and sediment delivery within the subwatershed. The total number of acres for hydrologic soil group D and C is multiplied by an index factor of 0.8 and 0.4, respectively in order to generate an index total. The index total was then converted to a percent of the subwatershed area and rated for overall sensitivity with respect to hydrologic group. Subwatersheds were rated high, moderate and low for greater than 40 percent, greater than 15 percent and less than or equal to 40 percent, and less than or equal to 15 percent, respectively.

Table 3.123 Index Total for Hydrologic Soil Group C and D

SUBWATERSHED	HYDROLOGIC SOIL GROUP C (acres)	INDEX TOTAL FOR HYDROLOGIC SOIL GROUP C	HYDROLOGIC SOIL GROUP D (acres)	INDEX TOTAL FOR HYDROLOGIC SOIL GROUP D	INDEX TOTAL (Acres)
Benny Creek	5007	2003	4417	3534	5536
East Duncan Creek	927	371	931	745	1116
Lower Duncan Creek	5221	2088	12267	9814	11902
Middle Silver Creek	7881	3152	15968	12774	15927
Thompson Reservoir	5202	2081	4820	3856	5937
Upper Duncan Creek	2040	816	2899	2319	3135
Upper Silver Creek	1487	595	2050	1640	2235
West Fork Silver Creek	2192	877	4466	3573	4450

Table 3.124 Percent of Subwatershed in Hydrologic Soil Group C and D

SUBWATERSHED	INDEX PERCENT OF SUBWATERSHED	HYDROLOGIC GROUP INDEX
Benny Creek	21%	MODERATE
East Duncan Creek	10%	LOW
Lower Duncan Creek	48%	HIGH
Middle Silver Creek	41%	HIGH
Thompson Reservoir	14%	LOW
Upper Duncan Creek	14%	LOW
Upper Silver Creek	14%	LOW
West Fork Silver Creek	19%	MODERATE

Subwatershed Sensitivity – Mass Wasting Hazard

Soil mapping units where no evidence of failure exists were rated as very stable. Occasional failures that were observed were rates as stable. The analysis area yielded four categories of information with regard to mass wasting—very stable, stable with rotational slumps as the mass movement type, stable with debris slides as the mass movement type, and not applicable.

The mass wasting information for the portion of the subwatersheds north of the Forest Service boundary, approximately 46,500 acres, has not yet been completed. However, the area is characterized by low relief and little to no history of mass wasting.

Table 3.125 Mass Wasting Characteristics of each Subwatershed

SUBWATERSHED	VERY STABLE	STABLE (rotational slumps)	STABLE (debris slides)	Not Applicable
Benny Creek	86%	6%	0%	8%
East Duncan Creek	50%	0%	0%	50%
Lower Duncan Creek	55%	12%	0%	33%
Middle Silver Creek	98%	0%	0%	2%
Thompson Reservoir	72%	3%	0%	25%
Upper Duncan Creek	72%	3%	0%	25%
Upper Silver Creek	83%	1%	1%	15%
West Fork Silver Creek	79%	13%	0%	8%

The index for mass wasting characteristics for the analysis was rated as follows. Greater than 85 percent of the subwatershed that was very stable was rated as low sensitivity, greater than 70 percent and less than 85 percent of the subwatershed that was very stable was rated as moderate and less than 70 percent was rated as high sensitivity. If any subwatershed had greater than 10 percent of the area in rotational slumps the category was raised to the next level of sensitivity.

Table 3.126 Index for Mass Wasting Characteristics

SUBWATERSHED	INDEX
Benny Creek	LOW
East Duncan Creek	HIGH
Lower Duncan Creek	VERY HIGH
Middle Silver Creek	LOW
Thompson Reservoir	MODERATE
Upper Duncan Creek	MODERATE
Upper Silver Creek	MODERATE
West Fork Silver Creek	HIGH

Subwatershed Sensitivity – Precipitation and Rain on Snow Potential

Precipitation amounts were taken from the Silver Creek SNOTEL station that is located at 5740 ft elevation and was installed in 1981. The average accumulated precipitation by September 30 for the water years (October 1 through September 30) of record (1981-2002) is 27.5 inches. The majority of the precipitation falls by June 1. The average accumulated precipitation by June 1 for the water years of record is 24.4 inches. Due to the limited number of precipitation gages located within or near the analysis area the precipitation value of 24.4 inches will be used for each subwatershed. Overall the limited amount of precipitation experienced in the area yields less sensitive watersheds on the whole.

The amount within the rain-on-snow zone for each subwatershed was not readily calculated. A clear picture of the elevation bands that are located within rain-on-snow potential zones is not available due to the limited number of gauging stations throughout the subwatersheds. The available gauging stations in the general area illustrate a typical rain-on-snow signature seen during several years of the gauging record. These sites are located at approximately 4400 ft elevation. One of the gauging stations is located with the Silver Creek 5th field watershed. For this reason, it would be accurate to estimate the lower boundary of the rain-on-snow zone to be 4500 feet for the Silver Creek 5th field watershed. The upper boundary of the rain-on-snow zone for Silver Creek could be estimated at approximately 6,000 feet. This elevation range places approximately 65 percent of the Silver Creek 5th field watershed within the approximated rain-on-snow area. The Silver Lake 5th field watershed does not have a gauging station within the watershed and therefore the same elevation range will be used.

However, the concern over rain-on-snow events is a very real concern in any area that experiences substantial snow pack. A significant snowmelt could be produced if a rain-on-snow event with very high winds, temperatures, humidity and precipitation were to occur at a time (Marks et al., 1998). The resultant snowmelt would enhance runoff and increase the potential for flooding. If conditions are ripe, a rain-on-snow flood event can be very damaging to the subwatershed. Each subwatershed will be discussed separately regarding the estimated risk of a rain-on-snow event and how that relates to risk in relation to subwatershed sensitivity.

The index rating for rain-on-snow area for each subwatershed will be rated separately for the 5th field watersheds. For the subwatersheds in the project area: any subwatershed with greater than or equal to 70 percent of the subwatershed in the rain-on-snow elevation range will be rated as high and any subwatershed with less than 70 percent and greater than 50 percent will be rated as moderate, and less than 50 percent will be rated as low.

Table 3.127 Rain-on-Snow Index Rating for each Subwatershed

SUBWATERSHED	PERCENT OF SUBWATERSHED WITHIN RAIN-ON-SNOW RANGE	RAIN-ON-SNOW SENSITIVITY INDEX
Benny Creek	60%	MODERATE
East Duncan Creek	45%	MODERATE
Lower Duncan Creek	85%	HIGH
Middle Silver Creek	65%	MODERATE
Thompson Reservoir	65%	MODERATE
Upper Duncan Creek	60%	MODERATE
Upper Silver Creek	95%	HIGH
West Fork Silver Creek	70%	HIGH

Subwatershed Sensitivity – Drainage Density

The drainage density for each subwatershed was determined by taking the miles of stream divided by the subwatershed area. Drainage density affects the rapidity by which water can flow to the outlet. A larger drainage density value, will yield a quicker flow response and higher the peak (Brooks et al. p. 78, 1991). This value was further divided into the drainage density values for perennial and intermittent streams. The low class of drainage density is considered between 3 to 4 mi/mi^2 (Strahler, 1964). None of the subwatersheds have drainage densities above 1.3 mi/mi^2. The index for the drainage density was rated relative to the eight subwatersheds and was separated into high (greater than or equal to 1.2 mi/mi^2), moderate (greater than or equal to 1.0 mi/mi^2 and less than 1.2 mi/mi^2) and low (less than 1.0 mi/mi^2).

Table 3.128 Drainage Density for each Subwatershed

SUBWATERSHED	PERENNIAL AND INTERMITTENT DRAINAGE DENSITY (mi/mi^2)	DRAINAGE DENSITY SENSITIVITY INDEX
Benny Creek	1.18	MODERATE
East Duncan Creek	0.64	LOW
Lower Duncan Creek	1.13	MODERATE
Middle Silver Creek	1.03	MODERATE
Thompson Reservoir	1.10	MODERATE
Upper Duncan Creek	0.84	LOW
Upper Silver Creek	1.24	HIGH
West Fork Silver Creek	1.27	HIGH

Subwatershed Sensitivity – Watershed Relief Ratio

The subwatershed relief ratio was generated by subtracting the outlet elevation from the subwatershed crest elevation divided by the length of the subwatershed. Upper Silver Creek and Lower Duncan Creek have the largest watershed relief ratio due to the shortest distances between the high and low point. West Fork Silver Creek loses the most elevation between high and low points but does so over the longest distance which yields an average watershed relief ratio. The index used for watershed relief was separated into high (greater than or equal to 0.75 ft/ft), moderate (greater than or equal to 0.5 ft/ft and less than 0.75 ft/ft) and low (less than 0.5 ft/ft).

Table 3.129 Watershed Relief Ratio for each Subwatershed

SUBWATERSHED	HIGH PT (ft)	LOW PT (ft)	DIFFERENCE IN ELEVATION (ft)	DISTANCE (ft), HIGH TO LOW PT	WATERSHED RELIEF RATIO	WATERSHED RELIEF SENSITIVITY INDEX
Benny Creek	7135	4956	2179	66,181	0.03	LOW
East Duncan Creek	6800	5200	1600	42,148	0.04	LOW
Lower Duncan Creek	7066	4320	2746	29,662	0.09	HIGH
Middle Silver Creek	7140	4315	2825	53,858	0.05	MODERATE
Thompson Reservoir	7560	4956	2604	51,007	0.05	MODERATE
Upper Duncan Creek	6820	5200	1620	57,204	0.03	LOW
Upper Silver Creek	7195	4435	2760	27,497	0.10	HIGH
West Fork Silver Creek	7680	4435	3245	79,888	0.04	LOW

Subwatershed Sensitivity – Mean Basin Elevation

Mean basin elevation was estimated by the elevation of the centroid of each subwatershed. Higher elevation subwatersheds have more inherent sensitivity. The index used for the centroid elevation information was high (greater than 5500 ft), moderate (greater than or equal to 5000 ft and less than 5500 ft) and low (less than 5000 ft).

Table 3.130 Centroid Elevation of each Subwatershed and Associated Rank

SUBWATERSHED	CENTROID ELEVATION (ft)	SENSITIVITY INDEX
Benny Creek	5789	HIGH
East Duncan Creek	6131	HIGH
Lower Duncan Creek	5100	MODERATE
Middle Silver Creek	4600	LOW
Thompson Reservoir	5000	MODERATE
Upper Duncan Creek	5930	HIGH
Upper Silver Creek	5300	MODERATE
West Fork Silver Creek	5060	MODERATE

Summary of Subwatershed Sensitivity

The following table is a synopsis of the overall subwatershed sensitivity for the subwatersheds within the analysis area.

Table 3.131 Overall Subwatershed Sensitivity

SUBWATERSHED	INDEX
Benny Creek	MODERATE
East Duncan Creek	MODERATE
Lower Duncan Creek	HIGH
Middle Silver Creek	MODERATE
Thompson Reservoir	MODERATE
Upper Duncan Creek	MODERATE
Upper Silver Creek	HIGH
West Fork Silver Creek	HIGH

The conditions of each subwatershed begins with the current condition and does not use this current condition as the baseline or desired condition of the subwatershed (Beschta et al., 1995). The desired conditions are taken from ICBEMP (1997), USFWS (1998), Clean Water Act guidance and historic ranges of canopy variability.

Cumulative Watershed Effects – Analysis Methods

The elements that are considered in the cumulative watershed effects analysis are roads, soils, canopy, riparian vegetation, channel, pools, large wood, temperature, sediment, and fish passage. Each of these elements is assigned a functionality rating. These elements are combined with the overall condition of the uplands, riparian area, and stream channels.

Cumulative Watershed Effects – Roads

Roads account for most of the sediment problems in a watershed because they are a link between sediment source areas (skid trails, landings, and cutslopes, etc.) and stream channels. They directly affect the channel morphology of streams by accelerating erosion and sediment delivery and by increasing the magnitude of peak flow (Furniss et al., 1991). A study of eroded material travel distances below fill slopes shows that more than 95 percent of relief culverts can be prevented from contributing sediment to streams if the travel distance is 300 feet or more. Roads with broad-based dips have nearly 100 percent of the contributing eroded material stopped within a travel distance of 100 feet (Burroughs and King 1989). As a result, INFISH (1995) recommends buffer strips of 300 feet between riparian areas and roads. In addition, maintaining a buffer between the road and stream channel provides a filter that minimizes the introduction of fine sediment into the stream channel. Road density (both open road density and closed road density), road impact index, the number of road crossings, roads within riparian areas, and the drainage network efficiency will all be used to determine the impact of roads at the subwatershed level.

Road densities vary widely within the project area by land ownership and within each subwatershed. Rosgen (1991) developed a Road Impact Index (RII), which is a qualitative indicator of sediment delivery risk. The RII will be used on a subwatershed basis and is calculated using the following formula: Road Impact Index = (miles of road within the subwatershed/area of the subwatershed in square miles) * the number of stream crossings. This method is based on the following assumptions: 1) higher road density allow for a higher potential of an increase in sediment yield due to the larger acreage of exposed surfaces and 2) the more drainage ways that are crossed the higher the probability that direct sediment introduction will occur. The number of roads within riparian areas, as defined by the Inland Native Fish Strategy (INFISH, 1995), will be presented for perennial fish bearing streams and intermittent streams. Also, the number of roads within 300 feet of any perennial or intermittent streams will be reported. INFISH (1995) recommends strips of 300 feet between riparian areas and roads. This buffer between roads and streams provides a filter that minimizes the introduction of fine sediment into the stream channel.

Drainage network efficiency will be calculated based on Wemple (1994). Generally speaking, an undisturbed watershed should move water through the system slowly. Therefore, a significant increase in drainage network efficiency signals a point of concern for watershed health. Wemple (1994) concluded that roads extend the stream network by as much as 40 percent during storm events by altering timing of water delivery to stream. An estimate of the percent increase in drainage network efficiency for each subwatershed will be calculated based on the 40 percent figure. Closed roads are considered to contribute to the overall drainage efficiency and are therefore included.

To reduce the adverse effects of roads on aquatic resources, road miles should be decreased through closure and decommissioning in subwatersheds with high road densities. The functionality rating of roads within each subwatershed will be based on the following list but adjustments will be made when considering road impact index, stream crossings, the number of roads within riparian areas, and drainage efficiency.

Functioning Appropriately – Subwatershed road density less than 1.0 mi/mi^2 and no valley bottom roads

Functioning at Risk – Subwatershed road density of 1.0 – 2.4 mi/mi^2 and some valley bottom roads

Functioning at unacceptable risk – Subwatershed road density greater than 2.4 mi/mi^2 and many valley bottom roads

Cumulative Watershed Effects – Canopy

Leaf area index indicates the amount of snow interception and shade generated from that canopy, both of which affect the amount and timing of runoff. Canopy cover is used as a surrogate for leaf area index because of available remote sensing tools. The canopy information was developed from the ISAT information available and then modified to reflect the current vegetation condition as a result of the fires. The assumption is made that forested stands, which are above or below the historic range of variability (HRV) may affect timing of runoff, amount of runoff and total yield of runoff from the

subwatershed. It is further assumed that forested stands that are within the historic range of variability for canopy do not contribute to cumulative effects. Canopies outside of the historic range of variability, increased canopy densities indicate a build up of understory trees. This build up heightens the risk of catastrophic fire, causes conifers to become stressed and susceptible to insects and disease and may also cause a reduction of water available for stream flow during summer months. The historic structural stages and ranges of canopy cover for the primary forest ecosystems on the Fremont National Forest are understood to be 26-40 percent for Ponderosa Pine and 25-55 percent for Lodgepole Pine and White Fir. The type of forest ecosystem was derived from the eco-class layer in GIS and the mortality expected from the fire. The percent of the forested acres of each eco-class that is above and below HRV was calculated and combined to determine the percent above and below HRV for each subwatershed.

Functioning Appropriately – Less than 20 percent of subwatershed above or below HRV

Functioning at Risk – 20-40 percent of subwatershed above or below HRV

Functioning Unacceptable Risk – 40-60 percent of subwatershed above or below HRV

The utility of this analysis allows one to better understand HRV after the fires of 2002. However, the action analyzed for this project is the removal of dead and dying trees (with the exception of noncommercial thinning) and will not affect the HRV of the stands as analyzed here.

Cumulative Watershed Effects – Soils

Soil condition was characterized through a field assessment of soil compaction. Soil compaction commonly occurs in high use areas such as roads, skid trails, and landings. The Fremont National Forest Soil Productivity Guide (SPG) addresses methods to plan and operate timber sales in order to minimize detrimental soil impacts. The goals states within the SPG are:

- For initial entries, Districts should plan for and design new activities that do not exceed detrimental soil conditions on more than 20 percent of a project area (includes the permanent and temporary transportation system, landings, and post sale activities.)
- In areas where less than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity (includes the permanent transportation system and post sale activities) following project implementation and restoration must not exceed 20 percent.
- In areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and the goal is to move toward a net improvement in soil quality and to achieve less than 20 percent detrimental soil conditions in the long term.

An inventory of the soil compaction on National Forest System lands was completed after the fires took place. The analysis area was divided into capability areas. Capability areas are groups of soil map units that have similar potential for erosion, compaction, displacement, and mass movement. Transects to determine soil compaction within the fire boundary were located within the primary capability areas in areas where salvage units were originally planned and inventoried in the field (91 transects were completed for the fire area and 89 transects within the planning area). The results from the field inventory were recorded and analyzed. For more details see Geology, Geomorphology and Soils section.

The area of each subwatershed outside of the fire boundary was not tested for compaction. General characteristics of the soils potential for erosion, compaction, displacement, and mass wasting within the subwatershed will be reported. The potential for soil erosion is based on expected soil losses by rill and gully erosion when all vegetation cover is removed. The potential for compaction refers to the relative ease with which the soil can be compacted when wet or moist. Compaction is used here as the point at which the soil macroscopic pore space is reduced by one-half or more or when the bulk density is increased by twenty percent, or more, above the natural state. The displacement potential rates the ease with which the soil can be loosened or moved. Displacement can be done by hoof, foot, vehicular or log traffic.

In order determine the functionality of each subwatershed with respect to soil condition the following rating system was used.

Functioning Appropriately – Less than 20 percent of subwatershed with detrimental soil compaction

Functioning at Risk – Greater than 20 percent of subwatershed with detrimental soil compaction

Cumulative Watershed Effects – Riparian Vegetation

Riparian areas occupy a small percentage of the area, but are an extremely vital component of the landscape, especially in arid eastern Oregon (Elmore and Beschta 1987). Riparian vegetation found in these areas buffers the fluvial system from potential impacts and disturbances caused by land management activities and natural events. Found in riparian areas within the area are a variety of sedges (*Carex* spp.), shrubs such as thinleaf alder (*Alnus incana*) and willow (*Salix* spp.), and deciduous trees such as aspen (*Populus tremuloides*) and black cottonwood (*Populus trichocarpa*). The stems of these plants provide roughness to dissipate floodwater energy and act as sediment filter. The strong root systems of these plants also provide resistance to a stream's erosive power. By collecting sediment and stabilizing stream banks, riparian plant species act to maintain the integrity of riparian areas and elevate or maintain water tables.

The condition of the riparian vegetation can have a pronounced impact on stream stability. The condition of riparian vegetation can be completed through the use of riparian scorecards. However, the implementation of the use of riparian score cards for the area is not yet completed. Bank stability is often used as surrogate to determine proper function of riparian vegetation when detailed information regarding riparian vegetation is not available. Streambank was inventoried as unstable if it lacked vegetation above the bankfull width stage. The total length of unstable bank (on either side of the stream) was totaled for a stream segment and divided by twice the length of the stream segment.

The information for the riparian vegetation and streambank stability was generated from a watershed analysis inventory completed in 2000 and Ochoco Bottomline surveys for intermittent streams completed after the fires in the fall of 2002. The riparian vegetation was inventoried as the three dominant riparian vegetation species found within the flood prone width. The dominance of late-seral species, like willow, dogwood, sedge, and grass, promotes high bank stability values.

The effects analysis will consider how the alternatives affect riparian vegetation and stream bank stability and how those changes could affect interior redband trout production, growth, recruitment, and survival.

Functioning Appropriately – Streambank stability greater than 90 percent

Functioning at Risk – Streambank stability between 80 percent-90 percent

Functioning at Unacceptable Risk – Streambank stability less than 80 percent

The effects analysis will consider how the alternatives affect riparian vegetation and stream bank stability and how those changes could affect interior redband trout production, growth, recruitment, and survival.

Cumulative Watershed Effects – Channel Condition Rating

Channel condition integrates past climatic, physiographic and management influences and is an essential indicator of overall subwatershed condition. Concerns have been raised regarding the effects of domestic grazing on channel condition and subsequently subwatershed condition. Intense, uncontrolled grazing can affect hydrologic function of an area through decreased infiltration, increased surface erosion and direct effects on streambank stability. The greatest effects occur when grazing within riparian areas creates trampled, bare conditions. Uncontrolled domestic livestock has a natural tendency to concentrate in riparian areas, thereby increasing the potential for damage to these sensitive sites. Since there is a lesser chance of significant damage to upslope areas than there is to the riparian areas, it is assumed that the effects of grazing will be integrated into the channel condition index.

The information for the channel condition was generated from a watershed analysis inventory completed in 2000 with additional data was collected after the fires burned. The additional data was focused on the amount of large wood per mile and the amount of shade along the creek. Ochoco Bottomline surveys for intermittent streams completed after the fires in the fall of 2002.

The key instream habitat features that will be analyzed for stream channel for this project are pool frequency, large wood frequency, water temperature, sediment, fish passage, and channel morphology. Data for every instream habitat features is not available on all streams.

Pool Frequency

Pools are considered one of the most important fish habitat features, and for most fish, pools are the preferred habitat type (Beschta and Platts 1986). Reeves et al. (1991) describes some of the reasons why trout use this habitat type: pools offer low velocity refuges, cooler stream temperatures during the summer months, and overwintering habitat. Streams that lack large, deep pools have been documented to freeze during the winter months on the Fremont National Forest (Fremont National Forest, Unpublished Data). Decker and Erman (1992) found that rainbow trout numbers were more abundant with

an increase in pool habitat. An increase in pool numbers and complexity produces conditions for increased fish numbers and biomass (Fausch and Northcote 1992). Pool frequency is typically reported as pools per mile and is a key feature in the determination of channel condition. The number of pools is evaluated against the weighted average of the 50th and 75th percentiles for natural and near natural streams in the northern Great Basin, Blue Mountains, and Central Idaho Mountains (USDA & USDI 1997). The natural or near natural frequency are determined using the table below, and the formula: desired numbers per mile = table value x 5280/average riffle width in feet. For example, a stream 10 feet wide with a slope of <2 percent would be expected to have 51 pools/mile of at the 75th percentile.

Table 3.132 Natural or Near Natural Frequency of Pools in Northern Great Basin Stream*

Slope Class	Pools/Mile	
	50th Percentile	75th Percentile
All	0.046	0.083
<2%	0.056	0.096
2-4%	0.060	0.101
>4%	0.030	0.058

*Also, includes data from Blue Mountain and Central Idaho Mountain Streams

Example:
0.096 x 5280/10 = 51 pools per mile

Table 3.133 Natural or Near Natural Frequency for Large Pools in Northern Great Basin Streams

Slope Class	Pools/Mile	
	50th Percentile	75th Percentile
All	0.000	0.003
<2%	0.000	0.005
2-4%	0.001	0.004
>4%	0.000	0.000

Large Pools are Pools that are greater than 2.6 feet deep

Functioning Appropriately – Pool numbers are greater than 75th percentile

Functioning at Risk – Pool numbers are greater than 50th and less than 75th percentile

Functioning at Unacceptable Risk – Pool numbers are less than 50th percentile

The effects analysis will consider how the alternatives affect pool frequency and large pools and how changes in those types of hiding and rearing cover alter the growth and survival of redband trout.

Large Wood Frequency

Large woody debris in streams is an important roughness element influencing channel morphology, sediment distribution, and water routing (Swanson and Lienkaemper 1978, Bisson et al. 1987). Large wood forms a step gradient, a stair-step effect along the channel. As a result, stream velocity is reduced (Zimmerman et al. 1967). Wood also serves as an important agent in pool formation. Large wood frequency is typically reported as pieces of wood per mile and is another key feature in the determination of channel condition. For this analysis, large wood is defined as being 20 inches in diameter on the small end and greater than 35 feet long in ponderosa and mixed conifer sites. The large wood must be within bankfull stage and can be live or dead.

Large woody debris is evaluated against the 50th and 75th percentiles for natural and near natural streams in the Northern Great Basin (USDA & USDI 1997). The natural or near natural frequency are determined using the table below, and the formula: desired numbers per mile = table value x 5280/average riffle width in feet. For example, a stream 10 feet wide with a slope of 2-4 percent would be expected to have 11 pieces of LWD/mile at the 50th percentile.

Table 3.134 Natural or Near Natural Frequency of LWD in Northern Great Basin Streams

Slope Class	Large Woody Debris/Mile	
	50th Percentile	75th Percentile
All	0.019	0.062
<2%	0.006	0.025
2-4%	0.020	0.085
>4%	0.020	0.067

Example:
0.020 x 5280/10 = 11 pieces per mile

Functioning Appropriately – Large wood numbers are greater than 75th percentile

Functioning at Risk – Large wood numbers are greater than 50th and less than 75th percentile

Functioning at Unacceptable Risk – Large wood numbers are less than 50th percentile

The effects analysis will consider how the alternatives affect large woody debris recruitment, undercut banks, and large pools, and how changes in those types of hiding and rearing cover alter the growth and survival of redband trout.

Temperature

Stream temperature is an important factor regulating aquatic life. Fish are cold blooded, and thus, assume the temperature of the water in which they live. For this reason, a fish's metabolism, and consequently their growth and development, are directly controlled by their thermal environment (Brown 1983). Therefore, the growth and survival of fish can be greatly affected by temperature extremes (Beschta et al. 1987). Because stream temperature affects fish habitat, the Oregon Department of Environmental Quality (DEQ) has established a state water quality temperature criteria (seven-consecutive average daily maximum temperature) to be at or below 17.8°C (64°F) with fish being the primary benefiting resource. Generally, water temperatures in excess of 21°C (70°F) are unfavorable and may cause stress to all age classes (Sigler and Sigler 1991). However, Behnke (1992) states that redband trout possess a hereditary basis to persist at higher water temperatures than other species of trout. Further, Sonski (1985) noted that redband trout raised in a hatchery increased growth until 24°C (75°F) and recommended temperatures ranging from 18.3 to 23.8°C (65 to 75°F) to keep broodstock in good condition. Behnke (1992) has captured (fly fishing) live redband in streams with temperatures of 28.3°C (82.9°F). Water temperatures exceeding 29.4°C (84.9°F) can be fatal to rainbow trout (Bjornn and Reiser 1991). Recent studies in southeast Oregon streams (Little Blitzen River and Bridge Creek in the Blitzen River Basin, and North Fork Twelvemile Creek in the Warner Basin) found that redband trout prefer water temperatures of 12.8°C (55°F). At this temperature, metabolic power and swimming ability were some of the highest reported for wild fish (Rodnick et al. in press). Stream shade and proper width-to-depth ratios are the key factors influencing water temperatures within streams of south central Oregon.

Functioning Appropriately – Seven-day average maximum stream temperature are less than 17.8°C

Functioning at Risk–Seven-day average maximum stream temperature are between 17.8°C and 24°C

Functioning at Unacceptable Risk – Seven-day average maximum stream temperature are greater than 24.0°C

The effects analysis will consider how the alternatives affect water temperature levels and how those changes could affect redband trout production, growth, recruitment, and survival.

Fine Sediment

Willers (1991) found that mortality increases as spawning gravel size decreases because fine sediment impedes the flow of oxygenated water over the eggs or can trap the alevins in the gravel. Likewise, other studies show an inverse relationship between fine sediment and reproductive success (Everest et al. 1987). The reference level of fines for a particular geologic type has not been identified; however, analysis shows that a level of less than 30 percent fines is generally attainable in the top four inches of spawning substrate throughout the Fremont National Forest. The data also shows a high correlation to road density and the presence of valley bottom roads.

Sediment can influence fish populations in several ways and can be directly linked to individual fish species and life stages. Two measurements of sediment levels that put particular emphasis on fisheries concerns are: 1) percent surface fines and 2) percent fines in spawning substrate. Fines are considered particles that are less than 6.4 mm along the intermediate axis (not the longest axis nor the shortest axis). Surface fines are determined with a Wolman pebble count, a systematic sampling of surface particle sizes. A bulk sample of pool tails and low gradient riffles is used to measure percent fines in

spawning substrate. The bulk sample is acquired through the insertion of a cylinder into the streambed and extracting the gravel from the cylinder. The samples are then dried and passed through a series of nested sieves to determine the percent of fines less than 6.4 mm.

Functioning Appropriately – Less than 20 percent fines for Rosgen stream types C and E, less than 25 percent fines for Rosgen stream types A and B

Functioning at Risk – 20 percent-30 percent fines for Rosgen stream types C and E, 25 percent-30 percent fines for Rosgen stream types A and B

Functioning at Unacceptable Risk – Greater than 30 percent fines for all stream types

Background erosion is 0.01 to 0.05 ton/acre. Post fire erosion is 0.09 ton/acre overall in Toolbox. Post fire erosion in the Silver fire area is 0.06 ton/acre overall yet select areas have anticipated erosion rates of 1.72 ton/acre.

The effects analysis will consider how the alternatives change sediment levels in spawning and rearing habitats and how those changes could affect redband trout production, growth, recruitment, and survival.

Fish Passage

Fish move up and down streams for a variety of reason, including refuge into smaller streams after a flood or precipitation event, spawning migration and to seek more suitable habitat as a result of competition or unfavorable stream temperatures. Radio telemetry studies conducted in 2000 and 2001 on the Fremont National forest indicate redband trout move a considerable amount during spring spawning and also during late summer as stream temperatures increase and flow decreases. Radio telemetry studies in the spring of 2000 and 2001 in the Chewaucan Basin, located south of the analysis area, quantified movement of several adult spawning redband trout. Average round trip, upstream and downstream, distances traveled by redband trout after tagging was 66 and 40 river kilometers in 2000 and 2001, respectively. The maximum upstream distance traveled by one fish in 2001 was 23 river kilometers while 44 percent of the radio-tagged fish moved upstream less than six river kilometers (Tenniswood 2001, p. 16 and Appendix B).

As fish move through a system they are faced with challenges to their movement at road crossings. Culverts, the typical road crossing structure on forested land, historically were designed with the efficient movement of water in mind. To facilitate efficient movement of water, the culverts were placed at steeper slopes than the stream, were smaller in diameter than the typical stream cross-section, and introduce less friction to the flowing water than the stream. The combination of these factors leads to the culvert being a barrier to fish movement through the system.

A culvert inventory was done on 399 culverts on the Fremont National Forest during 2000-2002. The inventory measured the characteristics of the culverts that influenced fish passage. Criteria were placed on several characteristics to determine if fish could pass through the culvert. It was determined that fish could either pass through the culvert (green), that further information was necessary to determine fish passage status (gray), or fish passage was impeded by the culvert (red). The inventory found that nearly 89 percent of the culverts inventoried impeded movement to fish.

The location of the culvert within the subwatershed is critical when considering the importance or effect of the passage blockage. The following functionality criteria consider both if a road crossing is an impediment to fish passage and also where the road crossing is located. Roads that cross perennial streams are a higher priority than those on intermittent streams.

Functioning Appropriately – All inventoried culverts on perennial or intermittent streams in the subwatershed are category green.

Functioning at Risk – Some inventoried culverts on a perennial or intermittent stream in the mid to upper stream reaches in the subwatershed are category red. All inventoried culverts on perennial streams are located low in the subwatershed are category green.

Functioning at Unacceptable Risk – Any inventoried culvert on a perennial stream in the lower reaches of the subwatershed is red.

Rosgen channel type

The effects analysis will consider how the alternatives affect Rosgen Channel types and how those changes could affect interior redband trout production, growth, recruitment, and survival. The Rosgen Classification system was selected because it aids in describing the natural potential of each stream, based on numerous measurements, such as entrenchment,

bankfull width-to-depth ratio, sinuosity, gradient, and dominant channel substrate (Rosgen 1996). *Entrenchment* is the vertical containment of the stream channel and refers to the ability of a stream to access its floodplain. The stream is entrenched when floodwaters are confined to the channel and is not entrenched when floodwaters are able to access the floodplain. *Bankfull width-to-depth ratio* indicates the shape of the channel, and is the ratio of bankfull width to mean bankfull depth. Bankfull stage is the point at which the stream accesses its floodplain and is a required measurement in order to determine width-to-depth ratios. It is synonymous to the flood stage, with an average return interval of 1.5 years (Leopold 1964), and is considered the channel forming flow. Width-to-depth ratios indicate whether the stream is wide and shallow or narrow and deep. *Sinuosity* refers to the extent with which a stream meanders across the landscape. Highly sinuous streams have many meanders and curves, while streams with low sinuosity are straighter with few meanders and curves. Gradient is the slope or steepness of the stream while the *dominant channel substrate* refers to the size of particle or rock that covers the stream channel.

Cumulative Watershed Effects by Subwatershed

Benny Creek

Existing Condition

Sensitivity

Benny Creek 6th field watershed (subwatershed) (HUC 171200050204) is approximately 42 square miles and is part of the Silver Creek 5th field watershed. There are no perennial streams within the subwatershed but there are several intermittent streams. The primary intermittent streams that are located within Benny Creek subwatershed are Graham Creek, Benny Creek and Hawk Creek. Graham Creek is approximately 3.2 miles long and located on the far south and eastern portion of the subwatershed. Benny Creek is approximately 16.4 miles long and extends from Winter Rim to Thompson Reservoir. Hawk Creek is approximately 4.4 miles long and located in the northern portion of the subwatershed.

Hydrologic soil group C, which is characterized by slow rates of infiltration and water transmission, characterizes nineteen percent of the subwatershed. Hydrologic soil group D, which is characterized by very slow rates of infiltration and water transmission, characterizes sixteen percent of the subwatershed. Thirty-five percent of the subwatershed area is characterized by hydrologic soil group C and D. The total index percent of hydrologic group C and D was rated as **moderate** sensitivity for this subwatershed. The subwatershed is dominated by very stable mass wasting characteristics with 86 percent of the subwatershed being rated as very stable. Six percent of the area is at some risk for rotational slumps. The sensitivity index for mass wasting was **low** for this subwatershed. All subwatersheds receive limited amounts of precipitation on average, which yields a less sensitive watershed on the whole. A rain-on-snow event is of particular concern any area with substantial snow pack. Benny Creek is located high in the system and on average holds snow in the upper elevations well into the spring. According to the estimated rain-on-snow range for the Silver Creek 5th field watershed of 4500-6000 feet, approximately 60 percent of the subwatershed is within this range. The sensitivity index for this element was rated as **moderate**.

Benny Creek has a low drainage density of 1.18 mi/mi^2, which is well below the low class of 3 to 4 mi/mi^2 (Strahler, 1964). In comparison to the other subwatersheds in the analysis area Benny Creek was rated as **moderate**. Subwatershed relief for Benny Creek is the lowest value of the eight subwatersheds being analyzed and was rated as **low** sensitivity. Over approximately 12.5 miles, an elevation of 2179 feet is lost for a resultant subwatershed relief ratio of 0.03 ft/ft. The centroid elevation of Benny Creek is 5789 feet which is the third highest in the analysis area and rated **high** for the sensitivity index. A higher centroid elevation value tends toward a more sensitive subwatershed.

Overall, Benny Creek has limited precipitation, no perennial streams, moderate sensitivity for streamflow generation areas, low sensitivity for mass wasting, and moderate sensitivity for rain-on-snow potential. The channel information ranges from low to high for the three elements considered. This information leads one to conclude that Benny Creek subwatershed has **moderate** sensitivity when compared to the other subwatersheds within the analysis area.

Functionality

Benny Creek is dominated by low-severity burn. Approximately 48 percent of the subwatershed burned, with 0.2 percent, 8.8 percent and 38.9 percent of the subwatershed burned at high, moderate and low-severity, respectively.

The roads, canopy and soils within the subwatershed will be used to characterize the uplands of Benny Creek. According to the transportation layer in Geographical Information Systems (GIS) there are 137 miles of road within Benny Creek subwatershed equating to an open road density of 3.27 mi/mi^2, which places the subwatershed **functioning at**

unacceptable risk. The Riparian Habitat Conservation Area (RHCA) for an intermittent stream is 50 feet on each side of the stream. Of the 137 miles of road approximately 2.0 miles are located within the RHCA for intermittent streams. There are 14.56 miles or 13 percent are located within 300 feet of intermittent streams. Roads cross channels at 49 locations, sites where direct sediment introduction occurs. The road impact index (RII) was calculated to be 0.54. Along with the 49 miles of stream channels, an estimated 82 of the 137 miles of road are hydrologically integrated with the stream network, thus increasing the drainage network by 167 percent—using study results from Wemple (1994).

The capability areas within Benny Creek were rated as having 64 percent of the area as low potential for erosion, 96 percent of the area as high potential for compaction, 98 percent of the area as low potential for displacement, and 99 percent as low potential for mass movement. Transects used to measure compaction were measured after the fire took place and were only measured on Forest Service land within the fire perimeter. Benny Creek was rated as having 87 percent and 13 percent of the subwatershed within the fire perimeter as low and moderate compaction, respectively. No transect within Benny Creek was found to have high compaction and therefore is rated as **functioning appropriately**.

The canopy analysis showed that approximately 73 percent, 33 percent and 74 percent of Lodgepole Pine, Ponderosa Pine and White Fir, respectively, were within the historic range of variability. The Ponderosa Pine stands have over 50 percent of the stands below HRV. Overall, the subwatershed has 43 percent below HRV and 12 percent above HRV and places the subwatershed at **functioning at unacceptable risk**.

Riparian vegetation and bank stability information for the Benny Creek subwatershed was generated from Ochoco Bottomline surveys for intermittent streams in fall of 2002. The streambank stability values will be used as a surrogate for the riparian vegetation rating. Inventories were completes on the main stem of Benny Creek, Graham Creek, and Hawk Creek. Benny Creek was broken into 6 reaches. All reaches except for one has recorded bank stability greater than 90 percent or functioning appropriately. The first reach was inventoried as having bank stability of 82 percent or functioning at risk. The average over all of the reaches is 91 percent stability. Both inventoried reaches of Graham Creek and the inventoried reach of Hawk Creek have bank stability values of greater than 97 percent or **functioning appropriately**.

Channel condition will be characterized and rated for functionality with respect to pool frequency, large wood frequency, temperature, fine sediment and fish passage. The pool frequency and large wood frequency is greater than the 75th percentile in all surveyed reaches of Benny Creek, Graham Creek, and Hawk Creek except for reach 2 of Hawk Creek. The current amount of large wood is between the 50th and 75th percentile in reach 2 of Hawk Creek. Overall, the rating for pools and large wood per mile is **functioning appropriately**. No known measures of sediment were made for any of the intermittent streams within the Benny Creek subwatershed. No temperature data is known to be available for any streams within this subwatershed. There were three inventoried culverts on intermittent streams within the subwatershed. Two, one at Benny Creek and the other at Graham Creek, were located within the fire boundary. The two located outside of the fire perimeter are on Benny Creek. All of culverts were found to impede the passage of fish but all culverts are on intermittent streams and therefore rated as **functioning at risk**.

Table 3.135 Benny Creek Subwatershed Channel Condition

REACH	ROSGEN	POOLS PER MILE			LARGE WOOD PER MILE			SUBSTRATE		REACH LENGTH (mi)
	TYPE	50th	75th	Total	50th	75th	Total	DOM	SUB.	
BENNY CREEK										
1	F/C	6	9	85	4	18	12	SAND	COBBLE	1.3
2	B	6	9	71	4	18	74	COBBLE	BOULDER	2.3
4	C/B	6	11	52	1	5	36	COBBLE	COBBLE	1.7
6	B/C	6	9	12	4	18	47	COBBLE	COBBLE	0.3
8	C	6	9	30	4	18	121	GRAVEL	COBBLE	0.1
10	G/C	6	9	28	4	18	84	COBBLE	BOULDER	0.6
GRAHAM CREEK										
1	C	8	13	103	6	24	46	COBBLE	GRAVEL	2.4
2	C	13	20	42	9	38	13	COBBLE	GRAVEL	1.9
HAWK CREEK										
1	B	12	17	58	8	34	43	COBBLE	GRAVEL	1.5

The current condition of Benny Creek, with the functionality ratings for each element considered under Cumulative Watershed Effects is shown in the summary table under "Environmental Consequences – Cumulative Watershed Effects". Generally, Benny Creek was rated as having moderate subwatershed sensitivity when compared to the other subwatersheds analyzed. It was rated as high sensitivity with respect to centroid elevation. Roads and canopy were rated as functioning at risk. Soil condition, bank stability, pool frequency and large wood frequency were rated as functioning appropriately. Fish passage was rated as functioning at risk. Temperature and sediment information was not available.

Past Activities (see also Appendix A)

- Fuels reduction: Under-burning: 1990-1994: 1360 acres, 1995-1999: 1850 acres, 2000-2002: 950 acres. Pile burning: 1990-1994: 70 piles, 2000-2002: 60 piles. *Underburning is typically at low severity and had little impact on the subwatershed.*
- Silvicultural activities within the subwatershed have included timber stand improvement or the thinning of sub-merchantable trees and merchantable harvest of timber. Timber stand improvement within this subwatershed occurred on 1,668 acres. Timber harvest activities on forest service land have focused on modifying structure and composition of stand while generating merchantable products. This subwatershed has seen 3,244 acres of harvest varying from intermediate, regeneration of both even aged and uneven aged, and salvage harvest. *Past timber harvest activities have been the main reason for high road densities within the subwatershed and the problems associated with high road densities. Timber harvest can also caused compaction and other detrimental soil conditions, expose areas to increased surface erosion, and may modify streamflow regimes. General watershed effects of timber removal on watersheds are well documented (Meehan, 1991, Troendle and Leaf, 1981) though no specific studies have been completed on the Fremont National Forest .*
- Personal use firewood: Approximately 300 personal use firewood permits sold at district with 2.5 percent occurring in this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.* [Also a present and future activity]
- Grazing has occurred in the Winter Rim pasture on the subwatershed as early as 1966 with sheep then transitioned to cattle in 1981. Numbers of animals have drastically reduced from 1500-2500 in 1966 to 300 cattle in 1981 to a 2 pasture rotation with 282 cattle to early season use with 660 cattle to currently 282 cattle on a 2 pasture rotation. Thompson Valley Allotment was through the summer months of 1946-1955 by 220 cattle. Foster Butter Allotment was used in 1966 by 1602 cattle on a rest rotation, 1980-1992 by 6807 AUMS on rest rotation by pasture and 1993-2002 by 6297 AUMS early season. *Clearly the use in the past has been heavy, but current management of livestock has limited their impacts on the subwatershed.*
- Powerline and communications facilities consist of 3.5 miles of 500 KV BPA/PGE/PPL powerline. *No known problems with these facilities exist with respect to soil and water.* [Also a present and future activity]
- National Recreation Trail (NRT), dispersed recreational sites and Fremont Point Cabin. Activities associated with the trail and recreational areas at isolated or concentrated locations near streams may cause limited resource damage in the form of compaction or trampling. *Heavy use near cabin by trampling and parking may have caused compaction of isolated areas.*
- Route marking on existing roads for Pole Butte Snowpark and Trail system. *Little to no problems associated with this activity exist with respect to soil and water.*
- Four water impoundments. *Concentrated use by vehicles, livestock and wildlife around pond may cause compaction problems and associated water ponding on the surface.* [Also a present and future activity]
- An estimated 3990 acres of timber were removed from private land within the subwatershed, which equates to 15 percent of the subwatershed in the fall of 2002. *The long 2003 rain and snow season extending from March into May provided soil moisture conditions for seedbed response and ground cover recovery. The removal of salvage timber directly after the fire occurred along with the response to the fire allowed for greater sedimentation directly after the fire occurred. However, the precipitation and the openings created by the salvage has allowed for good ground cover recovery on the private land and has therefore limited sedimentation transport opportunities.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Past fire activity shows there have been 106 fires since 1948, of which 97 percent of the acres burned were caused by lightning and the largest fire was 430 acres. *The intense fire suppression has resulted in more dense stands throughout the area and may help lead to more intense fires that would have historically occurred.*

- 2002 Fire Suppression. 31 miles of dozer line were constructed within the subwatershed and trees were fallen for safety or suppression objectives. *The additional compacted surface of dozer lines add to the road density and sedimentation problems associated with roads/trails. It is assumed that dozer lines were rehabilitated with waterbars and drainage according to BMPs and have reduced sediment production to background levels.*
- BAER projects. Drainage ditches were cleaned throughout subwatershed. *This activity facilitated proper movement of moisture off of roads.*
- Since 1970, numerous silvicultural activities have occurred on National Forest lands (See Appendix A, Table A-2). *The effect of this activity is reflected in the "Existing Condition" discussions of canopy, compaction and road densities at the start of this section.* This same past activity information applies to all eight subwatersheds.
- Industrial forest lands. Throughout the analysis area have logged extensively throughout the 20th century. By 2000, almost all stands were logged at least once. *The extensive use on private lands has increased ground disturbance and increased erosion.*
- Unclassified roads are roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR212.1). The number of unclassified roads was estimated within the project area through aerial photography and old maps. It was estimated that there are 0.93 mi/mi^2 using a sample of the analysis area. The unclassified roads are grown over through lack of use. They have not been properly closed or decommissioned, however and with the limited amount of precipitation in the area, the natural closure or decommissioning of the roads would be slow. *These roads are adding to an already high road density, they may be increasing drainage efficiency and decreasing infiltration on the subwatershed.* This same past activity information applies to all eight subwatersheds.

Toolbox Fire Recovery Project Activities (on a subwatershed basis)

Direct and indirect effects *on a project area basis* were discussed early in the Watershed section. This section concerns itself with how those direct and indirect effects apply to a cumulative effects finding, on a *subwatershed* basis.

Table 3.136 Benny Creek Direct and Indirect Effects

BENNY CREEK	ALT. A	ALT. C	ALT. D	ALT. E	ALT. G	ALT. H
TOTAL COMMERCIAL SALVAGE (acres)	0	1,960	658	1,437	1,960	1,809
GROUND BASED COMMERCIAL SALVAGE (acres)	0	1,945	644	1,437	1,945	1,809
AERIAL COMMERCIAL SALVAGE (acres)	0	15	15	0	15	0
PERCENT OF SUBWATERSHED AREA SALVAGE	0%	7%	2%	5%	7%	7%
TOTAL RHCA COMMERCIAL SALVAGE (acres)	0	87	15	75	88	15
RHCA 1 (acres)	0	0	0	0	0	0
RHCA 3 (acres)	0	38	13	33	38	13
RHCA 4 (acres)	0	49	2	42	49	2
TEMPORARY ROADS (miles)	0	3.7	0	2.5	3.7	3.7
RE-OPEN UNCLASSIFIED ROADS (miles)	0	2.7	0.65	2.05	2.71	1.93
PRESCRIBED FIRE (acres)	0	365	365	0	365	365
ROADS						
OPEN ROAD DENSITY (mi/mi^2)	3.27	2.93	2.93	3.08	3.08	2.93
CLOSE ROADS (mi)	0.0	9.7	9.7	6.5	3.2	9.7
DECOMMISSION RDS (mi)	0.0	4.9	4.9	1.5	4.9	4.9
OPEN ROADS (mi)	137.1	122.5	122.5	129.1	129.0	122.5
SEDIMENT SAVINGS FROM ROAD ACTIONS (tons/yr)	0.00	0.18	0.18	0.16	0.16	0.18
SEDIMENT LOSS FROM OPEN ROADS (tons/yr)	1.02	0.84	0.84	0.86	0.86	0.84
OPEN ROADS within 300 ft of STREAM (mi)	6.4	3.6	3.6	4.0	4.0	3.6
CLOSE ROADS within 300 ft of STREAM (mi)	0.0	2.0	2.0	1.7	1.6	2.0
DECOMISSION RDS within 300 ft of STREAM (mi)	0.0	0.8	0.8	0.66	0.8	0.8

Present and Future Activities (see also Appendix A)

- Foster Butter Allotment is expected to have a NEPA decision before 2004 grazing season. Current use is based on 2003 monitoring and NEPA decision. Winter Rim Allotment will have a NEPA decision before 2004 grazing season and use will be based on 2003 monitoring and NEPA decision. Recently burned areas compared to unburned areas produce more aboveground biomass (Tracy and McNaughton, 1996). This in concert with the active control of livestock in burned areas to keep cattle off of riparian area should be effective. *The NEPA analysis or Rangeland Health Assessments (BLM) will allow for thorough review of the grazing within this allotment.*
- Personal use firewood: In 2002, an estimated 981 cords were removed from this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Rebuilding of recreation cabin at Fremont Point. *The construction would have minor impacts on the subwatershed.*
- Two trail bridges would be relocated and several miles would be reconstructed. *There would be short-term effects from the trail construction and isolated areas of compaction as a result of the trail but these activities would have limited effect on the subwatershed.*
- 517 East Forest Recovery Project/Triad Restoration Project: These treatments include reintroduction of fire where fire historically played a role, commercial and pre-commercial thinnings, aspen enhancements, and large woody debris additions to Benny Creek. *Any sediment input to these streams because of this project is predicted to have an insignificant effect on redband trout because of the minimal quantities and low risk of entering fish habitat because of riparian buffers, mitigation measures, and Forest BMPs. This project would have beneficial affects on the subwatershed.*

Cumulative Watershed Effects

See also "Summary Table - Benny Creek Subwatershed Cumulative Watershed Effects" that follows discussion.

Alternative A

The number of roads that remain open under this alternative and the number of open roads within 300 feet of stream channels are of concern. No ground disturbing activity as a result of salvage harvest and fuels reduction would occur under this alternative. However, the number of miles of road would allow a chronic sediment source and allow for a maximum increase in the drainage network to continue. The calculation of sediment loss from roads equates to 0.08 pound of sediment per acre within this subwatershed. Under this alternative the road density is increased by 0.93 mi/mi^2 due to unclassified roads.

Action Alternatives

Approximately 48 percent of the subwatershed burned in 2002 and therefore the project is limited to only 48 percent of the subwatershed. The salvage harvest and associated fuels reduction accounts for activity on 7 percent of the subwatershed area in Alternative C, G and H and is moderate compared to other subwatersheds. Alternative D calls for 2 percent and is rated as minor. Alternative E calls for 5 percent and is rated as low. Overall, the minor amount of sediment associated with the harvest and the minimal amount of the subwatershed affected by the harvest should have minimal impact on the subwatershed. However, this subwatershed has all four units of concern when the sediment modeling was done. Units 130, 131, 133, and 134 all showed a higher probability of sediment production as a result of the harvest treatment. The four units are in all alternatives except for Alternative D where unit 130 is removed from salvage harvest. The risk associated with sediment on these units merits a site visit to check timely recovery after activities are complete. Monitoring of these sites to check timely recovery. The prescribed burn accounts for 1.4 percent of the subwatershed under all alternatives except Alternative E. However, several commercial salvage units are at coincident locations with the proposed prescribed burn locations. The temporary and unclassified roads would temporarily increase the miles of road by 4.5 percent for Alternatives C and G, by 4 percent for Alternative H, by 3.3 percent for Alternative E and by 0.5 percent for Alternative D. The increase in road miles would be short term and proper decommissioning of the roads would occur after the activity is complete. The unclassified road density would decrease from 0.93 mi/mi^2 to 0.64 mi/mi^2, 0.85 mi/mi^2, 0.71 mi/mi^2, 0.64 mi/mi^2 and 0.66 mi/mi^2. Sedimentation from salvage harvest is expected to be similar and minor for all action alternatives with Alternative D generating the least amount of sedimentation.

Approximately 10 miles of road would be closed and 5 miles of road would be decommissioned under Alternatives C, D and H. Under Alternative E 6.5 miles and 1.5 miles are closed and decommissioned, respectively. Alternative G closed 3.2 miles of road and decommissioned 4.9 miles of road. The reduction in road density is greater than 10 percent of the original road density for Alternative C, D and H. The closure and decommissioning of 2.8 miles of road within 300 feet of intermittent and perennial streams would be a primary improvement to the health of the subwatershed under Alternative C, D and H. The reduction in road density for Alternative E and G was 6 percent compared to the original road density. The sediment savings from road actions is generally the same in all alternatives as is the sediment loss from roads within this subwatershed. The road density would remain high for the subwatershed under all action alternatives. Alternatives C, D and H are the most aggressive with respect to road activity and would result in the most benefit of the action alternatives.

Temperature characteristics in the streams of the subwatershed are not expected to change as a result of any of the action alternatives.

Aspen enhancement would be implemented in Alternatives C, D, G and H. The enhancement of riparian vegetation, particularly where conifer encroachment occurs, has a positive effect on the subwatershed.

Road activities in the action alternatives are expected to restore or maintain the current functionality rating of the roads. Action alternatives under which large wood would be place in a stream in a particular subwatershed was rated as restoring that element as a result of the project.

Cumulative effects from the action alternatives are expected to be low in this subwatershed due to the recovery expected on private land salvage harvest, the effective rehabilitation of the suppression activities, monitoring and management of livestock use and allotment condition and monitoring of possible sediment source units. The action alternatives would reduce fuel loads and reduce road densities and their associated sedimentation to varying degrees.

Table 3.137 Summary Table - Benny Creek Subwatershed Cumulative Watershed Effects

	NAME - HUC								
WATERSHED	SILVER CREEK - 1712000502								
SUBWATERSHED	**BENNY CREEK** - 171200050204								
	LOW		MODERATE			HIGH			
SUBWATERSHED SENSITIVITY			X						
Characteristic(s) rated HIGH	Centroid elevation								
	CURRENT CONDITION - FUNCTIONALITY			**Alt A**	**Alt C**	**Alt D**	**Alt E**	**Alt G**	**Alt H**
ELEMENTS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK	RESTORE (**R**), MAINTAIN (**M**) or DEGRADE (**D**). Improvement as a result of the project? – **Yes** or **No**					
UPLANDS									
Roads			**X**	**D**	**R - Yes**	**R - Yes**	**M - Yes**	**M - Yes**	**R - Yes**
Canopy			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Soil	**X**			**M**	**M**	**M**	**M**	**M**	**M**
RIPARIAN VEGETATION / BANK STABILITY	**X**			**M**	**M**	**M**	**M**	**M**	**M**
CHANNEL CONDITIONS									
Pool frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Large wood frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Temperature	NOT AVAILABLE								
Fine sediment	NOT AVAILABLE								
Fish passage		**X**		**M**	**M**	**M**	**M**	**M**	**M**

East Duncan Creek

Existing Condition

Sensitivity

East Duncan Creek 6th field watershed (subwatershed) (HUC171200050302) is approximately 18 square miles and is part of the Silver Lake 5th field watershed. There are no perennial streams within the subwatershed but there are several intermittent streams. The subwatershed is dominated by East Duncan Creek, which is approximately 7 miles long and characterized by a series of steep canyons. The headwaters of East Duncan Creek begin at Winter Rim and flows down into Duncan Creek just north of the Forest Service boundary.

Hydrologic soil group C, which is characterized by slow rates of infiltration and water transmission, characterizes eight percent of the subwatershed. Hydrologic soil group D, which is characterized by very slow rates of infiltration and water transmission, characterizes eight percent of the subwatershed. Sixteen percent of the subwatershed area is characterized by hydrologic soil group C and D. The total index percent of hydrologic group C and D was rated as **low** for this subwatershed. The subwatershed is characterized by generally stable mass wasting characteristics with 50 percent of the subwatershed characterized as very stable and 50 percent was rated as not applicable for mass wasting. The sensitivity index for mass wasting was **high** for this subwatershed. All subwatersheds receive limited amounts of precipitation on average, which yields a less sensitive watershed on the whole. Approximately 45 percent of East Duncan Creek subwatershed is located within the rain-on-snow elevation range and the subwatershed was rated as **moderate**.

East Duncan Creek has very low drainage density of 0.64 mi/mi^2, which is well below the low class of 3 to 4 mi/mi^2 (Strahler 1964). In comparison to the other subwatersheds in the analysis area East Duncan Creek was rated as **low**. Subwatershed relief for East Duncan Creek is the very low amongst the eight subwatersheds being analyzed and was rated **low**. Over approximately 8.0 miles, an elevation of 1600 feet is lost for a resultant subwatershed relief ratio of 0.04 ft/ft. The centroid elevation of East Duncan Creek is 6131 feet, which is the highest in the analysis area and rated **high** for the sensitivity index. A higher centroid elevation value tends toward a more sensitive subwatershed.

Overall, East Duncan Creek has limited precipitation, no perennial streams, low sensitivity for streamflow generation areas, high sensitivity for mass wasting, and moderate sensitivity for rain-on-snow potential. The channel information rated as low for drainage density and subwatershed relief but high for centroid elevation. This information leads one to conclude that East Duncan Creek subwatershed has **moderate** sensitivity when compared to the other subwatersheds within the analysis area.

Functionality

East Duncan Creek is dominated by low-severity burn. Approximately 96 percent of the subwatershed burned with 0.3 percent, 12.9 percent and 83.1 percent of the subwatershed burned at high, moderate and low-severity, respectively.

The roads, canopy and soils within the subwatershed will be used to characterize the uplands of East Duncan Creek. According to the transportation layer in Geographical Information Systems (GIS) there are 76 miles of road within East Duncan Creek subwatershed equating to an open road density of 4.19 mi/mi^2, which places the subwatershed **functioning at unacceptable risk**. The Riparian Habitat Conservation Area (RHCA) for an intermittent stream is 50 feet on each side of the stream. Of the 137 miles of road approximately 1.2 miles are located within the RHCA for intermittent streams. There are 6.7 miles or 9 percent are located within 300 feet of intermittent streams. Roads cross channels at 15 locations, sites where direct sediment introduction occurs. The road impact index (RII) was calculated to be 0.21. Along with the 12 miles of stream channels, an estimated 46 of the 76 miles of road are hydrologically integrated with the stream network, thus increasing the drainage network by 395 percent—using study results from Wemple (1994).

The capability areas within East Duncan Creek were rated as having 70 percent of the area as low potential for erosion, 100 percent of the area as high potential for compaction, 99 percent of the area as low potential for displacement, and 100 percent as low potential for mass movement. Transects used to measure compaction were measured after the fire took place and were only measured on Forest Service land within the fire perimeter. East Duncan Creek was rated as having 39 percent and 61 percent of the inventoried subwatershed area as low and moderate compaction, respectively. No transect within East Duncan Creek was found to have high compaction therefore is rated as **functioning appropriately**.

The canopy analysis showed that approximately 55 percent, 39 percent and 19 percent of Lodgepole Pine, Ponderosa Pine and White Fir, respectively, were within the historic range of variability. Seventy-two percent of the White Fir acres are

above HRV while the other species show an equal mix between acres that are above and below HRV. Overall, 61 percent of the subwatershed is outside of HRV, which places the subwatershed at **functioning at unacceptable risk**.

Riparian vegetation and bank stability information for the East Duncan Creek subwatershed was generated from Ochoco Bottomline surveys for intermittent streams in fall of 2002. The streambank stability values will be used as a surrogate for the riparian vegetation rating. Inventories were completes on the main stem of East Duncan Creek and found no areas of bank instability. Therefore, the bank stability rating for East Duncan Creek is **functioning appropriately**.

Channel condition will be characterized and rated for functionality with respect to pool frequency, large wood frequency, temperature, fine sediment and fish passage. The pool frequency and large wood frequency is greater than the 75th percentile in all surveyed reaches of East Duncan Creek. The rating for pools and large wood per mile is **functioning appropriately**. No known measures of fine sediment were made for any of the intermittent streams within East Duncan Creek subwatershed. No temperature data is known to be available for any streams within this subwatershed. There were zero inventoried culverts within the subwatershed.

Table 3.138 East Duncan Creek Subwatershed Channel Condition

REACH	ROSGEN	POOLS PER MILE			LARGE WOOD PER MILE			SUBSTRATE		REACH
	TYPE	50th	75th	Total	50th	75th	Total	DOM	SUB.	LENGTH (mi)
EAST DUNCAN CREEK										
1	B	9	17	59	2	8	90	Gravel	Cobble	2.3

The current condition of East Duncan Creek, with the functionality ratings for each element considered under Cumulative Watershed Effects, is shown in the summary table under "Environmental Consequences – Cumulative Watershed Effects". Generally, East Duncan Creek was rated as having moderate subwatershed sensitivity when compared to the other subwatersheds analyzed. It was rated as high sensitivity with respect to centroid elevation and mass wasting. The roads category was rated as functioning at risk. Canopy, soil condition, bank stability, pool frequency, and large wood frequency were rated as functioning appropriately. Temperature, sediment and fish passage information was not available.

Past Activities

- Fuels reduction: Pile burning: 1990-1994: 30 piles, 2000-2002: 10 piles. Post harvest pile burning: 1995-1999: 360 acres. *Underburning and pile burning is typically at low severity and had little impact on the subwatershed.*
- Silvicultural activities within the subwatershed have included timber stand improvement or the thinning of sub-merchantable trees and merchantable harvest of timber. Timber stand improvement within this subwatershed occurred on 1,219 acres. Timber harvest activities on forest service land have focused on modifying structure and composition of stand while generating merchantable products. This subwatershed has seen 1,605 acres of harvest varying from intermediate, and regeneration of both even aged and uneven aged harvest. *Past timber harvest activities have been the main reason for high road densities within the subwatershed and the problems associated with high road densities. Timber harvest can also caused compaction and other detrimental soil conditions, expose areas to increased surface erosion, and may modify streamflow regimes. General watershed effects of timber removal on watersheds are well documented (Meehan, 1991; Troendle and Leaf, 1981) though no specific studies have been completed on the Fremont National Forest .*
- Personal use firewood: Approximately 300 personal use firewood permits sold at district with 2.5 percent occurring in this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Grazing has occurred in the Winter Rim pasture on the subwatershed as early as 1966 with sheep then transitioned to cattle in 1981. Numbers of animals have drastically reduced from 1500-2500 in 1966 to 300 cattle in 1981 to a 2 pasture rotation with 282 cattle to early season use with 660 cattle to currently 282 cattle on a 2 pasture rotation. *Clearly the use in the past has been heavy, but current management of livestock has limited their impacts on the subwatershed.*
- Powerline and communications facilities consist of 1 miles of 500 KV PPL powerline. *No known problems with these facilities exist with respect to soil and water.*
- Recreational trail and dispersed recreational sites. *Activities associated with the trail and recreational areas at isolated or concentrated locations near streams may cause limited resource damage in the form of compaction or trampling.*

- Route marking on existing roads for Pole Butte Snowpark and Trail system. *Little to no problems associated with this activity exist with respect to soil and water.*
- An estimated 4270 acres of timber were removed from private land within the subwatershed, which equates to 37 percent of the subwatershed in the fall of 2002. *The long 2003 rain and snow season extending from March into May provided soil moisture conditions for seedbed response and ground cover recovery. The removal of salvage timber directly after the fire occurred along with the response to the fire allowed for greater sedimentation directly after the fire occurred. However, the precipitation and the openings created by the salvage has allowed for good ground cover recovery on the private land and has therefore limited sediment transport opportunities.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Past fire activity shows there have been 45 fires since 1948, of which 77 percent of the acres burned were caused by lightning. *The intense fire suppression has resulted in more dense stands throughout the area and may help lead to more intense fires that would have historically occurred.*
- 2002 Fire Suppression. 9 miles of dozer line were constructed within the subwatershed and trees were fallen for safety or suppression objectives. *The additional compacted surface of dozer lines add to the road density and sedimentation problems associated with roads/trails. It is assumed that dozer lines were rehabilitated with waterbars and drainage according to BMPs and have reduced sediment production to background levels.*
- Ponderosa pine thinning. 4 acres in 2000. *The reduction of overstocking of ponderosa pine stands has a positive effect on the watershed.*
- Juniper thinning. 90 acres in 2000. *The thinning of this aggressive species that has well surpassed historic stocking has a positive effect on the subwatershed.*
- BAER projects. Drainage ditches were cleaned throughout subwatershed. *This activity facilitated proper movement of moisture off of roads.*
- Industrial forest lands. Throughout the analysis area have logged extensively throughout the 20th century. By 2000, almost all stands were logged at least once. *The extensive use on private lands has increased ground disturbance and increased erosion.*

Toolbox Fire Recovery Project Activities (on a subwatershed basis)

Direct and indirect effects *on a project area basis* were discussed early in the Watershed section. This section concerns itself with how those direct and indirect effects apply to a cumulative effects finding, on a *subwatershed* basis.

The elements discussed under direct and indirect effects as they pertain to the East Duncan Creek subwatershed are found below.

Table 3.139 East Duncan Creek Direct and Indirect Effects

EAST DUNCAN CREEK	ALT. A	ALT. C	ALT. D	ALT. E	ALT. G	ALT. H
TOTAL COMMERCIAL SALVAGE (acres)	0	1,284	598	1,021	1,284	1,228
GROUND BASED COMMERCIAL SALVAGE (acres)	0	1,273	598	1,021	1,273	1,228
AERIAL COMMERCIAL SALVAGE (acres)	0	11	0	0	11	0
PERCENT OF SUBWATERSHED AREA SALVAGE	0%	11%	5%	9%	11%	11%
TOTAL RHCA COMMERCIAL SALVAGE (acres)	0	45	22	39	45	22
RHCA 1 (acres)	0	0	0	0	0	0
RHCA 3 (acres)	0	42	21	37	42	21
RHCA 4 (acres)	0	3	1	2	3	1
TEMPORARY ROADS (miles)	0	1.42	0	1.42	1.42	1.42
RE-OPEN UNCLASSIFIED ROADS (miles)	0	0	0	0	0	0
PRESCRIBED FIRE (acres)	0	1,200	756	0	1,200	756
ROADS						
OPEN ROAD DENSITY (mi/mi^2)	4.19	2.90	2.90	3.36	3.36	2.93
CLOSE ROADS (mi)	0.0	8.3	8.3	14.0	0.0	9.7
DECOMMISSION ROADS (mi)	0.0	15.2	15.2	1.2	15.2	4.9
OPEN ROADS (mi)	76.0	52.5	52.5	60.8	60.8	52.5
SEDIMENT SAVINGS FROM ROAD ACTIONS (tons/yr)	0.00	0.04	0.04	0.03	0.03	0.04
SEDIMENT LOSS FROM OPEN ROADS (tons/yr)	0.39	0.35	0.35	0.36	0.36	0.35
OPEN ROADS within 300 ft of STREAM (mi)	1.9	0.3	0.3	0.3	0.3	0.3
CLOSE ROADS within 300 ft of STREAM (mi)	0.0	0.0	0.0	1.1	0.0	0.0
DECOMISSION ROADS within 300 ft of STREAM (mi)	0.0	1.6	1.6	0.5	1.6	1.6

Present and Future Activities

- Foster Butter Allotment is expected to have a NEPA decision before 2004 grazing season. Current use is based on 2003 monitoring and NEPA decision. Winter Rim Allotment will have a NEPA decision before 2004 grazing season and use will be based on 2003 monitoring and NEPA decision. Recently burned areas compared to unburned areas produce more aboveground biomass (Tracy and McNaughton, 1996). This in concert with the active control of livestock in burned areas to keep cattle off of riparian area should be effective. *The NEPA analysis or Rangeland Health Assessments (BLM) will allow for thorough review of the grazing within this allotment.*
- Personal use firewood: In 2002, an estimated 981 cords were removed from this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Approximately 0.5 miles of National Recreation Trail would be relocated and several miles would be reconstructed. *There would be short-term effects from the trail construction and isolated areas of compaction as a result of the trail but these activities would have limited effect on the subwatershed.*
- Windmill Restoration Project: This project proposes a variety of non-commercial treatments to restore the landscape to more historic conditions. These treatments include reintroduction of fire where fire historically played a role, pre-commercial thinnings, aspen enhancements, and large woody debris additions to East Duncan Creek. *Any sediment input to these streams because of this project is predicted to have no effect on redband trout because this species does not occur in these streams, which are intermittent. The subwatershed would benefit from these projects.*

Cumulative Watershed Effects

See also "Summary Table – East Duncan Creek Subwatershed Cumulative Watershed Effects" that follows discussion.

Alternative A

The number of roads that remain open under this alternative generates the highest road density of any subwatershed in the analysis area. No ground disturbing activity as a result of salvage harvest and fuels reduction would occur under this alternative. However, the number of miles of road would allow a chronic sediment source and allow for a maximum increase in the drainage network to continue. The calculation of sediment loss from roads equates to 0.07 pound of sediment per acre within this subwatershed.

Action Alternatives

Approximately 96 percent of the subwatershed burned in 2002. The salvage harvest and associated fuels reduction accounts for activity on 11 percent of the subwatershed area in Alternative C, G and H. In Alternative E harvest and fuels reduction accounts for 9 percent and in Alternative D it accounts for 5 percent. The minor amount of sediment associated with the harvest and the minimal amount of the subwatershed affected by the harvest should have minimal impact on the subwatershed. However, the addition of the acres of prescribed burn increases the percent of treated subwatershed by 10 percent and 6.5 percent for Alternatives C and G and Alternatives D and H, respectively. In concert, the prescribed burning and salvage account for treatment on 12 percent, 17 percent for Alternatives D and H, respectively and 21 percent for both Alternatives C and G. However, several commercial salvage units are at coincident locations with the proposed prescribed burn locations. Assuming the prescribed burn is of low-severity and the salvage produces minor amounts of sediment, the treatment should not be detrimental to the subwatershed. If either of the preceding statements is not true, the probability of detectable effects on the subwatershed increases in Alternative C and G. The temporary and unclassified roads would temporarily increase the miles of road by 1.9 percent for Alternatives C, E, G and H. No temporary or re-opened unclassified roads are expected for Alternative D. The increase in road miles would be short term and proper decommissioning of the roads would occur after the activity is complete. The unclassified road density would decrease from 0.93 mi/mi^2 to 0.64 mi/mi^2, 0.85 mi/mi^2, 0.71 mi/mi^2, 0.64 mi/mi^2 and 0.66 mi/mi^2. Sedimentation from salvage harvest is expected to be similar and minor for all action alternatives.

Due to nearly all subwatersheds being inside of the analysis area, the roads management activities within the subwatershed are extensive. Approximately 8.3 miles of road would be closed and 15.2 miles of road would be decommissioned under Alternatives C and D. Under Alternative E 14.0 miles and 1.2 miles are closed and decommissioned, respectively.

Alternative G closed 0.0 miles of road and decommissioned 15.2 miles of road. Alternative H closes 9.7 miles and decommissions 4.9 miles. The reduction in road density is greater than 10 percent of the original road density for all alternatives. The reduction is just over 30 percent in Alternative C, D and H. The closure and decommissioning of 1.6 miles of road within 300 feet of intermittent and perennial streams would be a primary improvement to the health of the subwatershed under all alternatives. The sediment savings from road actions is generally the same in all alternatives as is the sediment loss from roads within this subwatershed. The road density would remain high for the subwatershed under all alternatives. Alternatives C, D and H are the most aggressive with respect to road activity and would result in the most benefit of the action alternatives.

Temperature characteristics in the streams of the subwatershed are not expected to change as a result of any of the action alternatives.

The very high road density currently within the subwatershed and the short-term sedimentation associated with closure and decommissioning in order to reduce chronic problems from high road densities is a point of concern to varying degrees for all action alternatives. The subwatershed sensitivity was moderate and rated high for mass wasting. For these reasons, cumulative effects in the subwatershed are expected to be moderate. In addition, the recovery on private land salvage harvest, the effective rehabilitation of the suppression activities, monitoring and management of livestock use and allotment condition should not adversely affect the subwatershed.

Table 3.140 Summary Table – East Duncan Creek Subwatershed Cumulative Watershed Effects

	NAME - HUC								
WATERSHED	SILVER LAKE - 1712000503								
SUBWATERSHED	**EAST DUNCAN CREEK -** 171200050302								
	LOW		MODERATE			HIGH			
SUBWATERSHED SENSITIVITY			X						
Characteristic(s) rated HIGH	Centroid elevation, mass wasting								
	CURRENT CONDITION - FUNCTIONALITY			**Alt A**	**Alt C**	**Alt D**	**Alt E**	**Alt G**	**Alt H**
ELEMENTS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK	RESTORE (**R**), MAINTAIN (**M**) or DEGRADE (**D**). Improvement as a result of the project? – **Yes** or **No**					
UPLANDS									
Roads			**X**	**D**	**R - Yes**	**R - Yes**	**M - Yes**	**M - Yes**	**R - Yes**
Canopy			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Soil	**X**			**M**	**M**	**M**	**M**	**M**	**M**
RIPARIAN VEGETATION / BANK STABILITY	**X**			**M**	**M**	**M**	**M**	**M**	**M**
CHANNEL CONDITIONS									
Pool frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Large wood frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Temperature	NOT AVAILABLE								
Fine sediment	NOT AVAILABLE								
Fish passage	NOT AVAILABLE								

Lower Duncan Creek

Existing Condition

Sensitivity

Lower Duncan Creek 6th field watershed (subwatershed) (HUC 171200050303) is approximately 39 square miles and is part of the Silver Lake 5th field watershed. There are no perennial streams within the subwatershed. The lower reaches of Duncan Creek are located in the far western portion of the subwatershed. Willow Creek and several other unnamed intermittent streams are located in Lower Duncan Creek subwatershed and these streams eventually flow into Silver Lake.

Hydrologic soil group C, which is characterized by slow rates of infiltration and water transmission, characterizes twenty-one percent of the subwatershed. Hydrologic soil group D, which is characterized by very slow rates of infiltration and water transmission, characterizes forty-nine percent of the subwatershed. Seventy percent of the subwatershed area is characterized by hydrologic soil group C and D. The total index percent of hydrologic group C and D was rated as **high** sensitivity for this subwatershed. The majority, 55 percent, of the subwatershed that was inventoried is characterized by very stable mass wasting characteristics. However, twelve percent of the area is at some risk for rotational slumps. The remaining 33 percent was rated as not applicable with respect to mass wasting. Bear in mind that the majority of the subwatershed is located within the portion of land where the stability data was unavailable and has little to known history of mass wasting. The sensitivity index based on the available information was **moderate** because the majority of the subwatershed is understood to have low mass wasting characteristics. All subwatersheds receive limited amounts of precipitation on average, which yields a less sensitive watershed on the whole. Approximately 85 percent of the Lower Duncan Creek subwatershed is located within the rain-on-snow elevation band and was rated as **high** for this reason.

Lower Duncan Creek has low drainage density of 1.13 mi/mi^2, which is well below the low class of 3 to 4 mi/mi2 (Strahler 1964). In comparison to the other subwatersheds in the analysis area Lower Duncan Creek was rated as **moderate**. Subwatershed relief for Lower Duncan Creek is high amongst the eight subwatersheds being analyzed and was rated as **high** sensitivity. Over approximately 5.6 miles, an elevation of 2746 feet is lost for a resultant subwatershed relief ratio of 0.09 ft/ft. The centroid elevation of Lower Duncan Creek is 5100 feet and is in the **moderate** range for the analysis area. A higher centroid elevation value tends toward a more sensitive subwatershed.

Overall, Lower Duncan Creek has limited precipitation, no perennial streams, high sensitivity for streamflow generation areas, very high sensitivity for mass wasting, and low sensitivity for rain-on-snow potential. The channel information rated as moderate for drainage density and centroid elevation but high for subwatershed relief. This information leads one to conclude that East Duncan Creek subwatershed has **high** sensitivity when compared to the other subwatersheds within the analysis area.

Functionality

Lower Duncan Creek is dominated by low-severity burn. Approximately 56 percent of the subwatershed burned with 1.6 percent, 5.2 percent and 48.9 percent of the subwatershed burned at high, moderate and low-severity, respectively.

The roads, canopy and soils within the subwatershed will be used to characterize the uplands of Lower Duncan Creek. According to the transportation layer in Geographical Information Systems (GIS) there are 79 miles of road within Lower Duncan Creek subwatershed equating to an open road density of 2.03 mi/mi^2, which places the subwatershed **functioning at risk**. The Riparian Habitat Conservation Area (RHCA) for an intermittent stream is 50 feet on each side of the stream. Of the 79 miles of road approximately 1.4 miles are located within the RHCA for intermittent streams. There are 12.5 miles or 16 percent are located within 300 feet of intermittent streams. Roads cross channels at 36 locations, sites where direct sediment introduction occurs. The road impact index (RII) was calculated to be 0.26. Along with the 44 miles of stream channels, an estimated 48 of the 79 miles of road are hydrologically integrated with the stream network, thus increasing the drainage network by 107 percent—using study results from Wemple (1994).

The capability areas within Lower Duncan Creek were rated as having 53 percent of the area as high potential for erosion, 56 percent of the area as high potential for compaction, 70 percent of the area as low potential for displacement, and 87 percent as low potential for mass movement. Transects used to measure compaction were measured after the fire took place and were only measured on Forest Service land within the fire perimeter. Lower Duncan Creek was rated as having 62 percent and 38 percent of the inventoried subwatershed area as low and moderate compaction, respectively. No transect within Lower Duncan Creek was found to have high compaction and therefore is rated as **functioning appropriately**.

The canopy analysis showed that approximately 74 percent and 34 percent of Lodgepole Pine and Ponderosa Pine, respectively, were within the historic range of variability. Fifty-two percent of the acres of Ponderosa Pine are above HRV. Overall, 62 percent of the subwatershed is outside of HRV, which places the subwatershed at **functioning at unacceptable risk**.

Riparian vegetation and bank stability information for the Lower Duncan Creek subwatershed was generated from Ochoco Bottomline surveys for intermittent streams in fall of 2002. The streambank stability values will be used as a surrogate for the riparian vegetation rating. Inventories were completes on the Willow Creek, on Forest Service land, and found 88 percent bank instability overall. The first reach, totally 1.3 miles in length, had bank stability of 85 percent. The remaining reaches had higher bank stability but totaled 0.6 miles in length. Therefore, the bank stability rating for Lower Duncan Creek is **functioning at risk**.

Channel condition will be characterized and rated for functionality with respect to pool frequency, large wood frequency, temperature, fine sediment and fish passage. The pool frequency and large wood frequency is greater than the 75th percentile in the surveyed reach of Lower Duncan Creek. The rating for pools and large wood per mile is **functioning appropriately**. No known measures of fine sediment were made for any of the intermittent streams within Lower Duncan Creek subwatershed. No temperature data is known to be available for any streams within this subwatershed. There were zero inventoried culverts within the subwatershed.

Table 3.141 Lower Duncan Creek Subwatershed Channel Condition

REACH	ROSGEN	POOLS PER MILE			LARGE WOOD PER MILE			SUBSTRATE		REACH
	TYPE	50th	75th	Total	50th	75th	Total	DOM	SUB.	LENGTH (mi)
WILLOW CREEK										
1	C	20	30	86	14	58	33	Gravel	Cobble	1.3
2	C	12	19	98	8	36	18	Gravel	Cobble	0.4
3	C	12	18	95	8	35	37	Gravel	Cobble	0.2

The current condition of Lower Duncan Creek, with the functionality ratings for each element considered under Cumulative Watershed Effects, is shown in the summary table under "Environmental Consequences – Cumulative Watershed Effects".

Generally, Lower Duncan Creek was rated as having high subwatershed sensitivity when compared to the other subwatersheds analyzed. It was rated as high sensitivity with respect to the hydrologic soils group, mass wasting, and subwatershed relief. The roads category and bank stability were rated as functioning at risk. Canopy, soil condition, pool frequency, and large wood frequency were rated as functioning appropriately. Temperature, sediment and fish passage information was not available.

Past Activities

- Personal use firewood: Approximately 300 personal use firewood permits sold at district with 2.5 percent occurring in this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Powerline and communications facilities consist of 4.5 miles of 500 KV PPL, 2.5 miles of SVE powerline, multiple communications site. *No known problems with these facilities exist with respect to soil and water.*
- Recreational trail and dispersed recreational sites. *Activities associated with the trail and recreational areas at isolated or concentrated locations near streams may cause limited resource damage in the form of compaction or trampling.*
- Grazing in the Dead Indian/Duncan Allotment prior to the early 1980s to 2002 took place in pastures of this allotment with rest periods. *Clearly the use in the past has been heavy, but current management of livestock has limited their impacts on the subwatershed.*
- Six water impoundments. *Concentrated use by vehicles, livestock and wildlife around pond may cause compaction problems and associated water ponding on the surface.*
- The reservoir may or may not provide for fish movement through the infrastructure. *Ponding of water exposes more surface area to radiant heat and causes increases in water temperature.*
- Silvicultural activities within the subwatershed have included timber stand improvement or the thinning of sub-merchantable trees and merchantable harvest of timber. Timber stand improvement within this subwatershed

occurred on 543 acres. Timber harvest activities on forest service land have focused on modifying structure and composition of stand while generating merchantable products. This subwatershed has 596 acres of harvest varying from intermediate, and regeneration of both even aged and uneven aged harvest. *Past timber harvest activities have been the main reason for high road densities within the subwatershed and the problems associated with high road densities. Timber harvest can also caused compaction and other detrimental soil conditions, expose areas to increased surface erosion, and may modify streamflow regimes. General watershed effects of timber removal on watersheds are well documented (Meehan, 1991, Troendle and Leaf, 1981) though no specific studies have been completed on the Fremont National Forest.*

- An estimated 2240 acres of timber were removed from private land within the subwatershed, which equates to 9 percent of the subwatershed in the fall of 2002. The long 2003 rain and snow season extending from March into May provided soil moisture conditions for seedbed response and ground cover recovery. *The removal of salvage timber directly after the fire occurred along with the response to the fire allowed for greater sedimentation directly after the fire occurred. However, the precipitation and the openings created by the salvage has allowed for good ground cover recovery on the private land and has therefore limited sediment transport opportunities.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Past fire activity shows there have been 38 fires since 1948, of which 64 percent of the acres burned were human caused. *The intense fire suppression has resulted in more dense stands throughout the area and may help lead to more intense fires that would have historically occurred.*
- 2002 Fire Suppression. 34 miles of dozer line were constructed within the subwatershed and trees were fallen for safety or suppression objectives. *The additional compacted surface of dozer lines add to the road density and sedimentation problems associated with roads/trails. It is assumed that dozer lines were rehabilitated with waterbars and drainage according to BMPs and have reduced sediment production to background levels.*
- 2002 Fire Suppression-Retardant Drops. The communications tower on Dean Indian Mountain received retardant primarily. *The location is a long distance to any substantial stream channel and therefore, more than likely had limited effects on the subwatershed.*
- 2002 Fire Suppression-Firing Operations. *The burning resulted in limited high-severity fire conditions.*
- BAER projects. Drainage ditches were cleaned throughout subwatershed. *This activity facilitated proper movement of moisture off of roads. A relief culvert was installed at Road 2914000 to facilitate high flows and increased debris coming off of the recently burned area.*
- Industrial forest lands. Throughout the analysis area have logged extensively throughout the 20th century. By 2000, almost all stands were logged at least once. *The extensive use on private lands has increased ground disturbance and increased erosion.*

Toolbox Fire Recovery Project Activities (on a subwatershed basis)

Direct and indirect effects *on a project area basis* were discussed early in the Watershed section. This section concerns itself with how those direct and indirect effects apply to a cumulative effects finding, on a *subwatershed* basis.

The elements discussed under direct and indirect effects as they pertain to the Lower Duncan Creek subwatershed are found below.

Table 3.142 Lower Duncan Creek Direct and Indirect Effects

LOWER DUNCAN CREEK	ALT. A	ALT. C	ALT. D	ALT. E	ALT. G	ALT. H
TOTAL COMMERCIAL SALVAGE (acres)	0	1,514	765	1,251	1,515	1,048
GROUND BASED COMMERCIAL SALVAGE (acres)	0	1,207	468	944	1,207	1,048
AERIAL COMMERCIAL SALVAGE (acres)	0	308	297	309	308	0
PERCENT OF SUBWATERSHED AREA SALVAGE	0%	6%	3%	5%	6%	4%
TOTAL RHCA COMMERCIAL SALVAGE (acres)	0	22	0	40	22	0
RHCA 1 (acres)	0	0	0	0	0	0
RHCA 3 (acres)	0	21	0	20	21	0
RHCA 4 (acres)	0	2	0	0	2	0
TEMPORARY ROADS (miles)	0	1.14	0	1.14	1.14	1.14
RE-OPEN UNCLASSIFIED ROADS (miles)	0	0	0	0	0	0
PRESCRIBED FIRE (acres)	0	230	134	0	230	134
ROADS						
OPEN ROAD DENSITY (mi/mi^2)	2.03	1.78	1.78	1.96	1.96	1.78
CLOSE ROADS (mi)	0.0	6.9	6.9	2.7	0.0	6.9
DECOMMISSION ROADS (mi)	0.0	2.7	2.7	0.0	2.7	2.7
OPEN ROADS (mi)	79.3	69.7	69.7	76.6	76.6	69.7
SEDIMENT SAVINGS FROM ROAD ACTIONS (tons/yr)	0.00	0.02	0.02	0.00	0.00	0.00
SEDIMENT LOSS FROM OPEN ROADS (tons/yr)	0.50	0.48	0.48	0.49	0.49	0.48
OPEN ROADS within 300 ft of STREAM (mi)	0.7	0.0	0.0	0.0	0.6	0.0
CLOSE ROADS within 300 ft of STREAM (mi)	0.0	0.6	0.6	0.6	0.0	0.6
DECOMISSION ROADS within 300 ft of STREAM (mi)	0.0	0.1	0.1	0.1	0.1	0.1

Present and Future Activities

- Foster Butter Allotment is expected to have a NEPA decision before 2004 grazing season. Current use is based on 2003 monitoring and NEPA decision. Dead Indian/Duncan Allotment will not be used in 2003 or 2004 and be evaluated based on monitoring for further use. Recently burned areas compared to unburned areas produce more aboveground biomass (Tracy and McNaughton, 1996). This in concert with the active control of livestock in burned areas to keep cattle off of riparian area should be effective. *The NEPA analysis or Rangeland Health Assessments (BLM) will allow for thorough review of the grazing within this allotment.*
- Personal use firewood: In 2002, an estimated 981 cords were removed from this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Approximately 0.5 miles of National Recreation Trail would be relocated and several more miles would be reconstructed. *There would be short-term effects from the trail construction and isolated areas of compaction as a result of the trail but these activities would have limited effect on the subwatershed.*
- Juniper treatment-BLM. 10000 acres. *The thinning of this aggressive species that has well surpassed historic stocking has a positive effect on the subwatershed.*
- Seeding-BLM. 1650 acres. *This action should allow for more rapid recovery of subwatershed.*
- Seedling planting-BLM. 600 acres. *This action should allow for more rapid recovery of subwatershed.*
- Salvage harvest-BLM. 60 acres. *The reduction in fuels should be accomplished with minimal disturbance to the subwatershed.*

Cumulative Watershed Effects

See also "Summary Table – Lower Duncan Creek Subwatershed Cumulative Watershed Effects" that follows discussion.

Alternative A

The number of roads that remain open under this alternative generates a road density that satisfies the direction in the LRMP of having a road density that "does not exceed 2.5 mi/mi^2". The road density is rated as functioning at risk by USFWS (1998). No ground disturbing activity as a result of salvage harvest and fuels reduction would occur under this alternative. However, the opportunity to reduce the number of miles and lower the drainage density further is not available under this alternative.

Action Alternatives

Approximately 56 percent of the subwatershed burned in 2002 and activity on only 56 percent of the subwatershed is within the analysis area. The salvage harvest and associated fuels reduction accounts for activity on 6 percent of the subwatershed area in Alternative C and G, 5 percent in Alternative E, 4 percent in Alternative H and 3 percent in Alternative D. The minor amount of sediment associated with the harvest and the minimal amount of the subwatershed affected by the harvest should have minimal impact on the subwatershed. The prescribed fire in all alternatives would increase the area treated by less than 1 percent. The temporary and unclassified roads would temporarily increase the miles of road by 1.4 percent for Alternatives C, E, G and H. No temporary or re-opened unclassified roads are expected for Alternative D. The increase in road miles would be short term and proper decommissioning of the roads would occur after the activity is complete. The unclassified road density would decrease from 0.93 mi/mi^2 to 0.64 mi/mi^2, 0.85 mi/mi^2, 0.71 mi/mi^2, 0.64 mi/mi^2 and 0.66 mi/mi^2. Sedimentation from salvage harvest is expected to be similar and minor for all action alternatives.

Due to approximately half of the subwatershed being inside of the analysis area, the roads management activities within the subwatershed are somewhat limited. Approximately 6.9 miles of road would be closed and 2.7 miles of road would be decommissioned under Alternatives C, D and H. Under Alternative E 2.7 miles would be closed while under Alternative G 2.7 miles would be decommissioned. The reduction in road density is 12 percent of the original road density for Alternatives C, D and H. The reduction is just over 8 percent in Alternative E and G. The closure and decommissioning of 0.7 miles of road within 300 feet of intermittent and perennial streams would be a primary improvement to the health of the subwatershed under all alternatives except Alternative G. The sediment savings from road actions is generally the same in all alternatives as is the sediment loss from roads within this subwatershed. The road density would remain high for the

subwatershed under all alternatives. Alternatives C, D and H are the most aggressive with respect to road activity and would result in the most benefit of the action alternatives.

Temperature characteristics in the streams of the subwatershed are not expected to change as a result of any of the action alternatives.

Cumulative watershed effects in this subwatershed are moderate due to the planned activity of thinning 10,000 acres of juniper on BLM land, which constitutes 40 percent of the subwatershed. The effects of the action alternatives and the 60 acres of BLM salvage harvest are expected to be minor in this subwatershed. This is due to the moderate subwatershed sensitivity and the recovery expected on private land salvage harvest, the effective rehabilitation of the suppression activities, monitoring and management of livestock use and allotment condition and monitoring of possible sediment source units.

Table 3.143 Summary Table – Lower Duncan Creek Subwatershed Cumulative Watershed Effects

	NAME - HUC								
WATERSHED	SILVER LAKE - 1712000503								
SUBWATERSHED	**LOWER DUNCAN CREEK** - 171200050303								
	LOW		MODERATE			HIGH			
SUBWATERSHED SENSITIVITY			X						
Characteristic(s) rated HIGH	Soils hydrologic group, subwatershed relief								
	CURRENT CONDITION - FUNCTIONALITY			**Alt A**	**Alt C**	**Alt D**	**Alt E**	**Alt G**	**Alt H**
ELEMENTS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK	RESTORE (**R**), MAINTAIN (**M**) or DEGRADE (**D**). Improvement as a result of the project? – **Yes** or **No**					
UPLANDS									
Roads		**X**		**M**	**R - Yes**	**R - Yes**	**M - Yes**	**M - Yes**	**R - Yes**
Canopy			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Soil	**X**			**M**	**M**	**M**	**M**	**M**	**M**
RIPARIAN VEGETATION / BANK STABILITY		**X**		**M**	**M**	**M**	**M**	**M**	**M**
CHANNEL CONDITIONS									
Pool frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Large wood frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Temperature	NOT AVAILABLE								
Fine sediment	NOT AVAILABLE								
Fish passage	NOT AVAILABLE								

Middle Silver Creek

Existing Condition

Sensitivity

Middle Silver Creek 6th field watershed (subwatershed) (HUC 171200050209) is approximately 61 square miles and is part of the Silver Creek 5th field watershed. There is one perennial stream within the subwatershed and several intermittent streams. The perennial stream in the Middle Silver Creek subwatershed is the most northern portion of Silver Creek. The portion of Silver Creek within the Middle Silver Creek subwatershed is regulated by a dam/spillway.

Hydrologic soil group C, which is characterized by slow rates of infiltration and water transmission, characterizes twenty percent of the subwatershed. Hydrologic soil group D, which is characterized by very slow rates of infiltration and water transmission, characterizes forty-one percent of the subwatershed. Sixty-one percent of the subwatershed area is characterized by hydrologic soil group C and D. The total index percent of hydrologic group C and D was rated as **high** sensitivity. The vast majority, 98 percent, of the subwatershed that was inventoried is characterized by very stable mass wasting characteristics. Bear in mind that the majority of the subwatershed is located within the portion of land where the stability data was unavailable. However, the area has little to known history of mass wasting. The sensitivity index for mass wasting based on the available information was **low** for this subwatershed. All subwatersheds receive limited amounts of precipitation on average, which yields a less sensitive watershed on the whole. A rain-on-snow event is of particular concern any area with substantial snow pack. Middle Silver Creek is located lower in the system and on average holds limited snow. According to the estimated rain-on-snow range for the Silver Creek 5th field watershed of 4500-6000 feet, approximately 65 percent of the subwatershed is within this range. The sensitivity index for this element was rated as **moderate**.

Middle Silver Creek has low drainage density of 1.03 mi/mi^2, which is well below the low class (3 to 4 mi/mi2) cited by Strahler (1964). In comparison to the other subwatersheds in the analysis area Middle Silver Creek was rated as **moderate** sensitivity. Subwatershed relief for Middle Silver Creek is low amongst the eight subwatersheds being analyzed and was rated as **moderate** sensitivity. Over approximately 10.2 miles, an elevation of 2825 feet is lost for a resultant subwatershed relief ratio of 0.05 ft/ft. The centroid elevation of Middle Silver Creek is 4600 feet and is in the low range for the analysis area and rated **low** for the sensitivity index. A higher centroid elevation value tends toward a more sensitive subwatershed.

Overall, Middle Silver Creek has limited precipitation; one regulated perennial stream, high sensitivity for streamflow generation areas, low sensitivity for mass wasting, and moderate sensitivity for rain-on-snow potential. The channel information rated as low for centroid elevation and moderate for drainage density and subwatershed relief. This information leads one to conclude that East Duncan Creek subwatershed has **moderate** sensitivity when compared to the other subwatersheds within the analysis area.

Functionality

Middle Silver Creek is dominated by low-severity burn. Approximately 4 percent of the subwatershed burned with 0.0 percent, 0.2 percent and 4.1 percent of the subwatershed burned at high, moderate and low-severity, respectively.

The roads, canopy and soils within the subwatershed will be used to characterize the uplands of Middle Silver Creek. According to the transportation layer in Geographical Information Systems (GIS) there are 113 miles of road within Middle Silver Creek subwatershed equating to an open road density of 1.86 mi/mi^2, which places the subwatershed **functioning at risk**. The Riparian Habitat Conservation Area (RHCA) for an intermittent stream is 50 feet on each side of the stream and 300 feet on each side of a perennial fish-bearing stream. Of the 137 miles of road approximately 4.1 miles are located within the RHCA for intermittent streams and 0.5 miles are located with the RHCA for perennial fish-bearing streams. There are 21.6 miles or 19 percent are located within 300 feet of intermittent or perennial streams. Roads cross channels at 55 locations, sites where direct sediment introduction occurs. The road impact index (RII) was calculated to be 0.34. Along with the 62 miles of stream channels, an estimated 68 of the 113 miles of road are hydrologically integrated with the stream network, thus increasing the drainage network by 109 percent—using study results from Wemple (1994).

The capability areas within Middle Silver Creek were rated as having 70 percent of the area as low potential for erosion, 98 percent of the area as high potential for compaction, 100 percent of the area as low potential for displacement, and 100 percent as low potential for mass movement. Transects used to measure compaction were measured after the fire took place and were only measured on Forest Service land within the fire perimeter. Middle Silver Creek was rated as having 100 percent of the inventoried subwatershed area as low compaction. No transect within Middle Silver Creek was found to have high compaction and therefore is rated as **functioning appropriately**.

The canopy analysis showed that approximately 33 percent and 45 percent of Ponderosa Pine and White Fir, respectively, were within the historic range of variability. Fifty-two percent of the White Fir is above HRV. Overall, 65 percent of the subwatershed is outside of HRV, which places the subwatershed at **functioning at unacceptable risk**.

Information regarding the bank stability and riparian vegetation for Middle Silver Creek subwatershed is only available for a small portion of the far northern portion of main stem of Silver Creek within the subwatershed. No inventories of intermittent streams in the subwatershed were completed after the fire. The riparian vegetation is dominated by willow, sedge and grass. The bank stability was inventoried as 99 percent stable. This limited information yields a **functioning appropriately** rating.

Channel condition will be characterized and rated for functionality with respect to pool frequency, large wood frequency, temperature, fine sediment and fish passage. The pool frequency is greater than the 75th percentile in the surveyed reach of Silver Creek that is located within Middle Silver subwatershed. This section of Silver Creek is primarily a meadow site and thus was not evaluated for large wood. The rating for pools is **functioning appropriately**. No known measures of fine sediment and temperature are known to be available for this section of Silver Creek or on any of the other streams within this subwatershed. However, the section of Silver Creek within this subwatershed is on the 303(d) list for stream temperature (see Upper Silver Creek subwatershed channel condition discussion) and will be rated as **functioning at unacceptable risk**. There are zero inventoried culverts within Middle Silver subwatershed.

Table 3.144 Middle Silver Creek Subwatershed Channel Condition

REACH	ROSGEN	POOLS PER MILE			LARGE WOOD PER MILE			SUBSTRATE		REACH
	TYPE	50th	75th	Total	50th	75th	Total	DOM	SUB.	LENGTH (mi)
SILVER CREEK										
1	C	17	30	49	**	**	0	Gravel	Sand	0.7

The current condition of Lower Silver Creek, with the functionality ratings for each element considered under Cumulative Watershed Effects, is shown in the summary table under "Environmental Consequences – Cumulative Watershed Effects". Generally, Middle Silver Creek was rated as having moderate subwatershed sensitivity when compared to the other subwatersheds analyzed. It was rated as high sensitivity with respect to the hydrologic soils group. The roads category was rated as functioning at risk. Canopy, soil compaction and pool frequency were rated as functioning appropriately. Temperature was rated as functioning at unacceptable risk. Sediment and fish passage information was not available.

Past Activities

- Fuels reduction: Under-burning: 1980-1984: 280 acres, 1985-1989: 650 acres Pretreatment: 2000-2002: 780 acres. Pile burning: 1990-1994: 2 piles, 2000-2002: 2 piles. *Underburning and pile burning is typically at low severity and had little impact on the subwatershed.*
- Silvicultural activities within the subwatershed have included timber stand improvement or the thinning of sub-merchantable trees and merchantable harvest of timber. Timber stand improvement within this subwatershed occurred on 935 acres. Timber harvest activities on forest service land have focused on modifying structure and composition of stand while generating merchantable products. This subwatershed has seen 1,635 acres of harvest varying from intermediate, and regeneration of both even aged and uneven aged harvest. *Past timber harvest activities have been the main reason for high road densities within the subwatershed and the problems associated with high road densities. Timber harvest can also caused compaction and other detrimental soil conditions, expose areas to increased surface erosion, and may modify streamflow regimes. General watershed effects of timber removal on watersheds are well documented (Meehan, 1991, Troendle and Leaf, 1981) though no specific studies have been completed on the Fremont National Forest .*
- Personal use firewood: Approximately 300 personal use firewood permits sold at district with 2.5 percent occurring in this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Powerline and communications facilities consist of 5.5 miles of 500 KV BPA/PGE/PPL powerline, 10 miles of Midstate Electric powerline. *No known problems with these facilities exist with respect to soil and water.*
- Recreational trail and dispersed recreational sites. *Activities associated with the trail and recreational areas at isolated or concentrated locations near streams may cause limited resource damage in the form of compaction or trampling.*

- National Recreation Trailhead with corrals and campsite. *Compacted areas around campsites and facilities limit infiltration and may increase ponding.*
- Grazing in Silver Bridge prior to early 1980s to 2003 occurred in this subwatershed. Dead Indian/Duncan Allotment prior to the early 1980s to 2002 had 386 AUMS, rested in 2003. Murdock Allotment prior to early 1980s had 705 AUMS, 545 AUMS from 1890s to 2003. Silver Creek Allotment prior to early 1980s to 2003 had 200 AUMS. *Clearly the use in the past has been heavy, but current management of livestock has limited their impacts on the subwatershed.*
- Six diversions divert 1, 1, 1.5, 2.6, 3, 15.4 and 60 cfs. The diversions may or may not provide for fish movement through the infrastructure. *Ponding of water exposes more surface area to radiant heat and causes increases in water temperature.*
- Three water impoundments. *Concentrated use by vehicles, livestock and wildlife around pond may cause compaction problems and associated water ponding on the surface.*
- An estimated 110 acres of timber were removed from private land within the subwatershed, which equates to less than 1 percent of the subwatershed in the fall of 2002. *This activity had little to no effect on soil and water within the subwatershed.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Past fire activity shows there have been 35 fires since 1948, of which 71 percent of the acres burned were human caused. *The intense fire suppression has resulted in more dense stands throughout the area and may help lead to more intense fires that would have historically occurred.*
- 2002 Fire Suppression. 19 miles of dozer line were constructed within the subwatershed and trees were fallen for safety or suppression objectives. *The additional compacted surface of dozer lines add to the road density and sedimentation problems associated with roads/trails. It is assumed that dozer lines were rehabilitated with waterbars and drainage according to BMPs and have reduced sediment production to background levels.*
- 2002 Fire Suppression-Retardant Drops. There was some retardant dropped on the subwatershed. *The locations of the drops are unknown but it is assumed the effects are limited due to the limited number of drops and the nature of the material.*
- Ponderosa pine thinning. 330 acres in 2000. *The reduction of overstocking of ponderosa pine stands has a positive effect on the watershed.*
- Juniper thinning. 210 acres in 2000. *The thinning of this aggressive species that has well surpassed historic stocking has a positive effect on the subwatershed.*
- BAER projects. Drainage ditches were cleaned throughout subwatershed. *This activity facilitated proper movement of moisture off of roads.*
- Industrial forest lands. Throughout the analysis area have logged extensively throughout the 20th century. By 2000, almost all stands were logged at least once. *The extensive use on private lands has increased ground disturbance and increased erosion.*

Toolbox Fire Recovery Project Activities (on a subwatershed basis)

Direct and indirect effects *on a project area basis* were discussed early in the Watershed section. This section concerns itself with how those direct and indirect effects apply to a cumulative effects finding, on a *subwatershed* basis.

The elements discussed under direct and indirect effects as they pertain to the Middle Silver Creek subwatershed are found below.

Table 3.145 Middle Silver Creek Direct and Indirect Effects by Alternative

MIDDLE SILVER CREEK	ALT. A	ALT. C	ALT. D	ALT. E	ALT. G	ALT. H
TOTAL COMMERCIAL SALVAGE (acres)	0	419	84	330	419	410
GROUND BASED COMMERCIAL SALVAGE (acres)	0	419	84	330	419	410
AERIAL COMMERCIAL SALVAGE (acres)	0	0	0	0	0	0
PERCENT OF SUBWATERSHED AREA SALVAGE	0%	1%	0%	1%	1%	1%
TOTAL RHCA COMMERCIAL SALVAGE (acres)	0	9	0	6	9	0
RHCA 1 (acres)	0	0	0	0	0	0
RHCA 3 (acres)	0	3	0	2	3	0
RHCA 4 (acres)	0	6	0	4	6	0
TEMPORARY ROADS (miles)	0	0.79	0	0.79	0.79	0.79
RE-OPEN UNCLASSIFIED ROADS (miles)	0	0	0	0	0	0
PRESCRIBED FIRE (acres)	0	0	0	0	0	0
ROADS						
OPEN ROAD DENSITY (mi/mi^2)	1.86	1.82	1.82	1.84	1.84	1.82
CLOSE ROADS (mi)	0.0	1.6	1.6	1.3	0.7	1.6
DECOMMISSION ROADS (mi)	0.0	0.9	1.9	0.2	0.9	0.9
OPEN ROADS (mi)	113.0	110.6	110.6	111.5	111.5	122.5
SEDIMENT SAVINGS FROM ROAD ACTIONS (tons/yr)	0.00	0.09	0.09	0.08	0.08	0.09
SEDIMENT LOSS FROM OPEN ROADS (tons/yr)	0.90	0.81	0.81	0.83	0.83	0.81
OPEN ROADS within 300 ft of STREAM (mi)	1.3	0.4	0.4	0.6	0.6	0.4
CLOSE ROADS within 300 ft of STREAM (mi)	0.0	0.4	0.4	0.6	0.3	0.4
DECOMISSION ROADS within 300 ft of STREAM (mi)	0.0	0.5	0.5	0.1	0.4	0.5

Present and Future Activities

- Foster Butter Allotment is expected to have a NEPA decision before 2004 grazing season. Current use is based on 2003 monitoring and NEPA decision. Silver Bridge-BLM- Allotment has 262 AUMS on rest rotation with riparian pasture. Dead Indian Allotment will not be used in 2004 and be evaluated based on monitoring for further use. Murdock Allotment-BLM-Allotment will have 545 AUMS on rest rotation. Silver Creek-BLM-Allotment will have 200 AUMS mid April to late May. Recently burned areas compared to unburned areas produce more aboveground biomass (Tracy and McNaughton, 1996). This in concert with the active control of livestock in burned areas to keep cattle off of riparian area should be effective. *The NEPA analysis or Rangeland Health Assessments (BLM) will allow for thorough review of the grazing within this allotment.*
- Personal use firewood: In 2002, an estimated 981 cords were removed from this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Several miles of NRT will be reconstructed. *There would be short-term effects from the trail construction and isolated areas of compaction as a result of the trail but these activities would have limited effect on the subwatershed.*
- Approximately 4200 acres are planned for prescribed burning in 2004/2005. *This activity will be fully analyzed.*
- Juniper treatment-BLM. 1000 acres. *The thinning of this aggressive species that has well surpassed historic stocking has a positive effect on the subwatershed.*
- Seeding-BLM. 90 acres. *This activity will allow for more rapid recovery of subwatershed.*

Cumulative Watershed Effects

See also "Summary Table – Middle Silver Creek Subwatershed Cumulative Watershed Effects" that follows discussion.

Alternative A

The number of roads that remain open under this alternative generates a road density that satisfies the direction in the LRMP of having a road density that "does not exceed 2.5 mi/mi^2". The road density is rated as functioning at risk by USFWS (1998). No ground disturbing activity as a result of salvage harvest and fuels reduction would occur under this alternative. However, the opportunity to reduce the number of miles and lower the drainage density further is not available under this alternative.

Action Alternatives

Approximately 4 percent of the subwatershed burned in 2002 and activity on only 4 percent of the subwatershed is within the analysis area. The salvage harvest and associated fuels reduction accounts for activity on less than 1 percent to 1 percent of the subwatershed area. The minor amount of sediment associated with the harvest and the very limited amount of the subwatershed affected by the harvest should have little to no impact on the subwatershed. The temporary and unclassified roads would temporarily increase the miles of road by 0.7 percent for Alternatives C, E, G and H. There is no prescribed fire planned in this subwatershed. No temporary or re-opened unclassified roads are expected for Alternative D. The increase in road miles would be short term and proper decommissioning of the roads would occur after the activity is complete. The unclassified road density would decrease from 0.93 mi/mi^2 to 0.64 mi/mi^2, 0.85 mi/mi^2, 0.71 mi/mi^2, 0.64 mi/mi^2 and 0.66 mi/mi^2. Sedimentation from salvage harvest is expected to be similar and minor for all action alternatives.

Due to approximately only 4 percent of the subwatershed being inside of the analysis area, the roads management activities within the subwatershed are very limited. Approximately 1.6 miles of road would be closed and 0.9 miles of road would be decommissioned under Alternatives C, D and H. Under Alternative E 1.3 miles would be closed and 0.2 miles would be decommissioned. Alternative G 0.7 miles would be closed and 0.9 miles would be decommissioned. The reduction in road density is minor compared to the original road density. The closure and decommissioning of 0.7 to 0.9 miles of road within 300 feet of intermittent and perennial streams would be an improvement to the health of the subwatershed under all alternatives. The sediment savings from road actions is generally the same in all alternatives as is the sediment loss from roads within this subwatershed. The road density would remain high for the subwatershed under all alternatives. Alternatives C, D and H are the most aggressive with respect to road activity and would result in the most benefit of the action alternatives.

Temperature characteristics in the streams of the subwatershed are not expected to change as a result of any of the action alternatives.

Aspen enhancement would be implemented in Alternatives C, D, G and H. The enhancement of riparian vegetation, particularly where conifer encroachment occurs, has a positive effect on the subwatershed.

The cumulative watershed effects are expected to be low for this subwatershed. This is due to the expected recovery of the salvage on private land, the minor amount of BLM salvage planned for the subwatershed, the active management of livestock and monitoring of use within allotments and the effective rehabilitation of the suppression activities. The stream is currently listed under the 303(d) list. The action alternative has less than 10 acres of RHCA harvest in all action alternatives and this would not affect the temperature of Silver Creek to a measurable degree.

Table 3.146 Summary Table – Middle Silver Creek Subwatershed Cumulative Watershed Effects

	NAME - HUC								
WATERSHED	SILVER CREEK - 1712000502								
SUBWATERSHED	**MIDDLE SILVER CREEK** - 171200050309								
	LOW		MODERATE			HIGH			
SUBWATERSHED SENSITIVITY			X						
Characteristic(s) rated HIGH	Soils hydrology group								
	CURRENT CONDITION - FUNCTIONALITY			**Alt A**	**Alt C**	**Alt D**	**Alt E**	**Alt G**	**Alt H**
ELEMENTS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK	RESTORE (**R**), MAINTAIN (**M**) or DEGRADE (**D**). Improvement as a result of the project? – **Yes** or **No**					
UPLANDS									
Roads		**X**		**M**	**M - Yes**	**M - Yes**	**M - Yes**	**M - Yes**	**M - Yes**
Canopy			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Soil	**X**			**M**	**M**	**M**	**M**	**M**	**M**
RIPARIAN VEGETATION / BANK STABILITY	**X**			**M**	**M**	**M**	**M**	**M**	**M**
CHANNEL CONDITIONS									
Pool frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Large wood frequency	NOT APPROPRIATE FOR STREAM TYPE								
Temperature			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Fine sediment	NOT AVAILABLE								
Fish passage	NOT AVAILABLE								

Thompson Reservoir

Existing Condition

Sensitivity

Thompson Reservoir 6th field watershed (subwatershed) (HUC 171200050205) is approximately 64 square miles and is part of the Silver Creek 5th field watershed. There is one perennial stream within the subwatershed and several intermittent streams. The perennial stream in the Thompson Reservoir subwatershed is Guyer Creek. Guyer Creek begins on the eastern face of Yamsay Mountain, flow for approximately 11 miles and feeds into Thompson Reservoir. The primary intermittent streams within the subwatershed are Strawberry Creek, Indian Creek, and the headwaters of Silver Creek and Squaw Creek.

Hydrologic soil group C, which is characterized by slow rates of infiltration and water transmission, characterizes thirteen percent of the subwatershed. Hydrologic soil group D, which is characterized by very slow rates of infiltration and water transmission, characterizes twelve percent of the subwatershed. Twenty-four percent of the subwatershed area is characterized by hydrologic soil group C and D. The total index percent of hydrologic group C and D was rated as **low**. The vast majority, 72 percent, of the subwatershed is characterized by very stable mass wasting characteristics. Three percent of the subwatershed is at risk for rotational slumps. The sensitivity index for mass wasting was **moderate** for this subwatershed. All subwatersheds receive limited amounts of precipitation on average, which yields a less sensitive watershed on the whole. A rain-on-snow event is of particular concern any area with substantial snow pack. Thompson Reservoir is located high in the system and on average holds snow in the upper elevations well into the spring. According to the estimated rain-on-snow range for the Silver Creek 5th field watershed of 4500-6000 feet, approximately 65 percent of the subwatershed is within this range. The sensitivity index for this element was rated as **moderate**.

Thompson Reservoir has low drainage density of 1.10 mi/mi^2, which is well below the low class 3-4 mi/mi^2 (Strahler, 1964). In comparison to the other subwatersheds in the analysis area Thompson Reservoir was rated as **moderate**. Subwatershed relief for Thompson Reservoir is low amongst the eight subwatersheds being analyzed and was rated as **moderate** sensitivity. Over approximately 9.7 miles, an elevation of 2604 feet is lost for a resultant subwatershed relief ratio of 0.05 ft/ft. The centroid elevation of Thompson Reservoir is 5000 feet and is low for the analysis area and rated **moderate**. A higher centroid elevation value tends toward a more sensitive subwatershed.

Overall, Thompson Reservoir has limited precipitation, one perennial stream, moderate sensitivity for streamflow generation areas, moderate sensitivity for mass wasting, and moderate sensitivity for rain-on-snow potential. The channel information rated as moderate for drainage density, subwatershed relief and centroid elevation. This information leads one to conclude that East Duncan Creek subwatershed has **moderate** sensitivity when compared to the other subwatersheds within the analysis area.

Functionality

Thompson Reservoir is dominated by low-severity burn. Approximately 20 percent of the subwatershed burned with 0.1 percent, 3.7 percent and 16.2 percent of the subwatershed burned at high, moderate and low-severity, respectively.

The roads, canopy and soils within the subwatershed will be used to characterize the uplands of Thompson Reservoir. According to the transportation layer in Geographical Information Systems (GIS) there are 254 miles of road within Thompson Reservoir subwatershed equating to an open road density of 3.95 mi/mi^2. The Riparian Habitat Conservation Area (RHCA) for an intermittent stream is 50 feet on each side of the stream and 300 feet on each side of a perennial fish-bearing stream. Of the 254 miles of road approximately 3.7 miles are located within the RHCA for intermittent streams and 2.1 miles are located with the RHCA for perennial fish-bearing streams. There are 34 miles or 13 percent are located within 300 feet of intermittent or perennial streams. Roads cross channels at 70 locations (7 perennial stream crossings and 63 intermittent stream crossings), sites where direct sediment introduction occurs. The road impact index (RII) was calculated to be 0.93. Along with the 71 miles of stream channels, an estimated 152 of the 254 miles of road are hydrologically integrated with the stream network, thus increasing the drainage network by 216 percent—using study results from Wemple (1994). The road density of this subwatershed places it into the **functioning at unacceptable risk** category.

The capability areas within Thompson Reservoir were rated as having 58 percent of the area as low potential for erosion, 50 percent of the area as high potential for compaction, 45 percent of the area as low potential for compaction, 44 percent of the area as low potential for displacement, and 100 percent as low potential for mass movement. Transects used to measure compaction were measured after the fire took place and were only measured on Forest Service land within the fire

perimeter. Thompson Reservoir was rated as having 72 percent and 28 percent of the inventoried subwatershed area as low and moderate compaction, respectively. No transect within Thompson Reservoir was found to have high compaction and therefore is rated as functioning appropriately.

The canopy analysis showed that approximately 61 percent, 43 percent and 75 percent of Lodgepole Pine, Ponderosa Pine and White Fir, respectively, were within the historic range of variability. Overall, 50 percent of the subwatershed is outside of HRV, which places the subwatershed at **functioning at unacceptable risk**.

Information regarding the stream information for Thompson Reservoir subwatershed is only available for a Guyer Creek, a perennial stream, and two intermittent streams: Strawberry and Indian Creeks. Approximately 3.0 miles of Guyer Creek are in the project area, 1.9 on National Forest System Lands and 1.1 on private lands. No data is available for the private portions of Guyer Creek and all discussions regarding Guyer Creek will be regarding that portion on National Forest System Lands. All 3.0 miles of Guyer Creek within the fire perimeter burned during the Silver Fire. Mortality in RHCAs varied from low to moderate with pockets of very high. Along Guyer Creek, the riparian vegetation immediately adjacent to the channel was lightly to moderately burned. Some overstory ponderosa pines in the RHCAs and adjacent uplands were burned to the crowns or suffered significant heat scorch. Few pieces of large woody debris in the stream channel and adjacent floodplain was consumed throughout the affected reaches.

The dominant plant types in Guyer Creek are highly similar to late-seral species in composition and structure, resulting in bank stability values of 99 percent of greater. Again, there is evidence of lodgepole pine encroachment into the riparian area in every reach. Similar to both West Fork Silver and North Fork Silver Creeks, the abundance of late-seral vegetation, primarily alder, willow, and sedge, promotes the high bank stability values found along the entire length of Guyer Creek. All of the reaches surveyed are in an allotment that was either vacant or in non-use from 1990-1997. Current grazing strategies in Reach 2 call for short season/early grazing, which will continue to allow riparian areas to move towards their potential, while the upper reaches (outside of the project area) will not be grazed, as they have been administratively excluded from the allotment. The altered fire regime in the region continues to promote higher densities of lodgepole pine in riparian areas, creating a minor shift in relative species abundance. Ochoco Bottomline surveys of two intermittent streams, Strawberry Creek and Indian Creek, within Thompson Reservoir were completed after the fires of 2002. The overall stability rating for Strawberry and Indian Creeks was 94 percent and 93 percent, respectively. Silver Creek and Squaw Creek were not inventoried after the fire because little to none of these intermittent streams is located inside of the fire boundary. This information yields a **functioning appropriately** rating for the subwatershed.

Aquatic Habitat Condition

Table 3.147 Aquatic Habitat Rating in Guyer Creek, Summer 2000

Reach	Reach Length (miles)	Owner	Desired Wetted Width (‘)	Gradient (%)	Reach	LWD/ Mile	Pools/ Mile	Large Pools/ Mile	Spawning Gravel Fines (%)	Rosgen Channel Type
						50% / 75%	50% / 75%	50% / 75%		
1		Private			1 Desired				<20	
					1 Current				NA	
					1 Rating					
2	1.9	USFS	8	2	2 Desired	13 / 56	40 / 67	1 / 3	<20	B, E
					2 Current	52	107	0	NA	B, E_b B_c, E
					2 Rating	FA	FA	FUR		FA
3	2.9	USFS	7	2-4	3 Desired	15 / 64	45 / 76	1 / 3	<20	E, B
					3 Current	60	137	0	46	E_b, E, B_c, B
					3 Rating	FA	FA	FUR	FUR	FA
4	0.7	USFS	5	2-4	4 Desired	21 / 90	63 / 107	1 / 4	<20	E_b, B
					4 Current	48	155	0	NA	E_b, B
					4 Rating	FA	FA	FUR		FA
5	2.0	USFS	5	2-4	5 Desired	21 / 90	63 / 107	1 / 4	<20	E_b, E, B
					5 Current	52	151	0	46	E_b, E, B
					5 Rating	FA	FA	FUR	FUR	FA
6	1.1	USFS	4	>4	6 Desired	26 / 88	40 / 77	0 / 0	<25	B_a, B, A
					6 Current	36	78	0	NA	B_a, B, A
					6 Rating	FA	FA	FA		FA

FA – Functioning Appropriately, FAR – Functioning Appropriately but-at-Risk, FUR – Functioning At Unacceptable Risk, NA – Information Not Available; Habitat Abbreviations and Explanations: LWD – Large Woody Debris; Large Pools – Pools > 2.6 feet deep; percent Spawning Gravel Fines - <6.4mm

Table 3.148 Channel Condition for Intermittent Streams within Thompson Reservoir Subwatershed

REACH	ROSGEN	POOLS PER MILE			LARGE WOOD PER MILE			SUBSTRATE		REACH
	TYPE	50th	75th	Total	50th	75th	Total	DOM	SUB.	LENGTH (mi)
STRAWBERRY CREEK										
2	B	10	15	77	7	28	148	Sand	Gravel	1.5
3	A/B	25	37	64	17	72	43	Gravel	Sand	1.6
4	B	51	77	84	35	150	26	Gravel	Boulder	0.4
INDIAN CREEK										
1	C	15	22	34	10	43	34	Gravel	Sand	0.4
3	C	16	25	50	11	48	52	Grass	Silt/clay	0.9
4	B	37	57	38	26	109	68	Sand	Gravel	0.4

Channel condition will be characterized and rated for functionality with respect to pool frequency, large wood frequency, temperature, fine sediment and fish passage. The pool frequency is greater than the 75th percentile in the surveyed reaches of Guyer Creek and Strawberry Creek and in two of the three reaches in Indian Creek. The reach that is below the 75th percentile is less than 0.4 miles long and just greater than the 50th percentile. This information yields a **functioning appropriately** rating because the overwhelming characteristic of the surveyed streams is above the 75th percentile for pools. In terms of the large pool component, however, no deep (large) pools could be found in any of the reaches of Guyer Creek. Thus, all reaches of Guyer Creek received **functioning at unacceptable risk** ratings for the large pool habitat element. The large wood per mile for almost all reaches surveyed is between the 50th and 75th percentile and rates as **functioning at risk**.

Temperature data is available on Guyer Creek at 5360 feet elevation and is located outside of the fire perimeter. The recorded seven-day average maximum temperature for 1994, 1995, 1996, 1997 and 2000 is 17.0°C, 15.0°C, 15.6°C, 15.0°C and 16.2°C, respectively. There is no known data for temperature on any other stream within this subwatershed. The seven-day average maximum for the years of record is less than 17.8°C and **functioning appropriately**.

Forty-six percent fine sediments were documented at the sampling sites located in reaches upstream of the project area, promoting only 13 percent embryo survival. Although no measurements have been made in reach 2, it is assumed that higher than normal sediment levels occur here as well thus resulting in **functioning at unacceptable risk** rating.

The relatively high sediment levels reported within these upper reaches are somewhat unexpected as road crossings and bank instability are both minimal upstream from the sampling locations. One possible explanation is that the samples were taken at the lower end of a low gradient meadow reach, which may act as a natural settling point for fine sediment. In addition, reported values are likely associated with the naturally high erosion rates associated with soils and geomorphology of the area.

There are eight inventoried culverts within the Thompson Reservoir subwatershed and seven road crossings. Two culverts are inside of the fire perimeter, on intermittent streams, and one impedes fish passage while the other lacks information to make a determination. Four of the five culverts of Guyer Creek impede fish passage and are all located outside of the fire perimeter. Two of the four red culverts are located in the lower reaches of the stream system while the other two are in the upper reaches of the system. Replaced in 2000, the green culvert is located in the mid reaches of the system at road 3038000. The final culvert is high in the system, impedes fish passage and is located on an unnamed intermittent stream. The fish passage condition in Thompson Reservoir is **functioning at unacceptable risk** due to the red culverts low in the system on Guyer Creek.

All reaches of Guyer Creek are **functioning appropriately** in terms of their potential stream type as the shape and size of the stream channel is in balance with its setting. The abundance of alder and sedge in these reaches promotes high bank stability and narrow and deep channels that are resistant to the erosive energy associated with high flows. In addition, management activities appear to be conducive to maintaining vegetation in floodplains, which are able to dissipate energy associated with high flow events. Any modification to the magnitude and timing of stream flows has not shifted channels from their natural potential, even though upland vegetation and road density both received functioning appropriately but-at-risk ratings.

The current condition of Thompson Reservoir, with the functionality ratings for each element considered under Cumulative Watershed Effects, is shown in the summary table under "Environmental Consequences – Cumulative Watershed Effects".

Generally, Thompson Reservoir was rated as having moderate subwatershed sensitivity when compared to the other subwatersheds analyzed. It was not rated as high sensitivity with respect to any elements. The roads category and fish passage were rated as functioning at unacceptable risk. Canopy and large wood frequency were rated as functioning at risk. Soil compaction, bank stability, pool frequency, and temperature were rated as functioning appropriately. Sediment information was not available.

Past Activities

- Fuels reduction: Under-burning: 1984-1989: 1500 acres, 1990-1994: 270 acres, 1995-1999: 1860 acres, 200-2002: 350 acres. Pretreatment: 2000-2002: 4100 acres and 200-2002 160 acres. Pile burning: 1990-1994: 420 piles, 1995-1999 50 piles. Post harvest burning 600 acres 1990-1994. Crushing 150 acres 1995-1999. *Underburning and pile burning is typically at low severity and had little impact on the subwatershed. Crushing may increase compaction but most likely had little impact on the subwatershed.*
- Silvicultural activities within the subwatershed have included timber stand improvement or the thinning of sub-merchantable trees and merchantable harvest of timber. Timber stand improvement within this subwatershed occurred on 5,996 acres. Timber harvest activities on forest service land have focused on modifying structure and composition of stand while generating merchantable products. This subwatershed has seen 7,366 acres of harvest varying from intermediate, regeneration of both even aged and uneven aged, and salvage harvest. *Past timber harvest activities have been the main reason for high road densities within the subwatershed and the problems associated with high road densities. Timber harvest can also caused compaction and other detrimental soil conditions, expose areas to increased surface erosion, and may modify streamflow regimes. General watershed effects of timber removal on watersheds are well documented (Meehan, 1991, Troendle and Leaf, 1981) though no specific studies have been completed on the Fremont National Forest .*
- Personal use firewood: Approximately 300 personal use firewood permits sold at district with 2.5 percent occurring in this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Grazing has occurred in the Yamsay Mountain allotment on the subwatershed as early as 1944 with sheep then transitioned to cattle in 1946. Numbers of animals have drastically reduced from 1000 in 1944, 172 cattle in 1946, 323 cattle in 1961, 100 cattle in 1967, 200 cattle in 1979 on a rest/rotation, not used in 1992 through 1999, 50-100 short duration cattle from 2000 to 2002, and currently 100 cattle early deferred. *Clearly the use in the past has been heavy, but current management of livestock has limited their impacts on the subwatershed.*
- Grazing has occurred in the Winter Rim pasture on the subwatershed as early as 1966 with sheep then transitioned to cattle in 1981. Numbers of animals have drastically reduced from 1500-2500 in 1966 to 300 cattle in 1981 to a 2 pasture rotation with 282 cattle to early season use with 660 cattle to currently 282 cattle on a 2 pasture rotation. Thompson Valley Allotment was through the summer months of 1946-1955 by 220 cattle. Foster Butter Allotment was used in 1966 by 1602 cattle on a rest rotation, 1980-1992 by 6807 AUMS on rest rotation by pasture and 1993-2002 by 6297 AUMS early season. Silver Creek common was used by 1000 sheep in September 1940-1942 and by 100 cattle from 1961-1980 (May – Sept.). *Clearly the use in the past has been heavy, but current management of livestock has limited their impacts on the subwatershed.*
- Powerline and communications facilities consist of 1.5 miles of 500 KV BPA/PGE/PPL powerline and 6 miles of Midstate Electric powerline. *No known problems with these facilities exist with respect to soil and water.*
- Recreational trail and dispersed recreational sites. *Activities associated with the trail and recreational areas at isolated or concentrated locations near streams may cause limited resource damage in the form of compaction or trampling.*
- Thompson Reservoir Campground and East Bay Campground. Associated paved surfaces limit infiltration and increase running timing minimally. *Compacted areas around campsites and facilities limit infiltration and may increase ponding.*
- Route marking on existing roads for Pole Butte Snowpark and Trail system. *Little to no problems associated with this activity exist with respect to soil and water.*
- One water impoundment. *Concentrated use by vehicles, livestock and wildlife around pond may cause compaction problems and associated water ponding on the surface.*
- The reservoir may or may not provide for fish movement through the infrastructure. *Ponding of water exposes more surface area to radiant heat and causes increases in water temperature.*

- Non-industrial private land has partially harvested a limited number of ponderosa pine. *Little impact on soil and water has occurred as a result of this activity.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Past fire activity shows there have been 155 fires since 1948, of which 88 percent of the acres burned were human caused and the largest fire was 3,240 acres. *The intense fire suppression has resulted in more dense stands throughout the area and may help lead to more intense fires that would have historically occurred.*
- 2002 Fire Suppression. 30 miles of dozer line and 1 mile of hand line were constructed within the subwatershed and trees were fallen for safety or suppression objectives. *The additional compacted surface of dozer lines add to the road density and sedimentation problems associated with roads/trails. It is assumed that dozer lines were rehabilitated with waterbars and drainage according to BMPs and have reduced sediment production to background levels.*
- 2002 Fire Suppression-Retardant Drops. There was some retardant dropped on the subwatershed. *The exact locations of the drops are unknown but it is assumed the effects are limited due to the limited number of drops and the nature of the material.*
- Aspen enhancement. 130 acres in 2000. *The enhancement of riparian vegetation, particularly where conifer encroachment occurs has a positive effect on the watershed.*
- BAER projects. Drainage ditches were cleaned throughout subwatershed. *This activity facilitated proper movement of moisture off of roads.*
- Industrial forest lands. Throughout the analysis area have logged extensively throughout the 20th century. By 2000, almost all stands were logged at least once. *The extensive use on private lands has increased ground disturbance and increased erosion.*

Toolbox Fire Recovery Project Activities (on a subwatershed basis)

Direct and indirect effects *on a project area basis* were discussed early in the Watershed section. This section concerns itself with how those direct and indirect effects apply to a cumulative effects finding, on a *subwatershed* basis.

The elements discussed under direct and indirect effects as they pertain to the Thompson Reservoir subwatershed are found below.

Table 3.149 Thompson Reservoir Direct and Indirect Effects by Alternative

THOMPSON RESERVOIR	ALT. A	ALT. C	ALT. D	ALT. E	ALT. G	ALT. H
TOTAL COMMERCIAL SALVAGE (acres)	0	3,060	1,195	2,684	3,059	2,829
GROUND BASED COMMERCIAL SALVAGE (acres)	0	3,060	1,195	2,684	3,059	2,829
AERIAL COMMERCIAL SALVAGE (acres)	0	0	0	0	0	0
PERCENT OF SUBWATERSHED AREA SALVAGE	0%	7%	3%	7%	7%	7%
TOTAL RHCA COMMERCIAL SALVAGE (acres)	0	109	37	110	108	37
RHCA 1 (acres)	0	1	0	1	0	0
RHCA 3 (acres)	0	60	28	60	60	28
RHCA 4 (acres)	0	48	9	48	48	9
TEMPORARY ROADS (miles)	0	2.58	0	2.04	2.58	2.47
RE-OPEN UNCLASSIFIED ROADS (miles)	0	0.74	0	0.74	0.74	0.74
PRESCRIBED FIRE (acres)	0	0	0	0	0	0
ROADS						
OPEN ROAD DENSITY (mi/mi^2)	3.95	3.67	3.59	3.70	3.70	3.63
CLOSE ROADS (mi)	0.0	5.4	8.0	9.7	0.6	5.4
DECOMMISSION ROADS (mi)	0.0	12.5	15.2	6.1	15.2	15.2
OPEN ROADS (mi)	253.9	236.0	230.7	238.1	238.1	233.3
SEDIMENT SAVINGS FROM ROAD ACTIONS (tons/yr)	0.00	0.07	0.08	0.06	0.06	0.07
SEDIMENT LOSS FROM OPEN ROADS (tons/yr)	1.82	1.75	1.74	1.75	1.75	1.75
OPEN ROADS within 300 ft of STREAM (mi)	5.6	3.8	3.5	3.9	3.8	3.5
CLOSE ROADS within 300 ft of STREAM (mi)	0.0	0.4	0.4	0.1	0.0	0.4
DECOMISSION ROADS within 300 ft of STREAM (mi)	0.0	1.4	1.7	1.6	1.8	1.7

Present and Future Activities

- Grazing in the Yamsay Mountain Allotment is currently at 100 cattle early deferred from July 16 to August 31 and planning under NEPA is scheduled for 2007. Foster Butter Allotment is expected to have a NEPA decision before 2004 grazing season. Current use is based on 2003 monitoring and NEPA decision. Winter Rim Allotment will have a NEPA decision before 2004 grazing season and use will be based on 2003 monitoring and NEPA decision. Recently burned areas compared to unburned areas produce more aboveground biomass (Tracy and McNaughton, 1996). This in concert with the active control of livestock in burned areas to keep cattle off of riparian area should be effective. *The NEPA analysis or Rangeland Health Assessments (BLM) will allow for thorough review of the grazing within this allotment.*
- Personal use firewood: In 2002, an estimated 981 cords were removed from this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Some removal of timber from private non-industrial forest lands. *This is a small portion of the subwatershed and should have little impact on soil and water within the subwatershed.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- 517 East Forest Recovery Project/Triad Restoration Project: These treatments include reintroduction of fire where fire historically played a role, commercial and pre-commercial thinnings, aspen enhancements, and large woody debris additions to Squaw Creek. *Any sediment input to these streams because of this project is predicted to have an insignificant effect on redband trout because of the minimal quantities and low risk of entering fish habitat because of riparian buffers, mitigation measures, and Forest BMPs. This project would have beneficial affects on the subwatershed.*

Cumulative Watershed Effects

See also "Summary Table – Thompson Reservoir Subwatershed Cumulative Watershed Effects" that follows discussion.

Alternative A

The number of roads that remain open under this alternative and the number of open roads within 300 feet of stream channels are of concern. The road density under this alternative is the second highest of the eight subwatersheds analyzed. No ground disturbing activity as a result of salvage harvest and fuels reduction would occur under this alternative. However, the number of miles of road would allow a chronic sediment source and allow for a maximum increase in the drainage network to continue. The calculation of sediment loss from roads equates to 0.09 pound of sediment per acre within this subwatershed.

Action Alternatives

Approximately 20 percent of the subwatershed burned in 2002 and activity on only 20 percent of the subwatershed is within the analysis area. The salvage harvest and associated fuels reduction accounts for activity on 7 percent of the subwatershed area for all alternatives except Alternative D. Salvage and fuels activity accounts for 3 percent of the subwatershed area in Alternative D. The minor amount of sediment associated with the harvest and the very limited amount of the subwatershed affected by the harvest should have little to no impact on the subwatershed. There is no prescribed fire planned in this subwatershed. The temporary and unclassified roads would temporarily increase the miles of road by 1.3 percent for Alternatives C, G and H and by 1.1 percent for Alternative E. No temporary or re-opened unclassified roads are expected for Alternative D. The increase in road miles would be short term and proper decommissioning of the roads would occur after the activity is complete. The unclassified road density would decrease from 0.93 mi/mi^2 to 0.64 mi/mi^2, 0.85 mi/mi^2, 0.71 mi/mi^2, 0.64 mi/mi^2 and 0.66 mi/mi^2. Sedimentation from salvage harvest is expected to be similar and minor for all action alternatives.

Due to approximately only 20 percent of the subwatershed being inside of the analysis area, the roads management activities within the subwatershed are somewhat limited. Approximately 5.4 miles of road would be closed and 15.2 miles of road would be decommissioned under Alternatives D and H. Alternative C would close 5.4 miles of road and decommission 12.5 miles of road. Under Alternative E 9.7 miles would be closed and 6.1 miles would be decommissioned. Under Alternative G, 0.6 miles would be closed and 15.2 miles would be decommissioned. The reduction in road density is less than 10 percent in all alternatives compared to the original road density. The closure and decommissioning of 2.1 to 1.7 miles of road within 300 feet of intermittent and perennial streams would be an improvement to the health of the

subwatershed under all alternatives. The sediment savings from road actions is generally the same in all alternatives as is the sediment loss from roads within this subwatershed. The road density would remain high for the subwatershed under all alternatives. Alternatives C, D and H are the most aggressive with respect to road activity and would result in the most benefit of the action alternatives.

Temperature characteristics in the streams of the subwatershed are not expected to change as a result of any of the action alternatives.

Aspen enhancement, large wood placement and deciduous planting in perennial riparian areas would be implemented in Alternatives C, D, G and H. The enhancement of riparian vegetation, particularly where conifer encroachment occurs, has a positive effect on the subwatershed. Large wood placement would take place within the subwatershed and provide for hiding cover and stream variability that would enhance fish habitat. Deciduous planting in riparian areas of the perennial stream in the subwatershed would occur in areas that burned particularly hot.

The high road density currently within the subwatershed and the short-term sedimentation associated with closure and decommissioning in order to reduce chronic problems from high road densities is a point of concern to varying degrees for all action alternatives. The subwatershed sensitivity was moderate. For these reasons, cumulative effects in the subwatershed are expected to be moderate. In addition, the effective rehabilitation of the suppression activities, monitoring and management of livestock use and allotment condition should not adversely affect the subwatershed.

Table 3.150 Summary Table – Thompson Reservoir Subwatershed Cumulative Watershed Effects

	NAME - HUC								
WATERSHED	SILVER CREEK - 1712000502								
SUBWATERSHED	**THOMPSON RESERVOIR -** 171200050205								
	LOW		MODERATE			HIGH			
SUBWATERSHED SENSITIVITY			X						
Characteristic(s) rated HIGH	None								
	CURRENT CONDITION - FUNCTIONALITY			**Alt A**	**Alt C**	**Alt D**	**Alt E**	**Alt G**	**Alt H**
ELEMENTS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK	RESTORE (**R**), MAINTAIN (**M**) or DEGRADE (**D**). Improvement as a result of the project? – **Yes** or **No**					
UPLANDS									
Roads			**X**	**D**	**M - Yes**	**M - Yes**	**M - Yes**	**M - Yes**	**M - Yes**
Canopy			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Soil	**X**			**M**	**M**	**M**	**M**	**M**	**M**
RIPARIAN VEGETATION / BANK STABILITY	**X**			**M**	**M**	**M**	**M**	**M**	**M**
CHANNEL CONDITIONS									
Pool frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Large wood frequency		**X**		**M**	**R - Yes**	**R - Yes**	**M - No**	**R - Yes**	**R - Yes**
Temperature	X			**M**	**M**	**M**	**M**	**M**	**M**
Fine sediment	NOT AVAILABLE								
Fish passage			**X**	**M**	**M**	**M**	**M**	**M**	**M**

Upper Duncan Creek

Existing Condition

Sensitivity

Upper Duncan Creek 6th field watershed (subwatershed) (HUC 171200050301) is approximately 35 square miles and is part of the Silver Lake 5th field watershed. There are no perennial streams within the subwatershed but there are several intermittent streams. The subwatershed is dominated by Duncan Creek, which is approximately 11 miles long and characterized by a series of steep canyons and high elevation meadows. The headwaters of Duncan Creek begin at Winter Rim and several intermittent tributaries to Duncan Creek original off of the east face of Foster Butte. The subwatershed has several small, seasonally wet, high elevation lakes located in the western portion of the subwatershed. McCall Creek is the primary intermittent stream in the subwatershed and drains the northwestern portion of the subwatershed.

Hydrologic soil group C, which is characterized by slow rates of infiltration and water transmission, characterizes nine percent of the subwatershed. Hydrologic soil group D, which is characterized by very slow rates of infiltration and water transmission, characterizes thirteen percent of the subwatershed. Twenty-two percent of the subwatershed area is characterized by hydrologic soil group C and D. The total index percent of hydrologic group C and D was rated as **low**. The subwatershed is dominated by very stable mass wasting characteristics with 72 percent of the subwatershed being rated as very stable. Three percent of the area is at some risk for rotational slumps. The sensitivity index for mass wasting was **moderate** for this subwatershed. All subwatersheds receive limited amounts of precipitation on average, which yields a less sensitive watershed on the whole. Approximately 60 percent of the Upper Duncan Creek subwatershed is located within the rain-on-snow range and was rated as **moderate**.

Upper Duncan Creek has a very low drainage density of 0.84 mi/mi^2, which is well below the low class of 3 to 4 mi/mi^2 (Strahler, 1964). In comparison to the other subwatersheds in the analysis area Upper Duncan Creek was rated as **low**. Subwatershed relief for Upper Duncan Creek is the lowest of the eight subwatersheds being analyzed and was rated as **low** sensitivity. Over approximately 10.8 miles, an elevation of 1620 feet is lost for a resultant subwatershed relief ratio of 0.03 ft/ft. The centroid elevation of Upper Duncan Creek is 5930 feet, which is the second highest in the analysis area and rated as **high**. A higher centroid elevation value tends toward a more sensitive subwatershed.

Overall, Upper Duncan Creek has limited precipitation, no perennial streams, low sensitivity for streamflow generation areas, moderate sensitivity for mass wasting, and moderate sensitivity for rain-on-snow potential. The channel information rated as low for drainage density and subwatershed relief and high for centroid elevation. This information leads one to conclude that East Duncan Creek subwatershed has **moderate** sensitivity when compared to the other subwatersheds within the analysis area.

Functionality

Upper Duncan Creek is dominated by low-severity burn. Approximately 80 percent of the subwatershed burned with 0.1 percent, 12.4 percent and 67.5 percent of the subwatershed burned at high, moderate and low-severity, respectively.

The roads, canopy and soils within the subwatershed will be used to characterize the uplands of Upper Duncan Creek. According to the transportation layer in Geographical Information Systems (GIS) there are 134 miles of road within Upper Duncan Creek subwatershed equating to an open road density of 3.87 mi/mi^2, which places the subwatershed **functioning at unacceptable risk**. The Riparian Habitat Conservation Area (RHCA) for an intermittent stream is 50 feet on each side of the stream. Of the 134 miles of road approximately 1.6 miles are located within the RHCA for intermittent streams. There are 10.7 miles or 8 percent are located within 300 feet of intermittent streams. Roads cross channels at 36 locations, sites where direct sediment introduction occurs. The road impact index (RII) was calculated to be 0.47. Along with the 29 miles of stream channels, an estimated 80 of the 134 miles of road are hydrologically integrated with the stream network, thus increasing the drainage network by 278 percent—using study results from Wemple (1994).

The capability areas within Upper Duncan Creek were rated as having 65 percent of the area as low potential for erosion, 98 percent of the area as high potential for compaction, 93 percent of the area as low potential for displacement, and 100 percent as low potential for mass movement. Transects used to measure compaction were measured after the fire took place and were only measured on Forest Service land within the fire perimeter. Upper Duncan Creek was rated as having 72 percent and 28 percent of the inventoried subwatershed area as low and moderate compaction, respectively. No transect within Upper Duncan Creek was found to have high compaction and therefore is rated as **functioning appropriately**.

The canopy analysis showed that approximately 74 percent, 43 percent and 65 percent of Lodgepole Pine, Ponderosa Pine and White Fir, respectively, were within the historic range of variability. Overall, 49 percent of the subwatershed is outside of HRV, which places the subwatershed at **functioning at unacceptable risk**.

Riparian vegetation and bank stability information for the Upper Duncan Creek subwatershed was generated from Ochoco Bottomline surveys for intermittent streams in fall of 2002. The streambank stability values will be used as a surrogate for the riparian vegetation rating. Inventories were completes on the main stem of Duncan Creek and McCall Creek. The inventories found 97 percent stability on Duncan Creek, 88 percent and 96 percent stability on two 0.5-mile reaches of McCall Creek. Therefore, the bank stability rating for Duncan Creek is **functioning appropriately** due to the overall stability of the length of stream inventoried is greater than 90 percent.

Channel condition will be characterized and rated for functionality with respect to pool frequency, large wood frequency, temperature, fine sediment and fish passage. The pool frequency and large wood frequency is greater than the 75th percentile in two of the three surveyed reaches of Duncan and McCall Creek. The second reach in McCall Creek is below the 50th percentile and functioning at unacceptable risk. However, the rating for pools and large wood per mile for over 90 percent of the surveyed streams is **functioning appropriately** and is the rating for the entire subwatershed. No known measures of fine sediment were made for any of the intermittent streams within Upper Duncan Creek subwatershed. No temperature data is known to be available for any streams within this subwatershed. There are zero inventoried culverts in this subwatershed.

Table 3-151 Upper Duncan Creek Subwatershed Channel Condition

REACH	ROSGEN	POOLS PER MILE			LARGE WOOD PER MILE			SUBSTRATE		REACH
	TYPE	50th	75th	Total	50th	75th	Total	DOM	SUB.	LENGTH (mi)
DUNCAN CREEK										
1	B	6	11	65	1	5	68	Boulder	Gravel	4.2
McCALL CREEK										
1	C	17	26	43	12	49	19	Cobble	Gravel	0.6
2	C	18	27	8	12	52	8	Sand	Cobble	0.5

The current condition of Upper Duncan Creek, with the functionality ratings for each element considered under Cumulative Watershed Effects, is shown in the summary table under "Environmental Consequences – Cumulative Watershed Effects". Generally, Upper Duncan Creek was rated as having moderate subwatershed sensitivity when compared to the other subwatersheds analyzed. It was rated as high sensitivity with respect to the centroid elevation. The roads category was rated as functioning at unacceptable risk. Canopy, soil compaction, bank stability, pool frequency and large wood frequency were rated as functioning appropriately. Temperature, sediment and fish passage information was not available.

Past Activities

- Fuels reduction: Under-burning: 1995-1999: 250 acres. Pile burning: 1990-1994: 220 piles. Post harvest pile burning: 1995-1999: 560 acres. *Underburning is typically at low severity and had little impact on the subwatershed.*
- Silvicultural activities within the subwatershed have included timber stand improvement or the thinning of sub-merchantable trees and merchantable harvest of timber. Timber stand improvement within this subwatershed occurred on 2,106 acres. Timber harvest activities on forest service land have focused on modifying structure and composition of stand while generating merchantable products. This subwatershed has seen 3,270 acres of harvest varying from intermediate and regeneration of both even aged and uneven aged harvest. *Past timber harvest activities have been the main reason for high road densities within the subwatershed and the problems associated with high road densities. Timber harvest can also caused compaction and other detrimental soil conditions, expose areas to increased surface erosion, and may modify streamflow regimes. General watershed effects of timber removal on watersheds are well documented (Meehan, 1991, Troendle and Leaf, 1981) though no specific studies have been completed on the Fremont National Forest .*
- Personal use firewood: Approximately 300 personal use firewood permits sold at district with 2.5 percent occurring in this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*

- Grazing has occurred in the Winter Rim pasture on the subwatershed as early as 1966 with sheep then transitioned to cattle in 1981. Numbers of animals have drastically reduced from 1500-2500 in 1966 to 300 cattle in 1981 to a 2 pasture rotation with 282 cattle to early season use with 660 cattle to currently 282 cattle on a 2 pasture rotation. *Clearly the use in the past has been heavy, but current management of livestock has limited their impacts on the subwatershed.*
- Powerline and communications facilities consist of 6 miles of 500 KV BPA/PGE/PPL powerline and 2 miles of 500 KV PPL powerline. *No known problems with these facilities exist with respect to soil and water.*
- Recreational trail. *Activities associated with the trail and recreational areas at isolated or concentrated locations near streams may cause limited resource damage in the form of compaction or trampling.*
- Route marking on existing roads for Pole Butte Snowpark and Trail system. *Little to no problems associated with this activity exist with respect to soil and water.*
- Four water impoundments. *Concentrated use by vehicles, livestock and wildlife around pond may cause compaction problems and associated water ponding on the surface.*
- An estimated 5390 acres of timber were removed from private land within the subwatershed, which equates to 24 percent of the subwatershed in the fall of 2002. *The long 2003 rain and snow season extending from March into May provided soil moisture conditions for seedbed response and ground cover recovery. The removal of salvage timber directly after the fire occurred along with the response to the fire allowed for greater sedimentation directly after the fire occurred. However, the precipitation and the openings created by the salvage has allowed for good ground cover recovery on the private land and has therefore limited sediment transport opportunities.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Past fire activity shows there have been 76 fires since 1948, of which 76 percent of the acres burned were caused by lightning and the largest fire was 120 acres. *The intense fire suppression has resulted in more dense stands throughout the area and may help lead to more intense fires that would have historically occurred.*
- 2002 Fire Suppression. 29 miles of dozer line were constructed within the subwatershed and trees were fallen for safety or suppression objectives. *The additional compacted surface of dozer lines add to the road density and sedimentation problems associated with roads/trails. It is assumed that dozer lines were rehabilitated with waterbars and drainage according to BMPs and have reduced sediment production to background levels.*
- Ponderosa pine thinning. 2 acres in 2000. *The reduction of overstocking of ponderosa pine stands has a positive effect on the watershed.*
- Juniper thinning. 30 acres in 2000. *The thinning of this aggressive species that has well surpassed historic stocking has a positive effect on the subwatershed.*
- BAER projects. Drainage ditches were cleaned throughout subwatershed. *This activity facilitated proper movement of moisture off of roads.*
- Industrial forest lands. Throughout the analysis area have logged extensively throughout the 20th century. By 2000, almost all stands were logged at least once. *The extensive use on private lands has increased ground disturbance and increased erosion.*

Toolbox Fire Recovery Project Activities (on a subwatershed basis)

Direct and indirect effects *on a project area basis* were discussed early in the Watershed section. This section concerns itself with how those direct and indirect effects apply to a cumulative effects finding, on a *subwatershed* basis.

The elements discussed under direct and indirect effects as they pertain to the Upper Duncan Creek subwatershed are found below.

Table 3.152 Upper Duncan Creek Direct and Indirect Effects by Alternative

UPPER DUNCAN CREEK	ALT. A	ALT. C	ALT. D	ALT. E	ALT. G	ALT. H
TOTAL COMMERCIAL SALVAGE (acres)	0	2,202	1,237	1,792	2,205	1,975
GROUND BASED COMMERCIAL SALVAGE (acres)	0	2,128	1,188	1,792	2,130	1,975
AERIAL COMMERCIAL SALVAGE (acres)	0	75	49	0	75	0
PERCENT OF SUBWATERSHED AREA SALVAGE	0%	10%	6%	8%	10%	9%
TOTAL RHCA COMMERCIAL SALVAGE (acres)	0	136	43	111	136	43
RHCA 1 (acres)	0	0	0	0	0	0
RHCA 3 (acres)	0	105	40	92	105	40
RHCA 4 (acres)	0	31	3	19	31	3
TEMPORARY ROADS (miles)	0	1.39	0	1.05	1.39	1.38
RE-OPEN UNCLASSIFIED ROADS (miles)	0	2.36	1.49	1.08	2.36	1.8
PRESCRIBED FIRE (acres)	0	1,777	1,195	0	1,777	1,195
ROADS						
OPEN ROAD DENSITY (mi/mi^2)	3.86	2.86	2.86	3.42	3.42	2.86
CLOSE ROADS (mi)	0.0	21.0	21.0	15.2	1.9	21.0
DECOMMISSION ROADS (mi)	0.0	13.6	13.6	0.2	13.6	13.6
OPEN ROADS (mi)	133.7	99.1	99.1	118.2	118.2	99.1
SEDIMENT SAVINGS FROM ROAD ACTIONS (tons/yr)	0.00	0.14	0.14	0.09	0.09	0.14
SEDIMENT LOSS FROM OPEN ROADS (tons/yr)	0.87	0.72	0.72	0.77	0.77	0.72
OPEN ROADS within 300 ft of STREAM (mi)	5.2	3.0	3.0	3.4	3.4	3.0
CLOSE ROADS within 300 ft of STREAM (mi)	0.0	0.7	0.7	1.6	0.4	0.7
DECOMISSION ROADS within 300 ft of STREAM (mi)	0.0	1.5	1.5	0.2	1.4	1.5

Present and Future Activities

- Foster Butter Allotment is expected to have a NEPA decision before 2004 grazing season. Current use is based on 2003 monitoring and NEPA decision. Winter Rim Allotment will have a NEPA decision before 2004 grazing season and use will be based on 2003 monitoring and NEPA decision. Recently burned areas compared to unburned areas produce more aboveground biomass (Tracy and McNaughton, 1996). This in concert with the active control of livestock in burned areas to keep cattle off of riparian area should be effective. *The NEPA analysis or Rangeland Health Assessments (BLM) will allow for thorough review of the grazing within this allotment.*
- Personal use firewood: In 2002, an estimated 981 cords were removed from this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. The hand pulling of weeds would cause no detectable impact to soil and water. *There are no knows problems associated with this activity.*
- Windmill Restoration Project: This project proposes a variety of non-commercial treatments to restore the landscape to more historic conditions. These treatments include reintroduction of fire where fire historically played a role, pre-commercial thinnings, aspen enhancements, and large woody debris additions to East Duncan Creek. *Any sediment input to these streams because of this project is predicted to have no effect on redband trout because this species does not occur in these streams, which are intermittent. The subwatershed would benefit from these projects.*

Cumulative Watershed Effects

See also "Summary Table – Upper Duncan Subwatershed Cumulative Watershed Effects" that follows discussion.

Alternative A

The number of roads that remain open under this alternative generates the third highest road density of any subwatershed in the analysis area. There are 5.2 miles of road within 300 feet of intermittent and perennial streams that remain open under this alternative. No ground disturbing activity as a result of salvage harvest and fuels reduction would occur under this alternative. However, the number of miles of road would allow a chronic sediment source and allow for a maximum increase in the drainage network to continue. The calculation of sediment loss from roads equates to 0.07 pound of sediment per acre within this subwatershed.

Action Alternatives

Approximately 96 percent of the subwatershed burned in 2002. The salvage harvest and associated fuels reduction accounts for activity on 6 percent to 10 percent of the subwatershed area. The minor amount of sediment associated with the harvest and the small amount of the subwatershed affected by the harvest should have minimal impact on the subwatershed. However, the addition of the acres of prescribed burn increases the percent of treated subwatershed by 8 percent and 5.4 percent for Alternatives C and G and Alternatives D and H, respectively. In concert, the prescribed burning and salvage account for treatment on 11 percent and 14 percent for Alternatives D and H, respectively and 18 percent for both Alternatives C and G. However, several commercial salvage units are at coincident locations with the proposed prescribed burn locations. Assuming the prescribed burn is of low-severity and the salvage produces minor amounts of sediment, the treatment should not be detrimental to the subwatershed. If either of the preceding statements is not true, the probability of detectable effects on the subwatershed increases in Alternative C and G and to a lesser degree in Alternative D and H. Several of the salvage units are coincident with the locations of the proposed prescribed burn areas in Alternative C, D, G, and H. Temporary and unclassified roads would temporarily increase the miles of road by 2.8 percent for Alternatives C and G, by 2.4 percent for Alternative H, by 1.5 percent for Alternative E and by 1.1 percent for Alternative D. The increase in road miles would be short term and proper decommissioning of the roads would occur after the activity is complete. The unclassified road density would decrease from 0.93 mi/mi^2 to 0.64 mi/mi^2, 0.85 mi/mi^2, 0.71 mi/mi^2, 0.64 mi/mi^2 and 0.66 mi/mi^2. Sedimentation from salvage harvest is expected to be similar and minor for all action alternatives.

Due to nearly all of the subwatersheds being inside of the analysis area, the roads management activities within the subwatershed are extensive. Approximately 21.0 miles of road would be closed and 13.6 miles of road would be decommissioned under Alternatives C, D and H. Under Alternative E 15.2 miles and 0.2 miles are closed and decommissioned, respectively. Alternative G closed 1.9 miles of road and decommissioned 13.6 miles of road. The reduction in road density is greater than 10 percent of the original road density for all alternatives. Alternatives C, D and H reduce the road density by 26 percent from the original. The closure and decommissioning of 2.2 miles of road in

Alternative C, D and H and 1.8 miles of road in Alternative E and G within 300 feet of intermittent and perennial streams would be a primary improvement to the health of the subwatershed. The sediment savings from road actions is generally the same in all alternatives as is the sediment loss from roads within this subwatershed. The road density would remain high for the subwatershed under all alternatives. Alternatives C, D and H are the most aggressive with respect to road activity and would result in the most benefit of the action alternatives.

Temperature characteristics in the streams of the subwatershed are not expected to change as a result of any of the action alternatives.

The high road density currently within the subwatershed and the short-term sedimentation associated with closure and decommissioning in order to reduce chronic problems from high road densities is a point of concern to varying degrees for all action alternatives. The subwatershed sensitivity was moderate. For these reasons, cumulative effects in the subwatershed are expected to be moderate. In addition, the recovery on private land salvage harvest, the effective rehabilitation of the suppression activities, monitoring and management of livestock use and allotment condition should not adversely affect the subwatershed.

Table 3.153 Summary Table – Upper Duncan Creek Subwatershed Cumulative Watershed Effects

	NAME - HUC								
WATERSHED	SILVER LAKE - 1712000503								
SUBWATERSHED	**UPPER DUNCAN CREEK -** 171200050301								
	LOW		MODERATE			HIGH			
SUBWATERSHED SENSITIVITY			X						
Characteristic(s) rated HIGH	Centroid elevation								
	CURRENT CONDITION - FUNCTIONALITY			**Alt A**	**Alt C**	**Alt D**	**Alt E**	**Alt G**	**Alt H**
ELEMENTS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK	RESTORE (**R**), MAINTAIN (**M**) or DEGRADE (**D**). Improvement as a result of the project? – **Yes** or **No**					
UPLANDS									
Roads			**X**	**D**	**R - Yes**	**R - Yes**	**M - Yes**	**M - Yes**	**R - Yes**
Canopy			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Soil	**X**			**M**	**M**	**M**	**M**	**M**	**M**
RIPARIAN VEGETATION / BANK STABILITY	**X**			**M**	**M**	**M**	**M**	**M**	**M**
CHANNEL CONDITIONS									
Pool frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Large wood frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Temperature	NOT AVAILABLE								
Fine sediment	NOT AVAILABLE								
Fish passage	NOT AVAILABLE								

Upper Silver Creek

Existing Condition

Sensitivity

Upper Silver Creek 6th field watershed (subwatershed) (HUC 171200050206) is approximately 25 square miles and is part of the Silver Creek 5th field watershed. There is one perennial stream within the subwatershed and several intermittent streams. The perennial stream in the Upper Silver Creek subwatershed is the main stem of Silver Creek. This portion of Silver Creek begins at the outlet of Thompson Reservoir and flows for approximately 12 miles until it is joined by West Fork Silver Creek near the mouth of the subwatershed. Auger Creek is the primary intermittent stream within the subwatershed.

Hydrologic soil group C, which is characterized by slow rates of infiltration and water transmission, characterizes nine percent of the subwatershed. Hydrologic soil group D, which is characterized by very slow rates of infiltration and water transmission, characterizes thirteen percent of the subwatershed. Twenty-two percent of the subwatershed area is characterized by hydrologic soil group C and D. The total index percent of hydrologic group C and D was rated as **low** sensitivity. The vast majority, 83 percent, of the subwatershed is characterized by very stable mass wasting characteristics. One percent of the subwatershed is at risk for rotational slumps and one percent at risk for debris slides. The sensitivity index for mass wasting was **moderate**. All subwatersheds receive limited amounts of precipitation on average, which yields a less sensitive watershed on the whole. A rain-on-snow event is of particular concern any area with substantial snow pack. Upper Silver Creek is located midway in the system and on average holds snow in the upper elevations well into the spring. According to the estimated rain-on-snow range for the Silver Creek 5th field watershed of 4500-6000 feet, approximately 95 percent of the subwatershed is within this range. The sensitivity index for this element was rated as **high**.

Upper Silver Creek has low drainage density of 1.24 mi/mi^2, which is well below the low class 3 to 4 mi/mi^2 (Strahler, 1964). In comparison to the other subwatersheds in the analysis area Upper Silver Creek was rated as **high**. Subwatershed relief for Upper Silver Creek is high amongst the eight subwatersheds being analyzed and was rated as **high**. Over approximately 5.2 miles, an elevation of 2760 feet is lost for a resultant subwatershed relief ratio of 0.10 ft/ft. The centroid elevation of Upper Silver Creek is 5300 feet and is **moderate** for the analysis area. A higher centroid elevation value tends toward a more sensitive subwatershed.

Overall, Upper Silver Creek has limited precipitation, one perennial stream, low sensitivity for streamflow generation areas, moderate sensitivity for mass wasting, and high sensitivity for rain-on-snow potential. The channel information rated as high for drainage density and subwatershed relief and moderate for centroid elevation. This information leads one to conclude that East Duncan Creek subwatershed has **high** sensitivity when compared to the other subwatersheds within the analysis area.

Functionality

Upper Silver Creek is dominated by low-severity burn. Approximately 34 percent of the subwatershed burned with 0.4 percent, 1.9 percent and 31.4 percent of the subwatershed burned at high, moderate and low-severity, respectively.

The roads, canopy and soils within the subwatershed will be used to characterize the uplands of Upper Silver Creek. According to the transportation layer in Geographical Information Systems (GIS) there are 90 miles of road within Upper Silver Creek subwatershed equating to an open road density of 3.54 mi/mi^2, which places the subwatershed **functioning at unacceptable risk**. The Riparian Habitat Conservation Area (RHCA) for an intermittent stream is 50 feet on each side of the stream and 300 feet on each side of a perennial fish-bearing stream. Of the 90 miles of road approximately 2.0 miles are located within the RHCA for intermittent streams and 2.6miles are located with the RHCA for perennial fish-bearing streams. There are 14 miles or 16 percent are located within 300 feet of intermittent or perennial streams. Roads cross channels at 30 locations (3 perennial stream crossings and 27 intermittent stream crossings), sites where direct sediment introduction occurs. The road impact index (RII) was calculated to be 0.36. Along with the 32 miles of stream channels, an estimated 54 of the 90 miles of road are hydrologically integrated with the stream network, thus increasing the drainage network by 171 percent—using study results from Wemple (1994).

The capability areas within Upper Silver Creek were rated as having 50 percent of the area as low potential for erosion, 81 percent of the area as high potential for compaction, 94 percent of the area as low potential for displacement, and 94 percent as low potential for mass movement. Transects used to measure compaction were measured after the fire took place and were only measured on Forest Service land within the fire perimeter. Upper Silver Creek was rated as having 58 percent and 42 percent of the inventoried subwatershed area as low and moderate compaction, respectively. No transect within Upper Silver Creek was found to have high compaction and therefore is rated as **functioning appropriately**.

The canopy analysis showed that approximately 29 percent and 51 percent of Ponderosa Pine and White Fir, respectively, were within the historic range of variability. Sixty percent of the Ponderosa Pine acres were found to be below HRV. Overall, 68 percent of the subwatershed is outside of HRV, which places the subwatershed at **functioning at unacceptable risk**.

Stream information for Upper Silver Creek subwatershed is only available for a Silver Creek, the perennial stream within the Upper Silver Creek subwatershed. The majority of Silver Creek is within the Upper Silver Creek subwatershed. Approximately 9.3 miles of Silver Creek are in the project area. The entire 9.3 miles of Silver Creek burned at some level during the Silver Fire. Mortality in RHCAs varied from low to moderate with pockets ranging up to very high. Along Silver Creek, the riparian vegetation immediately adjacent to the channel was lightly to moderately burned. Numerous overstory ponderosa pines in the RHCAs and adjacent uplands were burned to the crowns or suffered significant heat scorch. Some large woody debris in the stream channel and adjacent floodplain was consumed throughout the affected stream reaches.

Reach 5 of Silver Creek begins at forest boundary and extends upstream 1.5 miles to the 2917 Road. Reach 6 begins at the 2917 Road and extends upstream 1.8 miles to the confluence of an intermittent stream entering from the east. Reach 7 begins at the confluence of this intermittent stream, extends upstream 2.3 miles, and ends approximately 0.3 miles upstream of the Auger Valley Dispersed Campsite. Reach 8 begins at this point and extends upstream 1.2 miles to the forest boundary.

The dominant plant types in reaches 5-8 (willow, dogwood, alder, sedge, and grass) are highly similar to late-seral species in composition and structure, resulting in adequate cover to protect stream banks and dissipate energy during high flows. There is evidence, however, of pine encroachment into the riparian area over much of the streams length in reaches 5 through 8. There are also small, localized areas of bank instability, mainly in reaches 5 and 7. Overall, late-seral species dominate and bank stability exceeds 98 percent in all surveyed reaches; consequently, this element is **functioning appropriately**.

The dominance of late-seral species in all reaches promotes their high bank stability values. Past livestock practices have likely influenced vegetative conditions but current grazing strategies are allowing riparian areas to be near their potential. Grazing strategies were changed in 1992 with all reaches being in a pasture that receives early-season grazing (livestock are off the pasture by August 15th). The altered fire regime in the region continues to promote higher densities of young pine in riparian areas, creating a minor shift in relative species abundance.

Aquatic Habitat Condition

The table below summarizes the data collected on aquatic habitat conditions for Silver Creek during the summer of 2000. It is used to reference discussion on the following aquatic habitat parameters: large woody debris, pools, spawning gravel fines, and Rosgen channel type. **Rating** refers to how that parameter is functioning, relative to desired condition for natural and near-natural by ICBEMP. ICBEMP criteria for evaluating functionality of aquatic habitats represents the best available science.

Table 3.154 Aquatic Habitat Ratings in Silver Creek, Summer 2000

Reach	Reach Length (miles)	Owner	Desired Wetted Width (‘)	Gradient (%)	Reach	LWD/ Mile	Pools/ Mile	Large Pools/ Mile	Spawning Gravel Fines (%)	Rosgen Channel Type
						50% / 75%	50% / 75%	50% / 75%		
1	0.7	USFS	17	1	1 Desired	**	17 / 30	3 / 7	< 20	C
					1 Current	0	49	38	NA	C
					1 Rating	FA	FA	FA		FA
2		Private			2 Desired				<20	
					2 Current				NA	
					2 Rating					
3		Private			3 Desired				<20	
					3 Current				NA	
					3 Rating					
4	1.6	BLM	22	1	4 Desired	1 / 6	13 / 23	3 / 6	<20	C, B_c
					4 Current	1	29	6	NA	C, B_c
					4 Rating	FAR	FA	FAR		FA

Table 3.154 Aquatic Habitat Ratings in Silver Creek, Summer 2000 (continued)

Reach	Reach Length (miles)	Owner	Desired Wetted Width (')	Gradient (%)	Reach	LWD/ Mile	Pools/ Mile	Large Pools/ Mile	Spawning Gravel Fines (%)	Rosgen Channel Type
5	1.5	USFS	22	1	5 Desired	1 / 6	13 / 23	3 / 6	<20	C, B_c
					5 Current	2	42	5	NA	C, B_c
					5 Rating	FAR	FA	FAR		FA
6	1.8	USFS	23	1	6 Desired	1 / 6	13 / 22	3 / 6	<20	C, B_c
					6 Current	2	43	6	NA	C, B_c
					6 Rating	FAR	FA	FAR		FA
7	2.3	USFS	23	1	7 Desired	1 / 6	13 / 22	3 / 6	<20	B_c, C
					7 Current	7	40	3	36	B_c, C
					7 Rating	FA	FA	FAR	FUR	FA
8	1.2	USFS	23	1	8 Desired	1 / 6	13 / 22	3 / 6	<25	B_c, C
					8 Current	7	49	3	NA	B_c, C
					8 Rating	FA	FA	FAR		FA
9	1.3	USFS	23	2	9 Desired	5 / 20	14 / 23	2 / 6	<25	B, B_c
					9 Current	9	44	3	NA	B, B_c

FA – Functioning Appropriately, FAR – Functioning At Risk, FUR – Functioning At Unacceptable Risk, NA – Information Not Available; Habitat Abbreviations and Explanations: LWD – Large Woody Debris at 12" diameter by 35' in length; Large Pools – Pools > 2.6 feet deep; percent Spawning Gravel Fines - <6.4mm

The pool frequency is greater than the 75th percentile in the surveyed reaches of Silver Creek within the subwatershed. This information yields a **functioning appropriately** rating. All of the reaches of Silver Creek in terms of the large pool component received a **functioning appropriately but at risk** ratings for the large pool habitat element. The large wood per mile for almost all reaches surveyed is between the 50th and 75th percentile and rates as **functioning at risk**. Fine sediment data was collected for Silver Creek in 1996 and 36 percent fines were measured. Measurement of fines greater than 30 percent places any stream into **functioning at unacceptable risk** for sediment.

Silver Creek is on the 303(d) list from the mouth to Thompson Valley Reservoir (see 303(d) listed waters section). The seven-day average daily maximum temperature for Silver Creek is collected at two sites. Silver Creek at 4530 feet elevation has documented seven-day average daily maximum temperatures of 22.8°C, 24.1°C, 23.9°C, 24.4°C and 26.2°C for 1993, 1997, 1998, 2000 and 2002, respectively. Silver Creek at 4920 feet elevation has documented seven-day average daily maximum temperatures of 20.2°C, 22.0°C and 24.3°C for 1993, 2000 and 2002, respectively. There is no known data for temperature on any other stream within this subwatershed. The seven-day average daily maximum for the years of record is greater than 17.8°C at Silver Creek and is therefore **functioning at unacceptable risk**. There is one inventoried culvert located on an intermittent tributary to Silver Creek in the upper reaches of the system outside of the fire perimeter. The culvert was found to impede fish passage and therefore the fish passage condition in Upper Silver Creek subwatershed is **functioning at risk**.

Measurements were made during the summer of 2000 to determine Rosgen Stream Channel Types for Silver Creek. Data was collected in each delineated stream reach and included channel gradient, substrate composition, channel sinuosity, bankfull width, bankfull depth, and floodprone area. The data was analyzed and calculations made to determine the channel type. All reaches of Silver Creek are **functioning appropriately** in terms of their potential stream type as the shape and size of the stream channel is in balance with its setting. The dominance of sedge, alder, willow and dogwood in these reaches promotes high bank stability and channels that are resistant to the erosive energy associated with high flows. In addition, management activities appear to be conducive to maintaining vegetation in the floodplains, which are able to dissipate energy associated with larger flow events. Although upland vegetation and road density both received functioning appropriately but-at-risk ratings, any modification to the magnitude and timing of stream flows has not shifted channels from their natural potential. The reason for this is primarily associated with Thompson Reservoir, which has modified the flow characteristics in Silver Creek – the reservoir collects the larger early spring runoff events and releases the water later in the year. Accordingly, the channel dimensions of Silver Creek have adjusted (become wider and shallower) to accommodate these regulated flows.

The current condition of Upper Silver Creek, with the functionality ratings for each element considered under Cumulative Watershed Effects, is shown in the summary table under "Environmental Consequences – Cumulative Watershed Effects". Generally, Upper Silver Creek was rated as having high subwatershed sensitivity when compared to the other subwatersheds analyzed. It was rated as high sensitivity with respect to rain-on-snow, drainage density and subwatershed relief. The roads category, canopy, large wood frequency and fish passage were rated as functioning at risk. Soil condition,

bank stability and pool frequency were rated as functioning appropriately. Temperature and sediment were rated as functioning at unacceptable risk.

Past Activities

- Fuels reduction: Under-burning: 1985-1989: 1530 acres, 1990-1994: 2250 acres, 1995-1999: 6200 acres. Pile burning: 1990-1994: 4 piles, 1995-1999: 17 piles, 2000-2002: 7 piles. Post harvest burning 1990-1994: 50 acres, 2000-2002: 100 acres. Crushing 190 acres 1995-1999. *Underburning and pile burning is typically at low severity and had little impact on the subwatershed. Crushing may increase compaction but most likely had little impact on the subwatershed.*
- Silvicultural activities have included timber stand improvement or the thinning of sub-merchantable trees and merchantable harvest of timber. Timber stand improvement occurred on 3,565 acres. Timber harvest activities on forest service land have focused on modifying structure and composition of stand while generating merchantable products. This subwatershed has seen 4,745 acres of harvest varying from intermediate, regeneration of both even aged and uneven aged, and salvage harvest. *Past timber harvest activities have been the main reason for high road densities within the subwatershed and the problems associated with high road densities. Timber harvest can also caused compaction and other detrimental soil conditions, expose areas to increased surface erosion, and may modify streamflow regimes. General watershed effects of timber removal on watersheds are well documented (Meehan, 1991, Troendle and Leaf, 1981) though no specific studies have been completed on the Fremont National Forest .*
- Personal use firewood: Approximately 300 personal use firewood permits sold at district with 2.5 percent occurring in this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Grazing has occurred in the Yamsay Mountain allotment as early as 1944 with sheep then transitioned to cattle in 1946. Numbers of animals have drastically reduced from 1000 in 1944, 172 cattle in 1946, 323 cattle in 1961, 100 cattle in 1967, 200 cattle in 1979 on a rest/rotation, not used in 1992 through 1999, 50-100 short duration cattle from 2000 to 2002, and currently 100 cattle early deferred. Use on the Silver Bridge Allotment was prior to early 1980 to 2003 with 232 AUMS. Thompson Valley Allotment was through the summer months of 1946-1955 by 220 cattle. Foster Butter Allotment was used in 1966 by 1602 cattle on a rest rotation, 1980-1992 by 6807 AUMS on rest rotation by pasture and 1993-2002 by 6297 AUMS early season. *Clearly the use in the past has been heavy, but current management of livestock has limited their impacts on the subwatershed.*
- Powerline and communications facilities consist of 3 miles of Midstate Electric powerline. *No known problems with these facilities exist with respect to soil and water.*
- NRT and dispersed recreational sites. *Activities associated with the trail and recreational areas at isolated or concentrated locations near streams may cause limited resource damage in the form of compaction or trampling.*
- The diversion dam may or may not provide for fish movement through the infrastructure. *Ponding of water exposes more surface area to radiant heat and causes increases in water temperature.*
- Non-industrial private land has partially harvested a limited number of ponderosa pine. *Little impact on soil and water has occurred as a result of this activity.*
- Any noxious weed treatment has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Past fire activity shows there have been 67 fires since 1948, of which 98 percent of the acres burned were caused by lightning and the largest fire was 2,110 acres. *The intense fire suppression has resulted in more dense stands throughout the area and may help lead to more intense fires that would have historically occurred.*
- 2002 Fire Suppression. 27 miles of dozer line and 1 mile of hand line were constructed within the subwatershed and trees were fallen for safety or suppression objectives. *The additional compacted surface of dozer lines add to the road density and sedimentation problems associated with roads/trails. It is assumed that dozer lines were rehabilitated with waterbars and drainage according to BMPs and have reduced sediment production to background levels.*
- Juniper thinning. 60 acres in 2000. *The thinning of this aggressive species that has well surpassed historic stocking has a positive effect on the subwatershed.*
- BAER projects. *Drainage ditches were cleaned throughout subwatershed. This activity facilitated proper movement of moisture off of roads.*
- Industrial forest lands. Throughout the analysis area have logged extensively throughout the 20th century. By 2000, almost all stands were logged at least once. *The extensive use on private lands has increased ground disturbance and increased erosion.*

Toolbox Fire Recovery Project Activities (on a subwatershed basis)

Direct and indirect effects *on a project area basis* were discussed early in the Watershed section. This section concerns itself with how those direct and indirect effects apply to a cumulative effects finding, on a *subwatershed* basis.

The elements discussed under direct and indirect effects as they pertain to the Upper Silver Creek subwatershed are found below.

Table 3.155 Upper Silver Creek Direct and Indirect Effects by Alternative

UPPER SILVER CREEK	ALT. A	ALT. C	ALT. D	ALT. E	ALT. G	ALT. H
TOTAL COMMERCIAL SALVAGE (acres)	0	1,386	407	869	1,376	1,277
GROUND BASED COMMERCIAL SALVAGE (acres)	0	1,357	407	869	1,356	1,277
AERIAL COMMERCIAL SALVAGE (acres)	0	29	0	0	21	0
PERCENT OF SUBWATERSHED AREA SALVAGE	0%	9%	3%	5%	8%	8%
TOTAL RHCA COMMERCIAL SALVAGE (acres)	0	134	49	102	125	70
RHCA 1 (acres)	0	13	4	5	4	4
RHCA 3 (acres)	0	121	65	97	121	66
RHCA 4 (acres)	0	0	0	0	0	0
TEMPORARY ROADS (mi)	0	2.12	0	1.63	2.12	1.86
RE-OPEN UNCLASSIFIED ROADS (mi)	0	6.18	1.58	5.02	6.18	5.92
PRESCRIBED FIRE (acres)	0	0	0	0	0	0
ROADS						
OPEN ROAD DENSITY (mi/mi^2)	3.54	3.01	3.01	3.23	3.23	3.01
CLOSE ROADS (mi)	0.0	6.7	6.7	4.9	1.1	6.7
DECOMMISSION ROADS (mi)	0.0	6.8	6.8	3.0	6.8	6.8
OPEN ROADS (mi)	89.9	76.5	76.5	82.1	82.1	76.5
SEDIMENT SAVINGS FROM ROAD ACTIONS (tons/yr)	0.00	0.08	0.08	0.07	0.07	0.08
SEDIMENT LOSS FROM OPEN ROADS (tons/yr)	0.60	0.52	0.52	0.53	0.53	0.52
OPEN ROADS within 300 ft of STREAM (mi)	6.2	3.7	3.7	3.9	3.9	3.7
CLOSE ROADS within 300 ft of STREAM (mi)	0.0	0.4	0.4	0.9	0.2	0.4
DECOMISSION ROADS within 300 ft of STREAM (mi)	0.0	2.1	2.1	1.4	2.1	2.1

Present and Future Activities

- Grazing in the Yamsay Mountain Allotment is currently at 100 cattle early deferred from July 16 to August 31 and planning under NEPA is scheduled for 2007. Foster Butter Allotment is expected to have a NEPA decision before 2004 grazing season. Current use is based on 2003 monitoring and NEPA decision. Silver Bridge-BLM-Allotment has 262 AUMS on rest rotation with riparian pasture. Recently burned areas compared to unburned areas produce more aboveground biomass (Tracy and McNaughton, 1996). This in concert with the active control of livestock in burned areas to keep cattle off of riparian area should be effective. *The NEPA analysis or Rangeland Health Assessments (BLM) will allow for thorough review of the grazing within this allotment.*
- Personal use firewood: In 2002, an estimated 981 cords were removed from this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Some removal of timber from private non-industrial forest lands. *This is a small portion of the subwatershed and should have little impact on soil and water within the subwatershed.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. The hand pulling of weeds would cause no detectable impact to soil and water. *There are no knows problems associated with this activity.*
- Several more NRT miles would be reconstructed. *There would be short-term effects from the trail construction and isolated areas of compaction as a result of the trail but these activities would have limited effect on the subwatershed.*
- Juniper treatment-BLM. 1000 acres. *The thinning of this aggressive species that has well surpassed historic stocking has a positive effect on the subwatershed.*
- Seeding-BLM. 200 acres. *This activity will allow for more rapid recovery of subwatershed.*
- Seedling planting-BLM. 250 acres. *This activity will allow for more rapid recovery of subwatershed.*
- 517 East Forest Recovery Project/Triad Restoration Project: These treatments include reintroduction of fire where fire historically played a role, commercial and pre-commercial thinnings, aspen enhancements, and large woody debris additions to Silver Creek. *Any sediment input to these streams because of this project is predicted to have an insignificant effect on redband trout because of the minimal quantities and low risk of entering fish habitat because of riparian buffers, mitigation measures, and Forest BMPs. This project would have beneficial affects on the subwatershed.*

Cumulative Watershed Effects

See also "Summary Table – Upper Silver Creek Subwatershed Cumulative Watershed Effects" that follows discussion.

Alternative A

The number of roads that remain open under this alternative and the number of open roads within 300 feet of stream channels are of concern. The road density under this alternative is the fourth highest of the eight subwatersheds analyzed. No ground disturbing activity as a result of salvage harvest and fuels reduction would occur under this alternative. However, the number of miles of road would allow a chronic sediment source and allow for a maximum increase in the drainage network to continue. The calculation of sediment loss from roads equates to 0.07 pound of sediment per acre within this subwatershed.

Action Alternatives

Approximately 34 percent of the subwatershed burned in 2002 and activity on only 34 percent of the subwatershed is within the analysis area. The salvage harvest and associated fuels reduction accounts for activity on 3 percent to 9 percent of the subwatershed area. The minor amount of sediment associated with the harvest and the very limited amount of the subwatershed affected by the harvest should have little impact on the subwatershed. There is no prescribed burn planned in this subwatershed. The temporary and unclassified roads would temporarily increase the miles of road by 9.2 percent for Alternatives C and G, by 8.7 percent for Alternative H, by 7.4 percent for Alternative E and by 1.8 percent for Alternative D. The increase in road miles would be short term and proper decommissioning of the roads would occur after the activity is complete. The unclassified road density would decrease from 0.93 mi/mi^2 to 0.64 mi/mi^2, 0.85 mi/mi^2, 0.71 mi/mi^2, 0.64 mi/mi^2 and 0.66 mi/mi^2. Sedimentation from salvage harvest is expected to be similar and minor for all action alternatives.

Due to only 34 percent of the subwatershed being inside of the analysis area, the roads management activities within the subwatershed are somewhat limited. Approximately 6.7 miles of road would be closed and 6.8 miles of road would be decommissioned under Alternatives C, D and H. Alternative E would close 4.9 miles of road and decommission 3.0 miles of road. Under Alternative G 1.1 miles would be closed and 6.8 miles would be decommissioned. The reduction in road

density is approximately 15 percent in Alternatives C, D and H compared to the original road density. The reduction in road density compared to the original for Alternative E and G is 9 percent. The closure and decommissioning of between 2.3 and 2.5 miles of road within 300 feet of intermittent and perennial streams would be an improvement to the health of the subwatershed under all alternatives. The sediment savings from road actions is generally the same in all alternatives as is the sediment loss from roads within this subwatershed. The road density would remain high for the subwatershed under all alternatives. Alternatives C, D and H are the most aggressive with respect to road activity and would result in the most benefit of the action alternatives.

Temperature characteristics in the streams of the subwatershed, including those on the 303(d) list, are not expected to change as a result of any of the action alternatives.

Aspen enhancement, large wood placement and deciduous planting in perennial riparian areas would be implemented in Alternatives C, D, G and H. The enhancement of riparian vegetation, particularly where conifer encroachment occurs, has a positive effect on the subwatershed. Large wood placement would take place within the subwatershed and provide for hiding cover and stream variability that would enhance fish habitat. Deciduous planting in riparian areas of the perennial stream in the subwatershed would occur in areas that burned particularly hot.

The subwatershed sensitivity was high. Temperature and fine sediment were rated as functioning at unacceptable risk. It is understood that all alternatives would generate minor amounts of sediment from salvage harvest and fuel reduction. The sediment in the streams and stream temperature should not increase as a result of the action alternatives. This is less likely to occur in alternatives with fewer acres in RHCA harvest. Therefore, the subwatershed is rated moderate for cumulative watershed affects. In addition, the recovery on private land salvage harvest, the effective rehabilitation of the suppression activities, monitoring and management of livestock use and allotment condition should not adversely affect the subwatershed.

Table 3.156 Summary Table – Upper Silver Creek Subwatershed Cumulative Watershed Effects

	NAME - HUC								
WATERSHED	SILVER CREEK - 1712000502								
SUBWATERSHED	**UPPER SILVER CREEK -** 171200050206								
	LOW		MODERATE			HIGH			
SUBWATERSHED SENSITIVITY						X			
Characteristic(s) rated HIGH	Rain on snow, drainage density, subwatershed relief								
	CURRENT CONDITION - FUNCTIONALITY			**Alt A**	**Alt C**	**Alt D**	**Alt E**	**Alt G**	**Alt H**
ELEMENTS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK	RESTORE (**R**), MAINTAIN (**M**) or DEGRADE (**D**). Improvement as a result of the project? – **Yes** or **No**					
UPLANDS									
Roads			**X**	**D**	**R - Yes**	**R - Yes**	**M - Yes**	**M - Yes**	**R - Yes**
Canopy			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Soil	**X**			**M**	**M**	**M**	**M**	**M**	**M**
RIPARIAN VEGETATION / BANK STABILITY	**X**			**M**	**M**	**M**	**M**	**M**	**M**
CHANNEL CONDITIONS									
Pool frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Large wood frequency		**X**		**M - No**	**R - Yes**	**R - Yes**	**M – No**	**R - Yes**	**R - Yes**
Temperature			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Fine sediment			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Fish passage		**X**		**M**	**M**	**M**	**M**	**M**	**M**

West Fork Silver Creek

Existing Condition

Sensitivity

West Fork Silver Creek 6th field watershed (subwatershed) (HUC 171200050207) is approximately 38 square miles and is part of the Silver Creek 5th field watershed. There are two perennial streams within the subwatershed and several intermittent streams. The perennial streams in the West Fork Silver Creek subwatershed are the West Fork Silver Creek and North Fork Silver Creek. The headwaters of both West Fork and North Fork Silver Creek are off of the east face of Yamsay Mountain. North Fork Silver Creek flows for approximately 5.9 miles before it flows into West Fork Silver Creek. West Fork Silver Creek continues through the subwatershed flowing through some high meadows and eventually flows into Silver Creek at the mouth of the subwatershed.

Hydrologic soil group C, which is characterized by slow rates of infiltration and water transmission, characterizes nine percent of the subwatershed. Hydrologic soil group D, which is characterized by very slow rates of infiltration and water transmission, characterizes nineteen percent of the subwatershed. Twenty-eight percent of the subwatershed area is characterized by hydrologic soil group C and D. The total index percent of hydrologic group C and D was rated as **moderate**. The majority, 79 percent, of the subwatershed is characterized by very stable mass wasting characteristics. However, thirteen percent of the subwatershed is at risk for rotational slumps. The sensitivity index for mass wasting was **high** for this subwatershed. All subwatersheds receive limited amounts of precipitation on average, which yields a less sensitive watershed on the whole. A rain-on-snow event is of particular concern any area with substantial snow pack. West Fork Silver Creek is located high in the system and on average holds snow in the West Fork elevations well into the spring. According to the estimated rain-on-snow range for the Silver Creek 5th field watershed of 4500-6000 feet, approximately 70 percent of the subwatershed is within this range. The sensitivity index for this element was rated as **high**.

West Fork Silver Creek has low drainage density of 1.27 mi/mi^2, which is the highest drainage density of the analysis area. In comparison to the other subwatersheds in the analysis area, West Fork Silver Creek was rated as **high**. However, this value is well below the low class drainage density of 3 to 4 mi/mi^2 (Strahler, 1964). Subwatershed relief for West Fork Silver Creek is low amongst the eight subwatersheds being analyzed and rated as **low** sensitivity. Over approximately 15 miles, an elevation of 3245 feet is lost for a resultant subwatershed relief ratio of 0.04 ft/ft. The subwatershed shape is long and relatively narrow which is characteristic of a more sensitive subwatershed. The centroid elevation of West Fork Silver Creek is 5060 feet and is **moderate** for the analysis area. A higher centroid elevation value tends toward a more sensitive subwatershed.

Overall, West Fork Silver Creek has limited precipitation, two perennial streams, low sensitivity for streamflow generation areas, high sensitivity for mass wasting, and high sensitivity for rain-on-snow potential. The channel information rated as high for drainage density, low for subwatershed relief and moderate for centroid elevation. This information leads one to conclude that East Duncan Creek subwatershed has **high** sensitivity when compared to the other subwatersheds within the analysis area.

Functionality

West Fork Silver Creek is dominated by low-severity burn. Approximately 41 percent of the subwatershed burned with 0.8 percent, 5.8 percent and 33.8 percent of the subwatershed burned at high, moderate and low-severity, respectively.

The roads, canopy and soils within the subwatershed will be used to characterize the uplands of West Fork Silver Creek. According to the transportation layer in Geographical Information Systems (GIS) there are 129 miles of road within West Fork Silver Creek subwatershed equating to an open road density of 3.43 mi/mi^2, which places the subwatershed **functioning at unacceptable risk**. The Riparian Habitat Conservation Area (RHCA) for an intermittent stream is 50 feet on each side of the stream and 300 feet on each side of a perennial fish-bearing stream. Of the 129 miles of road approximately 1.6 miles are located within the RHCA for intermittent streams and 5.5miles are located with the RHCA for perennial fish-bearing streams. There are 15 miles or 12 percent are located within 300 feet of intermittent or perennial streams. Roads cross channels at 31 locations (5 perennial stream crossings and 26 intermittent stream crossings), sites where direct sediment introduction occurs. The road impact index (RII) was calculated to be 0.36. Along with the 48 miles of stream channels, an estimated 77 of the 129 miles of road are hydrologically integrated with the stream network, thus increasing the drainage network by 162 percent—using study results from Wemple (1994).

The capability areas within West Fork Silver Creek were rated as having 64 percent of the area as low potential for erosion, 66 percent of the area as high potential for compaction, 69 percent of the area as low potential for displacement, and 98

percent as low potential for mass movement. Transects used to measure compaction were generated after the fire took place and were only measured on Forest Service land within the fire perimeter. West Fork Silver Creek was rated as having 54 percent and 46 percent of the inventoried subwatershed area as low and moderate compaction, respectively. No transect within West Fork Silver Creek was found to have high compaction and therefore will be rated as **functioning appropriately**.

The canopy analysis showed that approximately 62 percent, 38 percent and 76 percent of Lodgepole Pine, Ponderosa Pine and White Fir, respectively, were within the historic range of variability. Fifty percent of the Ponderosa Pine acres were found to be below HRV. Overall, 48 percent of the subwatershed is outside of HRV, which places the subwatershed at **functioning at unacceptable risk**.

Information regarding the bank stability and riparian vegetation for West Fork Silver Creek subwatershed is available for North Fork Silver Creek and West Fork Silver Creek, the two perennial, fish-bearing streams within the West Fork Silver Creek subwatershed.

West Fork Silver Creek is within the West Fork Silver Creek Subwatershed. Approximately 9.4 miles of West Fork Silver Creek are in the project area. All of the 9.4 miles of West Fork Silver Creek burned at some level during the Silver Fire. Mortality in RHCAs varied from low to moderate with pockets ranging up to very high. Along West Fork Silver Creek, the riparian vegetation immediately adjacent to the channel was lightly to moderately burned, however several areas experienced a complete consumption of riparian vegetation. Numerous overstory ponderosa pines in the RHCAs and adjacent uplands were burned to the crowns or suffered significant heat scorch. Some large woody debris in the stream channel and adjacent floodplain was consumed throughout the affected stream reaches.

North Fork Silver Creek is also within the West Fork Silver Creek subwatershed. Approximately 2.3 miles of North Fork Silver Creek are in the project area with all 2.3 miles experiencing some level of burning during the Silver Fire. Mortality in RHCAs varied from low to moderate with pockets ranging up to very high. Along North Fork Silver Creek, the riparian vegetation immediately adjacent to the channel was lightly to moderately burned with an area of very high mortality at its confluence with West Fork Silver Creek. Some overstory ponderosa pines in the RHCAs and adjacent uplands were burned to the crowns or suffered significant heat scorch. Some large woody debris in the stream channel and adjacent floodplain was consumed throughout the affected reaches.

Reach 4 of West Fork Silver Creek begins at the forest boundary and extends upstream 3.0 miles to where the canyon ends. Reach 5 of Silver Creek begins at this point and extends upstream 1.2 miles to the forest boundary just upstream of the 2917 Road. Reach 6 begins at the forest boundary just downstream of the Silver Creek Marsh Campground and extends upstream 1.2 miles to just upstream of the 27 Road. Reach 7 begins at this point and extends upstream 2.0 miles to the confluence with North Fork Silver Creek. Reach 8 begins at the confluence of North Fork Silver Creek and extends upstream 3.0 miles to the 3038 Road. Reach 1 of North Fork Silver Creek begins at the confluence with West Fork Silver Creek and extends upstream 2.3 miles to the 3038 Road.

Riparian Ecosystems and Bank Stability

West Fork Silver Creek

The dominant riparian vegetation (sedge, alder, dogwood, willow, grass and lodgepole pine) within all surveyed reaches, with the exception of Reach 5, is highly similar to late-seral species composition and structure, and combined with bank stability values, results in a **functioning appropriately** rating for each reach. Reach 5, on the other hand, is **functioning appropriately but-at-risk** due to a higher abundance of grass and the lack of willow in the older age-classes and its lower bank stability values. Additionally, there is evidence of lodgepole pine encroachment into the riparian area over much of the streams length, especially in the upper reaches (reaches 8 and above). The dominance of late-seral species in all reaches promotes their high bank stability values. In Reach 5, banks are continuing to build and recover as riparian vegetation moves closer to its desired condition – grass and wild iris are more common than expected indicating that plant succession in moving towards, but has not yet reached, a late-seral community. Past livestock practices have likely influenced vegetative conditions, especially the lack of mature willow, but current grazing strategies are allowing riparian areas to move towards their potential. Grazing strategies within the lower reaches currently involves early season use, with reaches 6, 7, and 8 receiving short season/early grazing, while the upper reaches are excluded from grazing. In addition, a sizable portion of the stream in the project area (reaches 6-8) was not grazed during the period of 1990-1996. The altered fire regime in the region continues to promote higher densities of lodgepole pine in riparian areas, creating a minor shift in relative species abundance with fewer shade intolerant species such as willow and aspen. An additional factor affecting bank stability within the lower reaches of this stream might be the increased drainage network associated with roads throughout the sub-watershed, possibly influencing the timing and magnitude of stream flows and their effects on channel scouring.

North Fork Silver

The dominant plant types in Reach 1 – alder, sedge, and grass – is highly similar to late-seral species in composition and structure, resulting in adequate cover to protect streambanks and dissipate energy during high flows. There is evidence, however, of lodgepole pine encroachment into the riparian area over much of the streams length. Overall, late-seral species dominate and bank stability exceeds 98 percent; consequently, this element is **functioning appropriately**. The abundance of late-seral species in all Reach 1 promotes high bank stability values. The majority of the area did not have authorized livestock use from 1990-1997 (part of a vacant allotment, or received non-use). Current grazing strategies in Reach 1 are conducive to keeping riparian areas in a condition that is near their potential. The altered fire regime in the region continues to promote higher densities of young lodgepole pine in riparian areas, creating a minor shift in relative species abundance with fewer shade intolerant species such as willow and aspen.

Aquatic Habitat Condition

Table 3.157 Aquatic Habitat Ratings in West Fork Silver Creek, Summer 2000

Reach	Reach Length (miles)	Owner	Desired Wetted Width (‘)	Gradient (%)	Reach	LWD/ Mile	Pools/ Mile	Large Pools/ Mile	Spawning Gravel Fines (%)	Rosgen Channel Type
						50% / 75%	50% / 75%	50% / 75%		
1	0.5	BLM	6	1	1 Desired	**	49 / 84	0 / 4	<20	C, E
					1 Current	0	110	7	NA	C, E
					1 Rating	FA	FA	FA		FA
2	0.3	BLM	10	1	2 Desired	3 / 13	30 / 51	0 / 3	<25	C, E
					2 Current	7	109	22	15	C, E
					2 Rating	FA+	FA	FA	FA	FA
3	1.1	BLM	12	1	3 Desired	3 / 11	25 / 42	0 / 2	<25	B_c, C
					3 Current	8	102	2	NA	B_c, C
					3 Rating	FAR	FA	FAR		FA
4	3.0	USFS	11	1	4 Desired	3 / 12	27 / 46	0 / 2	<25	B_c, C, B, E
					4 Current	33	116	6	NA	B_c, C, B, E
					4 Rating	FA	FA	FA		FA
5	1.2	USFS	9	<1	5 Desired	4 / 15	33 / 56	0 / 3	<25	C, E
					5 Current	21	87	5	25	C, E
					5 Rating	FA	FA	FA	FAR	FAR
5a		Private			6 Desired				<20	
					6 Current				NA	
					6 Rating					
6	1.2	USFS	8	<1	7 Desired	4 / 17	37 / 63	0 / 3	<20	C, E, B_c
					7 Current	7	111	18	NA	C, E, B_c
					7 Rating	FA+	FA	FA		FA
7	2.0	USFS	8	3	8 Desired	13 / 56	40 / 67	1 / 3	<25	B, B_c, E, B_a
					8 Current	20	115	1	35	B, B_c, E, B_a
					8 Rating	FAR	FA	FAR	FUR	FA
8	3.0	USFS	8	1-2	9 Desired	4 / 17	37 / 63	0 / 3	<25	E, B
					9 Current	27	96	0	NA	E, B
					9 Rating	FA	FA	FAR		FA
9	1.5	USFS	7	1-2	10 Desired	5 / 19	42 / 72	0 / 4	<20	E, B
					10 Current	45	108	0	30	E, B
					10 Rating	FA	FA	FAR	FUR	FA
10	1.3	USFS	7	<1	11 Desired	5 / 19	42 / 72	0 / 4	<20	E_b, B
					11 Current	21	120	0	NA	E_b, B
					11 Rating	FA	FA	FAR		FA
11	1.7	USFS	5	1-2	12 Desired	6 / 26	59 / 101	0 / 5	<20	E, E_b
					12 Current	34	134	0	NA	E, E_b
					12 Rating	FA	FA	FAR		FA
12	0.7	USFS	5	2-4	12 Desired	21 / 90	63 / 107	0 / 5	<20	B, E_b
					12 Current	56	143	0	28	B, E_b
					12 Rating	FA+	FA	FAR	FAR	FA
13	1.0	USFS	4	>4	13 Desired	26 / 88	40 / 77	0 / 0	<20	A, B_a
					13 Current	41	122	0	NA	A, B_a
					13 Rating	FA+	FA	FA		FA

FA – Functioning Appropriately, FAR – Functioning Appropriately but-at-Risk, FUR – Functioning At Unacceptable Risk NA – Information Not Available; Habitat Abbreviations and Explanations: LWD – Large Woody Debris; Large Pools – Pools > 2.6 feet deep; percent Spawning Gravel Fines - <6.4mm

Table 3.158 Aquatic Habitat Ratings in North Fork Silver Creek, Summer 2000

Reach	Reach Length (miles)	Owner	Desired Wetted Width (')	Gradient (%)	Reach	LWD/ Mile	Pools/ Mile	Large Pools/ Mile	Spawning Gravel Fines (%)	Rosgen Channel Type
						50% / 75%	50% / 75%	50% / 75%		
1	2.3	USFS	5	1-4	1 Desired	21 / 90	63 / 107	1 / 4	<20	B, E_b, E
					1 Current	78	108	0	NA	B, E_b, E
					1 Rating	FA+	FA	FUR		FA
2	2.6	USFS	5	2-4	7 Desired	21 / 90	63 / 107	1 / 4	<20	B, B_a E_b, E
					7 Current	34	117	0	52	B, B_a E_b, E
					7 Rating	FA+	FA	FUR	FUR	FA

FA – Functioning Appropriately, FAR – Functioning Appropriately but-at-Risk, FUR – Functioning at Unacceptable Risk, NA – Information Not Available; Habitat Abbreviations and Explanations: LWD – Large Woody Debris; Large Pools – Pools > 2.6 feet deep; percent Spawning Gravel Fines - <6.4mm

Channel condition will be characterized and rated for functionality with respect to pool frequency, large wood frequency, temperature, fine sediment and fish passage. The pool frequency is greater than the 75th percentile in the surveyed reaches of West Fork and North Fork Silver Creek within the subwatershed. This information yields a **functioning appropriately** rating. Of the reaches surveyed in the West Fork Silver Creek, reaches 4, 5, and 6 are **functioning appropriately** in terms of the large pool component, while fewer deep (large) pools were found in the other reaches, 7 and 8, all of which received **functioning appropriately but-at-risk** ratings for large pools. In terms of the large pool component for North Fork Silver Creek, however, no deep (large) pools could be found in the reach, and thus received a **functioning inappropriately** rating for the large pool habitat element. The large wood per mile for nearly half of the length of reaches surveyed is between the 50th and 75th percentile and the other half of the length of reaches surveyed is above the 75th percentile. The majority of the reaches that are between the 50th and 75th percentile are from North Fork Silver Creek. The majority of the reaches of the main stem of West Fork Silver Creek are above the 75th percentile but just above the 75th percentile. Therefore, the subwatershed is rated as **functioning at risk** for large wood. Sediment data was collected for West Fork Silver Creek in 1996 and 2000 at three locations. At 4450 feet elevation 31 percent and 15 percent fines were measured in 1996 and 2000, respectively. At 4740 feet elevation 26 percent and 25 percent fines were measured in 1996 and 2000, respectively. At 4850 feet elevation 41 percent and 35 percent fines were measured in 1996 and 2000, respectively. The sites at 4460 feet elevation and 4850 feet elevation were measured with one sample in the spring of 2003 and measured 30 percent and 32 percent fines, respectively. Measurements of greater than 30 percent fines places any stream into **functioning at unacceptable risk** for sediment.

Spawning Gravel Fines

Fine sediment in spawning substrates has been sampled at five locations within West Fork Silver Creek. In Reach 5, a C/E stream type, the percent fines were at 25 percent, promoting 62 percent embryo survival. Thus, Reach 5 is functioning appropriately but-at-risk. In reach 7, which is a primarily B/E stream type, sampling results showed 35 percent fine sediment, promoting 34 percent embryo survival, resulting in a functioning at unacceptable risk rating for Reach 7. Results of monitoring fine sediments in spawning substrates within West Fork Silver Creek indicates that levels of fine sediment are typically higher than recommended. Sediment in potential spawning substrates of West Fork Silver Creek varies between 15 percent and 35 percent (26 percent and 45 percent in 1996). One of the reasons for these relatively high reported sediment values is likely associated with the naturally high erosion rates associated with soils (located in the pumice zone) and geomorphology of the area. Monitoring in this system shows that in the upper portions of the drainage, where impacts from logging activities are minimal, sediment levels are about 28 percent (measured only in 1996). Below West Fork Silver Creek Marsh, which is influenced by beaver activity, sediment levels were measured at 25 percent (26 percent in 1996). Between these two areas, substrate fines were measured at 35 and 30 percent (41 and 45 percent in 1996). Review of aerial photographs of the area reveals impacts from past logging in the adjacent uplands, which, along with associated roading may be influencing sediment levels. However, potential natural erosion rates are high in the areas where the highest sediment levels occur (also the area where harvesting and roading have occurred), possibly influencing localized sediment levels. The stream system may be unable to meet the recommended sediment levels in the absence of beaver.

The connection between beaver dams and the lower levels of sediment measured below the marsh, indicates the importance of maintaining beaver habitat and beaver populations in the stream system. Beaver dams are important for trapping sediment and providing cool water refugia for fish. There has been an overall decrease in average sediment values between 2001 (average of 26 percent) and 1996 (average of 36 percent). This difference is likely attributed to the flushing of fine sediments out of the system associated with the flood of 1997, one of the largest on record. One sediment sampling site was located on North Fork Silver Creek. Fifty-two percent fine sediments (60 percent recorded in 1996) were documented at the sampling site located upstream of the project area, promoting only 7 percent (3 percent based on 1996 sample) embryo

survival. It is assumed that relatively high sediment levels occur in Reach 1 and was therefore given a functioning at unacceptable risk rating. The data for the entire subwatershed yields a rating of **functioning at unacceptable risk** for spawning gravel fines.

West Fork Silver Creek is on the 303(d) list from the mouth to Silver Creek Marsh (see 303(d) listed waters section). The seven-day average daily maximum temperature in the listed portion of the stream is collected at two sites. West Fork Silver Creek at 4460 feet elevation has documented seven-day average daily maximum temperatures of 27.0°C, 21.2°C, 21.8°C, 21.4°C, 21.1°C and 23.8°C for 1994, 1995, 1996, 1997, 1998, and 2000, respectively. West Fork Silver Creek at 4740 feet elevation has documented seven-day average daily maximum temperatures of 27.0°C, 21.0°C, 27.0°C, 22.6°C, 22.6°C, 22.0°C, 21.6°C, 21.0°C and 27.6°C for 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999 and 2000, respectively. There are three other temperature monitoring sites within the subwatershed and no other known data for temperature on any other stream within this subwatershed. The seven-day average daily maximum for the years of record is greater than 17.8°C in portions of West Fork Silver Creek and is therefore **functioning at unacceptable risk**. As illustrated in the table below, the upper elevation of West Fork Silver Creek and North Fork Silver Creek maintain at much lower temperatures than the lower elevations.

Table 3.159 Temperature Monitoring Sites in West Fork Silver Creek Subwatershed

SITE	ELEVATION	1993	1994	1995	1996	1997	1998	1999	2000	2002
INSIDE FIRE BOUNDARY										
NORTH FORK SILVER CREEK	5050	12.7	15.4	12.3	12.9	12.5	13.0	12.3	14.3	17.4
WEST FORK SILVER CREEK	5050	13.1	16.4	12.8	13.8	13.3	13.2	12.4	15.3	17.8
OUTSIDE FIRE BOUNDARY										
WEST FORK SILVER CREEK	5580	NA	18.0	12.9	13.3	12.6	12.5	NA	13.9	15.3
ALL TEMPERATURES GIVEN IN DEGREES CELSIUS										

There are four inventoried culvert located on West Fork Silver Creek. One of the two of the culverts located within the fire perimeter was replaced in 2000. The other was inventoried as an impediment to passage but is currently being backwatered by downstream material and is no longer a barrier to upstream movement. The other two culverts impede fish movement and are located in the upper reaches of the system and therefore the fish passage condition in West Fork Silver Creek subwatershed is **functioning at risk**.

Rosgen Channel Type

All surveyed reaches of West Fork Silver Creek, except Reach 5, are functioning appropriately in terms of their potential stream type as the shape and size of the stream is in balance with its geomorphic setting. Although Reach 5 has stream channels that are similar to the stream type expected, segments of the reach have bankfull width-to-depth ratios that are slightly greater than expected and thus the reach is determined to be functioning appropriately but-at-risk. An abundance of late-seral riparian vegetation is essential for maintaining low-gradient stream types, like those found along a good portion of West Fork Silver Creek. All reaches, with the exception of Reach 5, have an abundance of alder, willow, and sedge that promote high bank stability with channels that are resistant to the erosive energy associated with high flows. Management activities appear to be conducive to maintaining this vegetation within the floodplain – which acts to dissipate energy associated with high flow events, trap sediments, and build banks – allowing the stream to maintain or move towards its desired state. Although conditions in Reach 5 are nearing their desired state, small portions are still showing signs of a recovering stream. These areas have less willow and more grass than expected, which are contributing to the unstable stream banks within this reach and the functioning appropriately but-at-risk rating. As late-seral vegetation continues to develop along these reaches, it will act to trap sediment and build banks, causing the channel to continue to narrow and deepen, moving towards its naturally stable and desired state. Overall, the riparian vegetation is dominated by willow, bog birch, sedge and grass for both North Fork and West Fork Silver Creek. The bank stability was inventoried as greater than 95 percent stable in all twelve inventoried reaches of West Fork Silver Creek and inventoried as greater than 99 percent stable in the two reaches of North Fork Silver Creek. This information yields a **functioning appropriately** rating.

Reach 1 of North Fork Silver Creek is **functioning appropriately** in terms of its potential stream type as the shape and size of the stream channel is in balance with its setting. The dominance of alder and sedge promotes high bank stability and narrow and deep channels that are resistant to the erosive energy associated with high flows. Also, management activities appear to be conducive to maintaining vegetation in floodplains, which are able to dissipate energy associated with high

flow events. Any modification to the magnitude and timing of stream flows has not shifted channels from their natural potential, even though upland vegetation and road density both received functioning appropriately but-at-risk ratings.

The current condition of West Fork Silver Creek, with the functionality ratings for each element considered under Cumulative Watershed Effects, is shown in the summary table under "Environmental Consequences – Cumulative Watershed Effects". Generally, West Fork Silver Creek was rated as having high subwatershed sensitivity when compared to the other subwatersheds analyzed. It was rated as high sensitivity with respect to mass wasting, rain-on-snow, and drainage density. The roads category, canopy, large wood frequency and fish passage were rated as functioning at risk. Soil condition, bank stability and pool frequency were rated as functioning appropriately. Temperature and sediment were rated as functioning at unacceptable risk.

Past Activities

- Fuels reduction: Under-burning: 1985-1989: 330 acres, 1995-1999: 5000 acres. Pretreatment 1990-1994: 100 acres, 2000-2002: 950 acres. Pile burning: 1990-1994: 420 piles, 1995-1999: 60 piles. Post harvest burning 1990-1994: 240 acres, 1995-1999: 40 acres. Crushing 230 acres 1995-1999. *Underburning and pile burning is typically at low severity and had little impact on the subwatershed. Crushing may increase compaction but most likely had little impact on the subwatershed.*
- Silvicultural activities within the subwatershed have included timber stand improvement or the thinning of sub-merchantable trees and merchantable harvest of timber. Timber stand improvement within this subwatershed occurred on 4,241 acres. Timber harvest activities on forest service land have focused on modifying structure and composition of stand while generating merchantable products. This subwatershed has seen 4,281 acres of harvest varying from intermediate, regeneration of both even aged and uneven aged, and salvage harvest. *Past timber harvest activities have been the main reason for high road densities within the subwatershed and the problems associated with high road densities. Timber harvest can also caused compaction and other detrimental soil conditions, expose areas to increased surface erosion, and may modify streamflow regimes. General watershed effects of timber removal on watersheds are well documented (Meehan, 1991, Troendle and Leaf, 1981) though no specific studies have been completed on the Fremont National Forest .*
- Personal use firewood: Approximately 300 personal use firewood permits sold at district with 2.5 percent occurring in this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Grazing has occurred in the Yamsay Mountain allotment on the subwatershed as early as 1944 with sheep then transitioned to cattle in 1946. Numbers of animals have drastically reduced from 1000 in 1944, 172 cattle in 1946, 323 cattle in 1961, 100 cattle in 1967, 200 cattle in 1979 on a rest/rotation, not used in 1992 through 1999, 50-100 short duration cattle from 2000 to 2002. Use on the Silver Bridge Allotment was prior to early 1980 to 2003 with 232 AUMS. Upper Bridge Allotment from early 1980 to 2003 has 108 AUMS. *Clearly the use in the past has been heavy, but current management of livestock has limited their impacts on the subwatershed.*
- Powerline and communications facilities consist of 5 miles of Midstate Electric powerline. *No known problems with these facilities exist with respect to soil and water.*
- Recreational trail and dispersed recreational sites. *Activities associated with the trail and recreational areas at isolated or concentrated locations near streams may cause limited resource damage in the form of compaction or trampling.*
- Silver Creek Marsh Campground. Associated paved surfaces limit infiltration and increase running timing minimally. *Compacted areas around campsites and facilities limit infiltration and may increase ponding.*
- Two water impoundments. *Concentrated use by vehicles, livestock and wildlife around pond may cause compaction problems and associated water ponding on the surface.*
- Three diversions divert 1, 3 and 525 cfs. The diversion dam may or may not provide for fish movement through the infrastructure. *Ponding of water exposes more surface area to radiant heat and causes increases in water temperature.*
- Non-industrial private land has partially harvested a limited number of ponderosa pine. *Little impact on soil and water has occurred as a result of this activity.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Past fire activity shows there have been 78 fires since 1948, of which 97 percent of the acres burned were caused by lightning and the largest fire was 1,440 acres. *The intense fire suppression has resulted in more dense stands throughout the area and may help lead to more intense fires that would have historically occurred.*

- 2002 Fire Suppression. 24 miles of dozer line and 1 mile of hand line were constructed within the subwatershed and trees were fallen for safety or suppression objectives. *The additional compacted surface of dozer lines add to the road density and sedimentation problems associated with roads/trails. It is assumed that dozer lines were rehabilitated with waterbars and drainage according to BMPs and have reduced sediment production to background levels.*
- Aspen enhancement. 10 acres in 2000. *The enhancement of riparian vegetation, particularly where conifer encroachment occurs has a positive effect on the subwatershed.*
- Juniper thinning. 150 acres in 2000. *The thinning of this aggressive species that has well surpassed historic stocking has a positive effect on the subwatershed.*
- BAER projects. Drainage ditches were cleaned throughout subwatershed. *This activity facilitated proper movement of moisture off of roads. A relief culvert at Road 2700000 was installed to facilitate expected high water and increased debris after the burn. Log erosion barriers were placed within the subwatershed to capture sediment coming off areas that burned particularly hot.*
- Industrial forest lands. Throughout the analysis area have logged extensively throughout the 20th century. By 2000, almost all stands were logged at least once. *The extensive use on private lands has increased ground disturbance and increased erosion.*

Toolbox Fire Recovery Project Activities (on a subwatershed basis)

Direct and indirect effects *on a project area basis* were discussed early in the Watershed section. This section concerns itself with how those direct and indirect effects apply to a cumulative effects finding, on a *subwatershed* basis.

The elements discussed under direct and indirect effects as they pertain to the West Fork Silver Creek subwatershed are found below.

Table 3.160 West Fork Silver Creek Direct and Indirect Effects by Alternative

WEST FORK SILVER CREEK	ALT. A	ALT. C	ALT. D	ALT. E	ALT. G	ALT. H
TOTAL COMMERCIAL SALVAGE (acres)	0	2,615	1,430	2,107	2,604	2,448
GROUND BASED COMMERCIAL SALVAGE (acres)	0	2,585	1,430	2,107	2,584	2,448
AERIAL COMMERCIAL SALVAGE (acres)	0	30	0	0	21	0
PERCENT OF SUBWATERSHED AREA SALVAGE	0%	11%	6%	9%	11%	10%
TOTAL RHCA COMMERCIAL SALVAGE (acres)	0	89	30	69	78	30
RHCA 1 (acres)	0	23	12	13	12	12
RHCA 3 (acres)	0	58	18	49	58	18
RHCA 4 (acres)	0	8	0	8	8	0
TEMPORARY ROADS (mi)	0	2.68	0	2.58	2.68	2.03
RE-OPEN UNCLASSIFIED ROADS (mi)	0	9.17	1.97	6.69	9.17	9.04
PRESCRIBED FIRE (acres)	0	0	0	0	0	0
ROADS						
OPEN ROAD DENSITY (mi/mi^2)	3.43	2.74	2.74	3.02	3.02	2.74
CLOSE ROADS (mi)	0.0	13.3	13.3	13.2	3.0	13.3
DECOMMISSION ROADS (mi)	0.0	12.4	12.4	2.3	12.4	12.4
OPEN ROADS (mi)	128.7	102.9	102.9	113.3	113.3	102.9
SEDIMENT SAVINGS FROM ROAD ACTIONS (tons/yr)	0.00	0.11	0.11	0.09	0.09	0.11
SEDIMENT LOSS FROM OPEN ROADS (tons/yr)	0.79	0.68	0.68	0.70	0.69	0.68
OPEN ROADS within 300 ft of STREAM (mi)	6.3	2.9	2.9	3.1	3.1	2.9
CLOSE ROADS within 300 ft of STREAM (mi)	0.0	1.4	1.4	1.8	1.2	1.4
DECOMISSION ROADS within 300 ft of STREAM (mi)	0.0	2.0	2.0	1.46	2.0	2.0

Present and Future Activities

- Grazing in the Yamsay Mountain Allotment is currently at 100 cattle early deferred from July 16 to August 31 and planning under NEPA is scheduled for 2007. Foster Butter Allotment is expected to have a NEPA decision before 2004 grazing season. Current use is based on 2003 monitoring and NEPA decision. Silver Bridge-BLM-Allotment has 262 AUMS on rest rotation with riparian pasture. Upper Bridge-BLM-Allotment has 108 AUMS on rest rotation from early March to early October. Recently burned areas compared to unburned areas produce more aboveground biomass (Tracy and McNaughton, 1996). This in concert with the active control of livestock in burned areas to keep cattle off of riparian area should be effective. *The NEPA analysis or Rangeland Health Assessments (BLM) will allow for thorough review of the grazing within this allotment.*
- Personal use firewood: In 2002, an estimated 981 cords were removed from this subwatershed. *Little cutting occurs within RHCAs and there are no known problem areas associated with this activity.*
- Some removal of timber from private non-industrial forest lands. *This is a small portion of the subwatershed and should have little impact on soil and water within the subwatershed.*
- Any noxious weed treatment in the subwatershed has followed BMP for application of chemical agents near stream channels. *The hand pulling of weeds would cause no detectable impact to soil and water. There are no knows problems associated with this activity.*
- Juniper treatment-BLM. 1000 acres. *The thinning of this aggressive species that has well surpassed historic stocking has a positive effect on the subwatershed.*
- West Fork Silver Creek Watershed Restoration/Enhancement Project: These treatments include reintroduction of fire where fire historically played a role, commercial and pre-commercial thinnings, aspen enhancements, and large woody debris additions to West Fork Silver Creek, riparian vegetation enhancement, various aspen treatments, and beaver reintroductions. *Any sediment input to these streams because of this project is predicted to have an insignificant effect on redband trout because of the minimal quantities and low risk of entering fish habitat because of riparian buffers, mitigation measures, and Forest BMPs. This project would have beneficial impacts on the subwatershed.*

Cumulative Watershed Effects

See also "Summary Table – West Fork Silver Creek Subwatershed Cumulative Watershed Effects" that follows discussion.

Alternative A

The number of roads that remain open under this alternative and the number of open roads within 300 feet of stream channels are of concern. The road density under this alternative is the fifth highest of the eight subwatersheds analyzed. No ground disturbing activity as a result of salvage harvest and fuels reduction would occur under this alternative. However, the number of miles of road would allow a chronic sediment source and allow for a maximum increase in the drainage network to continue. The calculation of sediment loss from roads equates to 0.07 pound of sediment per acre within this subwatershed.

Action Alternatives

Approximately 40 percent of the subwatershed burned in 2002 and activity on only 40 percent of the subwatershed is within the analysis area. The salvage harvest and associated fuels reduction accounts for activity on 6 percent to 11 percent of the subwatershed area. The minor amount of sediment associated with the harvest and the very limited amount of the subwatershed affected by the harvest should have little impact on the subwatershed. There is no prescribed burn planned for this subwatershed. The temporary and unclassified roads would temporarily increase the miles of road by 9.2 percent for Alternatives C and G, by 8.6 percent for Alternative H, by 7.2 percent for Alternative E and by 1.5 percent for Alternative D. The increase in road miles would be short term and proper decommissioning of the roads would occur after the activity is complete. The unclassified road density would decrease from 0.93 mi/mi^2 to 0.64 mi/mi^2, 0.85 mi/mi^2, 0.71 mi/mi^2, 0.64 mi/mi^2 and 0.66 mi/mi^2. Sedimentation from salvage harvest is expected to be similar and minor for all action alternatives.

Only 40 percent of the subwatershed is located inside of the analysis area, however the roads management activities within the subwatershed are significant. Approximately 13.3 miles of road would be closed and 12.4 miles of road would be decommissioned under Alternatives C, D and H. Alternative E would close 13.2 miles of road and decommission 2.3 miles of road. Under Alternative G 3.0 miles would be closed and 12.4 miles would be decommissioned. The reduction in road density is approximately 20 percent in Alternatives C, D and H compared to the original road density. The reduction in road density compared to the original for Alternative E and G is 11 percent. The closure and decommissioning of between 3.2 and 3.4 miles of road within 300 feet of intermittent and perennial streams would be an improvement to the health of

the subwatershed under all alternatives. The sediment savings from road actions is generally the same in all alternatives as is the sediment loss from roads within this subwatershed. The road density would remain high for the subwatershed under all alternatives. Alternatives C, D and H are the most aggressive with respect to road activity and would result in the most benefit of the action alternatives.

Temperature characteristics in the streams of the subwatershed, including those currently on the 303(d) list, are not expected to change as a result of any of the action alternatives.

Aspen enhancement, large wood placement and deciduous planting in perennial riparian areas would be implemented in Alternatives C, D, G and H. The enhancement of riparian vegetation, particularly where conifer encroachment occurs, has a positive effect on the subwatershed. Large wood placement would take place within the subwatershed and provide for hiding cover and stream variability that would enhance fish habitat. Deciduous planting in riparian areas of the perennial stream in the subwatershed would occur in areas that burned particularly hot.

The subwatershed sensitivity was high. Temperature and fine sediment were rated as functioning at unacceptable risk. It is understood that all alternatives would generate minor amounts of sediment from salvage harvest and fuel reduction. The sediment in the streams and stream temperature should not increase as a result of the action alternatives. This is less likely to occur in alternatives with fewer acres in RHCA harvest. Therefore, Alternative C, G and E are rated as high for cumulative watershed effects. Alternative D and H are rated moderate for cumulative watershed affects. In addition, the recovery on private land salvage harvest, the effective rehabilitation of the suppression activities, monitoring and management of livestock use and allotment condition should not adversely affect the subwatershed.

Table 3.161 Summary Table – West Fork Silver Creek Subwatershed Cumulative Watershed Effects

	NAME - HUC								
WATERSHED	SILVER CREEK - 1712000502								
SUBWATERSHED	**WEST FORK SILVER CREEK -** 171200050207								
	LOW		MODERATE			HIGH			
SUBWATERSHED SENSITIVITY						X			
Characteristic(s) rated HIGH	Mass wasting, rain on snow, drainage density								
	CURRENT CONDITION - FUNCTIONALITY			**Alt A**	**Alt C**	**Alt D**	**Alt E**	**Alt G**	**Alt H**
ELEMENTS	FUNCTIONING APPROPRIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK	RESTORE (**R**), MAINTAIN (**M**) or DEGRADE (**D**). Improvement as a result of the project? – **Yes** or **No**					
UPLANDS									
Roads			**X**	**D**	**R - Yes**	**R - Yes**	**M - Yes**	**M - Yes**	**R - Yes**
Canopy			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Soil	**X**			**M**	**M**	**M**	**M**	**M**	**M**
RIPARIAN VEGETATION / BANK STABILITY	**X**			**M**	**M**	**M**	**M**	**M**	**M**
CHANNEL CONDITIONS									
Pool frequency	**X**			**M**	**M**	**M**	**M**	**M**	**M**
Large wood frequency	**X**			**M - No**	**R - Yes**	**R - Yes**	**M – No**	**R - Yes**	**R - Yes**
Temperature			**X**	**M**	**M**	**M**	**M**	**M**	**M**
Fine sediment	NOT AVAILABLE								
Fish passage		**X**		**M**	**M**	**M**	**M**	**M**	**M**

Cumulative Effects-Fisheries

Alternative A

Minor short-term changes in aquatic habitat of redband trout would be expected with the implementation of Alternative A. Short-term changes include: increased fine sediment from existing roads and to a lesser extent from hill slopes burned in the fire, any large wood in RHCAs that was cut down during suppression efforts are aiding in pool formation and providing cover for redband trout, and late summer stream temperatures may slightly increase due to reduced overstory canopy. In the long-term, numerous snags greater than 12 inches dbh would be recruited to stream channels. Increased large woody debris would substantially increase both the quantity and quality of pool habitat in perennial fish bearing streams.

Fine sediment would continue to be a problem due to extensive road systems. Other potential sediment sources that could combine with these inputs in these streams during the 2003-2006 period include, natural sediment increases caused by the 2002 fire, road maintenance activities within RHCAs, private salvage sales, sediment producing activities on private land, primarily grazing and roads, sediment produced by 2002 fire suppression and future fire suppression activities.

Alternatives C and E

In Silver Creek, West Fork Silver Creek, North Fork Silver Creek and Guyer Creek, fine sediments in spawning substrates are high as a result of past and ongoing activities. These alternatives include a variety of activities that are expected to affect sediment levels in either the short-term or the long-term, including salvage harvest activities, reforestation, road management (especially decommissioning) and instream placement of large wood. Alternative C includes substantially more road decommissioning that Alternative E, while Alternative E has less commercial salvage in RHCAs than does Alternative G.

The short-term sediment inputs produced by Alternatives C and E, although not considered to be significant, are likely to combine with these pre-existing sediment sources to produce short-term impacts on redband trout spawning and rearing habitat in all streams. Based on the tons per year estimates, cumulative effects of sedimentation may cause short-term reductions in pool volumes, reduced quality of spawning areas, and sedimentation of shallow margin areas used for rearing. The Biological Evaluation concludes that this activity may impact individuals or habitat, but would not likely contribute to a trend toward federal listing or loss of viability to the population or species. Alternative C, with RHCA harvest along fish bearing streams, has the potential for increased short-term sedimentation into redband trout habitat. The road management activities included in Alternative C (and the other action alternative) and the natural riparian vegetative recovery that will have occurred by 2004 are the primary factors that should contribute to a long-term reduction in sedimentation into redband trout habitat.

The cumulative effect of Alternatives C and E on water temperatures in Silver, West Fork Silver, North Fork Silver, and Guyer Creeks would be insignificant because these alternatives are unlikely to increase water temperature to a measurable degree. The only event that would potentially increase water temperatures is the loss of riparian vegetation and overstory conifers because of the fire.

Alternatives C and E would not affect large woody debris recruitment. In-channel habitat conditions within all potentially affected stream reaches will see improvements in large wood, number of pools and number of deep pools. In headwater areas above the fire instream habitat is expected to remain static or improve over time.

Alternatives D, G and H

In Silver Creek, West Fork Silver Creek, North Fork Silver Creek and Guyer Creek, fine sediments in spawning substrates are high as a result of past and ongoing activities. These alternatives include a variety of activities that are expected to affect sediment levels in either the short-term or the long-term, including salvage harvest activities, reforestation, road management (especially decommissioning), instream placement of large wood.

The short-term sediment inputs produced by Alternatives D, G, and H (which include no harvest within the RHCAs of fish-bearing streams, other than roadside hazard corridors) although not considered to be significant, are likely to combine with these pre-existing sediment sources to produce short-term impacts on redband trout spawning and rearing habitat in all streams. Based on the tons per year estimates, cumulative effects of sedimentation may cause short-term reductions in pool volumes, reduced quality of spawning areas, and sedimentation of shallow margin areas used for rearing. The Biological Evaluation concludes that this activity may impact individuals or habitat, but would not likely contribute to a trend toward federal listing or loss of viability to the population or species. Alternative C, with RHCA harvest along fish bearing streams, has the potential for increased short-term sedimentation into redband trout habitat. The road management activities

included the action alternatives and the natural riparian vegetative recovery that will have occurred by 2004 are the primary factors that should contribute to a long-term reduction in sedimentation into redband trout habitat.

The cumulative effect of Alternatives D, G, and H on water temperatures in Silver, West Fork Silver, North Fork Silver, and Guyer Creeks would be insignificant because these alternatives are unlikely to increase water temperature to a measurable degree. The only event that would potentially increase water temperatures is the loss of riparian vegetation and overstory conifers because of the fire.

Alternatives D, G, and H would not affect large woody debris recruitment. In-channel habitat conditions within all potentially affected stream reaches will see improvements in large wood, number of pools and number of deep pools. In headwater areas above the fire instream habitat is expected to remain static or improve over time.

Forest Plan Consistency

Watershed and Roads

The following bold statements are taken from the Fremont National Forest Land and Resource Management Plan (LRMP, 1989.

Maintain or improve soil productivity (p. 80) and keep soil erosion levels within tolerable limits (p. 83). Due to the limited amount of expected erosion production from the salvage harvest in all alternatives, all alternatives are consistent with the Forest Plan. The action alternatives would reduce long-term sedimentation from the currently extensive road system. Alternatives A and E would not introduce the short-term sedimentation expected from instream projects that Alternative C, D, G and H would introduce. However, Alternatives A and E would not allow for the expected long-term benefits from instream projects.

Monitor results and impacts of land management activities on soil productivity (p. 83). Monitoring plans are shown in Appendix D. A strong focus will be on soil response to land management activities.

Protect water quality through implementation and enforcement, monitoring and evaluation, and modification of best management practices (BMPs) (p. 88). BMPs, found in Appendix C, will be followed for the land management activities discussed in this document.

Assess the cumulative effects of activities on water quality or stream channels (p. 86). The cumulative effects of the activities were analyzed in this document on a subwatershed (sixth field HUC) basis and no subwatershed has more than 11 percent of its entire area being treated by commercial salvage under any action alternative.

Overall density for roaded area of the Forest will not exceed 2.5 miles per square mile (p. 116). Within the project area road densities are reduced in all action alternatives. Alternatives C, D and H would a resultant open road density of 1.76 mi/mi^2, 1.68 mi/mi^2 and 1.72 mi/mi^2, respectively. Alternative E and G both result in a road density of 2.57 mi/mi^2, which is a reduction from the current road density of 3.68 mi/mi^2.

All system roads will be operated and maintained to protect the resources, perpetuate the intended road management objective, and promote safety (p. 116). BMPs will be followed for all land management activities. Improvements to drainage (drainage improvement at 2917413 under Alternatives C, D, G, and H) and to several road segments would benefit and further protect resources. Roadside hazard corridors would be treated in all action alternatives to promote safe travel through the forest.

Prescribed fire will be considered for use in meeting management objectives in areas where ecological studies show that fire has played a significant role in ecosystem development (p. 118). Prescribed fire is proposed in Alternatives C, D, G, and H and not proposed in Alternative E.

Applicable state and federal water quality standards will be met. Currently water quality is being monitored and water quality is not expected to degrade as a result of this project. Alternatives C, D, G, and H include riparian restoration projects proposed that would enhance water quality within several reaches of streams within this project.

In cases of irresolvable conflict, soil, fish, water, and wildlife (in MA 15) will receive preferential consideration. At this point, an irresolvable conflict does not exist with regard to this project.

Watershed, wildlife, and fisheries habitat rehabilitation and improvements will be required to meet goals for aquatic/riparian systems. Soil and riparian protection/restoration project are proposed for Alternative C, D, G, and H and not proposed for Alternative E.

Consider soil impacts when planning all ground-disturbing management activities, implement sound soil conservation and management practices, monitor impacts of those practices, and maintain the productive potential of the lands (Soil Productivity Guide, Fremont National Forest, 2000). Soil impacts were considered during project planning, with findings disclosed both in this section and in the Geology, Geomorphology and Soils section. BMPs will be followed, and monitoring of land management activities would take place under all action alternatives.

All alternatives are compliant with LRMP standards and guidelines relating to watershed. No Forest Plan amendment would be required to implement any of the action alternatives.

Fisheries

All of the alternatives were found to be consistent with the applicable Forest-wide fisheries and watershed standards addressed in the Regulatory Framework section. None of the alternatives would hinder the attainment of INFISH Riparian Management Objectives (RMOs) for pool frequency, large woody debris, water temperature, and width to depth ratio, or cause significant harm to native fish and their habitats in the long-term. The short-term effects on pool volume from sediment increases that is expected with the action alternatives would not be significant enough to produce a non-attainment of the pool frequency RMO. In the long-term, the pool frequency RMO would be maintained or improved as natural riparian vegetative recovery occurs and project related sediment gets transported out of the affected pools and larger scale sediment reductions occur from improvements to the road network. The large woody debris RMO would be maintained or improved in all streams with improvements occurring in Silver Creek and West Fork Silver Creek, in all action alternatives. Natural recruitment of large woody debris would occur in all streams over the long-term. The water temperature RMO would be maintained, as measurable increases in stream temperature are unlikely to occur in any perennial stream. The width-to-depth ratio RMO would be maintained because the short-term sediment and peak/base flow increases would not occur on a large enough scale to cause significant channel widening. Several of the RMOs are currently below objective (large woody debris, water temperature, and large pools). Improvement in road drainage within the fire perimeter, as included in all action alternatives, would reduce sediment inputs to stream channels. Large wood within the burn area would increase as trees die and are recruited to the stream channel and/or placed in the channel as part of the aquatic habitat restoration that is included in all action alternatives. Increased large woody debris would provide instream structure to aid in pool formation and complexity. Plantings of deciduous tree species within affected riparian areas will improve water temperatures over the long-term.

Determination of Effects on Sensitive Species

The proposed project may impact individual redband trout or habitat, but will not likely contribute to a trend toward federal listing or reduced viability for the population or species (MIIH) for all alternatives (see following table). Redband trout populations in some or all potentially affected stream channels are limited as a result of high levels of fine sediment in spawning gravels, a lack of high quality pool habitat, lack of large woody debris, and water temperatures that may exceed State of Oregon water quality standards. Mitigations identified in this report, reconstruction and or elimination of problem roads or road segments, establishment of adequate RHCAs, close adherence to the Forest Soil Productivity standards, timber sale BMPs, and road BMPs will minimize any potential effects. Implementation of the watershed restoration activities proposed in all action alternatives will help to accelerate recovery of occupied redband trout habitat. At a watershed scale, upgrading of existing roads, decommissioning of unneeded roads, strict adherence to grazing standards and guidelines, and improvements in upland vegetation (a progression towards the Historic Range of Variability) should be considered to improve and/or re-establish functional watershed processes.

Although the redband trout present in the affected sub-watersheds has specific habitat requirements, it is assumed that trending toward the natural or near-natural habitat conditions described by ICBEMP (USDA & USDI 1997), will lead to properly functioning streams and desired future conditions. A positive trending towards these conditions will ensure species viability and sustainability.

Table 3.162 Sensitive Species Biological Evaluation Summary for the Toolbox Fire Recovery Project

Species	Alt. A	Alt. C	Alt. D	Alt. E	Alt. G	Alt. H
Redband Trout	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH

CULTURAL RESOURCES

- Introduction
- Regulatory Framework
- Analysis Area
- Analysis Methods
- Existing Condition
  - Toolbox Portion
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- Consistency with Forest Plan and Other Regulatory Direction

Introduction

Cultural resources (also known as heritage resources) include structures, sites, roads, trails, areas, and objects of scientific, historic or social value. They are irreplaceable, nonrenewable features documenting the past human use of our nation. Within the National Forests, these sites document the prehistoric and historic life-ways of the American Indian, the routes and actions of the early explorers, trappers, and settlers, the industrial activities of logging, mining, and stock grazing, community resource use, the history of forest recreation, and National Forest administration. The proposed action or its alternatives has the potential to damage the significant data, features, historic qualities, and natural settings of these sites unless adequate protections or mitigations are undertaken.

Regulatory Framework

The National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992) is the primary legislation governing modern heritage resource management on the National Forests, as well as on activities of all other federal agencies. Section 106 of the Act states, "The head of any Federal agency having direct or indirect jurisdiction over a proposed federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, as the case may be, take in to account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of such Federal agency shall afford the Advisory Council on Historic Preservation established under Title II of this Act a reasonable opportunity to comment with regard to such undertaking." Section 110 of the act states, "The heads of all Federal agencies shall assume responsibility of the preservation of historic properties which are owned or controlled by such agency." And that "Each Federal agency shall establish….a preservation program for the identification, evaluation and nomination to the National Register of Historic Places, and protection of historic properties." It also states that actions will be carried out, "in consultation with other Federal, State, and local agencies, Indian tribes, native Hawaiian organizations carrying out historic preservation planning activities and with the private sector." All other heritage resource management laws and regulations support, clarify, or expand on the National Historic Preservation Act. Under these statutes, the Forest Service is required to consider the effects of agency actions on heritage resources that are determined eligible for the National Register of Historic Places (NHRP) or on heritage resources not yet evaluated for eligibility.

Federal Regulations 36 CFR 800 (Protection of Historic Properties), 36CFR 63 (Determination of Eligibility to the National Register of Historic Places), 36 CFR 296 (Protection of Archaeological Resources), and Forest Service Manual 2360 (FSM 2360) provide the basis of specific Forest Service heritage resource management practices. These laws and regulations guide the Forest Service in identifying, evaluating, and protecting heritage resources on National Forest System lands. Federal agencies are also mandated to manage heritage resources under the guidelines of, and in cooperation with, the State Historic Preservation Offices (SHPO), and the Advisory Council on Historic Preservation (ACHP).

The National Environmental Policy Act of 1969 (NEPA) mandates that federal agencies consider the effects of activities on the natural and cultural landscapes. In NEPA, Agencies are directed to perform project planning such that the nation will "preserve important historic, cultural, and natural aspects of out national heritage, and maintain wherever possible, an environment which supports diversity and variety of individual choice," (Section 101(b) (4) of National Environmental Policy Act of 1969).

Several laws describe the role of Tribes in the federal decision-making process, including heritage management. The Archaeological Resource Protection Act (ARPA) requires Tribal notification regarding permitted removal of artifacts from federal lands. The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) recognizes Tribal control of human remains and certain cultural objects on public lands and requires consultation prior to their removal. Under the American Indian Religious Freedom Act of 1978 (AIRFA) the Forest Service considered impacts of actions on traditional Tribal cultural sites. The National Historic Preservation Act (NHPA) also specifically calls for Tribal participation in the NHPA Section 106 consultation process.

Cultural resource management on the Fremont-Winema National Forests is also guided by agreements made between Region 6 of the Forest Service and the Oregon State Historic Preservation Office (SHPO). Section 110 of NHPA outlines the requirements for consultation and agreements with other local, state, and federal agencies. In 1994, a new agreement with the Oregon SHPO was signed, implementing requirements covering public and Tribal participation, project review, and Forest heritage preservation programs. The Oregon SHPO provides the guidelines for adequate survey and reporting standards. Other agreements with the Oregon SHPO cover the management of specific site types such as lithic scatters, railroad grades, historic mining ditches, culturally modified trees, and depression-era Forest Service administrative buildings.

The Fremont Forest Plan tiers to the laws discussed above. Forest-wide Standards for Cultural Resource Management include:

General

Significant cultural resources will be managed using a combination of Inventory, Evaluation, Protection, and Enhancement Activities.

Inventory

1. A Cultural Resource Inventory will be conducted on all Forest lands, in addition to specific ground-disturbing areas, prior to the commencement of the project. These inventories will follow the guidelines set forth in the Forest Inventory Plan and will be supervised by a professional archaeologist.

Protection

1. Known cultural resources will be protected from adverse effects until they have been evaluated to determine whether they are eligible for inclusion in the National Register of Historic Places.

2. Ground-disturbing activities will be designed to ensure that there should be no effect on inventoried cultural properties that have been determined eligible to the National Register of Historic Places (36CFR60.4). When protection is not possible, treatment of the site will be conducted in order to negate or mitigate adverse effects.

Results of project-level cultural resource inventories, evaluations, and mitigations will be documented in project environmental assessments.

Native American Religious Freedom Act

1. The Klamath Tribal Executive Council will be requested to identify tribal issues for proposed projects on former reservation land.

2. Sites within former reservation lands on the Bly and Silver Lake Ranger Districts that provide members of the Klamath Tribe opportunities to practice their native religion will be protected as they are identified. This will be done in the sprit of good land stewardship and in consultation with the tribe.

3. Proposed activities will be analyzed for effects on traditional food-gathering sites. (Fremont National Forest 1989)

The Klamath Tribes (Klamath, Modoc, and Yahooskin Band of the Paiutes) consider this area to be part of their homeland territory (Spier 1930, Ray 1942). Spier (1930), Coville (1897), Barnett (1910), Stern (1966), and Gatschet (1890) provide ethnographic information of the culture of the Klamath Tribes. Ray (1938) and Wheeler-Voegelin (1955) provide some information of the Yahooskin Band of the Northern Paiute. The Klamath and Paiute followed the seasonal abundances of wild plants and animals. The Klamath had larger village sites near stable food sources such as Klamath Lake, Klamath Marsh, and the Williamson, Sprague, and Klamath Rivers. They would venture out to collect from adjacent areas on collection trips from the main village (Spier 1930, Coville 1897). The Yahooskin Paiute are thought to have ranged much farther on seasonal food collection rounds, but maintained village sites at Silver Lake, Summer Lake, and adjacent areas. The Toolbox Fire Recovery Project area lies within lands that these tribes relinquished under an 1864 Treaty. Disagreement between the Tribes, the U.S. Government, and the local non-tribal populous resulted in several reservation boundary surveys and lawsuits. In the early 1900s, the cases were decided, and the reservation boundary finalized. In 1954, Congress proclaimed the Klamath Tribes as no longer a separate entity from the rest of the American population, and terminated the tribal status. A settlement of money was offered to the tribal members, and the reservation was no longer considered the property of the Tribes. In 1961, these lands were divided between the newly created Winema National Forest, the Fremont National Forest, the Klamath Wildlife Refuge, and portions were sold to private corporations. This action transferred 14,232 acres of land from the former reservation to the Silver Lake Ranger District, 2,000 of which are within the project area. The Klamath Tribes were restored to formal tribal status by Congress in 1986.

The Klamath Tribes are included in the scoping process concerning all projects within the Fremont-Winema National Forests. Informal and formal consultation is undertaken with the Culture and Heritage Office of the Klamath Tribes. Upcoming projects and potential conflicts between projects and cultural resources are presented to the Office Director. At these consultations, site avoidance methods and proposed site protection mitigations are discussed. Concerns and ideas from the Culture and Heritage Office are considered and addressed in project planning. Guidelines for Tribal consultation and cultural resource management are outlined in Memorandum of Agreement Between the Klamath Tribes and the Forest Service, signed by the Regional Forester and the Klamath Tribal Chairman in 1999.

The Klamath Tribes were notified of the Toolbox Fire Recovery Project in the Fall 2002 and Spring 2003 SOPA (Schedule of Proposed Action) meetings at the Chiloquin Ranger Station, Chiloquin, Oregon. In June, 2003, prior to the release of the DEIS, the Fremont-Winema North Zone Archaeologist will present information regarding the 2002 fire and proposed rehabilitation projects to the Tribal Cultural Resource Officials. The Klamath Tribes will also be afforded the opportunity to comment on the DEIS prior to release to the general public. Additional meetings may be set up with the Tribal Chairman, Tribal Council, or other departments, based on their wishes following their initial review. Concerns of the Tribe will be taken into account during the refinement of the alternatives and proposed activity units following this internal review.

Yamsay Mountain is located nine miles west of the project area. The summit of Yamsay Mountain, including the surrounding slopes and Jackson Creek, have been designated a Traditional Cultural Property (TCP) for the Klamath Indians. "Yamsay Mountain and its environs are regarded by contemporary members of the Klamath Tribes (Klamath, Modoc, Yahooskin Paiutes) as a place of extraordinary spiritual significance essential to maintaining their cultural history and traditions," (Eligibility Notification, Keeper of the National Register of Historic Places, 12/23/1998). The western edge of the project area is located 9 miles east of the summit of Yamsay Mountain, and eight miles east of Buck Ridge, the eastern boundary of the Yamsay Mountain TCP. It is unlikely that the implementation of the project will cause auditory or visual disturbances at the summit of Yamsay Mountain that are beyond the impacts caused by the fire itself. To date, there are no other known religious sites requiring protection under AIRFA that will be temporarily or permanently impacted by the project.

Analysis Area

The area analyzed for heritage resources for the Toolbox Fire Recovery Project EIS includes all National Forest System lands that may be affected by project activities associated with any of the alternatives under consideration, as well as any private lands that may be directly or indirectly impacted by project implementation, (such as constructed roads on private lands to access Federal lands). The geographic area (inclusive of National Forest System Lands only) embraces

approximately 48,000 acres. Treatment units are located on National Forest System lands within the Silver Fire, the Toolbox Fire, and portions of the Winter Fire, all on the Fremont-Winema National Forests. The area of potential effect (APE) includes all areas where direct impacts will occur, such as those resulting from timber harvest, slash burning, temporary road construction, or erosion due to vegetative cover lost in the fires of 2002. It also includes areas where project activities may have an indirect (visual, auditory, or atmospheric) effect on cultural resources or their setting (e.g., timber harvest within the viewshed of the Yamsay Mountain Traditional Cultural Property). This APE was established because, even where direct effects to heritage sites are avoided, indirect effects can adversely impact cultural resources.

Analysis Methods

When a project is proposed on the Fremont-Winema National Forests, heritage program specialists participate in its planning and in the analysis of potential project effects. This participation consists of: 1) review of historical materials, archival documents, and overviews relevant to the project area; 2) analysis of the nature of the project and its potential to affect cultural resources; 3) review of public concerns regarding the project and its potential effect; and 4) consultation with interested Tribes, heritage interest groups, and the Oregon State Historic Preservation Office. In the process, the heritage specialist determines the project's APE based on the geographic area in which a project may alter the character or use of any existing historic properties.

Based on this information, heritage specialists determine whether existing cultural resource data is adequate to complete the environmental analysis and disclose potential effects on cultural resources. If the information is insufficient, additional research, inventory, or both, will be undertaken. Where additional inventory is needed, heritage personnel design a survey strategy to locate all historic properties within the area of potential effect. This strategy is designed in accordance with the criteria defined in *Fremont National Forest, A Cultural Resource Inventory Plan,* (Kaiser, 1984). If a survey discovers previously unknown cultural resources, those resources are recorded and their National Register eligibility status determined in consultation with the Oregon State Historic Preservation Office (Oregon SHPO). Both background research and fieldwork are documented in a report submitted to the Oregon SHPO. The heritage program manager consults with Oregon SHPO to determine the nature of the project's effects on significant properties. If needed, the heritage program manager and Oregon SHPO work together to determine appropriate project redesign, restrictions, designation of sensitive areas, or mitigation measures. The heritage program manager coordinates recommendations, actions, and monitoring with the project leader, Oregon SHPO, and interested Tribal preservation officials.

A project is determined to affect an historic property when project activities alter the characteristics that qualify the property for inclusion in the National Register of Historic Places (NRHP) (see 36CFR800.9). Alteration to features of the property's location, setting, or use may be relevant, depending on the property's significant characteristics. An adverse effect results when the project may diminish the integrity of an historic property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects include, but are not limited to: physical destruction, damage, or alteration of all or part of the property; isolation of the property from its setting; alteration of the setting's character when that character contributes to the property's National Register eligibility; introduction of visual, audible, or atmospheric elements out of character with the property or its setting; and neglect of a property resulting in its deterioration or destruction, (National Park Service, 1995).

The Forest Service Heritage Resource Program is responsible for managing cultural resources to prevent loss or damage before they can be evaluated for scientific study, interpretive efforts, or other appropriate uses. This requires projects to be implemented in a manner that avoids adverse effects on historic properties. Where a proposed project would result in impacts to historic properties, project design should anticipate that treatment of the property would conform to sound preservation practice and be consistent with all applicable preservation standards. Project design should ensure that the essential form and integrity of historic properties is not impaired. If the potential for adverse effects cannot be avoided, appropriate mitigation treatments are determined in accordance with 36 CFR 800.5. As an example, mitigation of impacts for timber harvest may include establishment of buffer zones, directional falling, alteration of harvest unit boundaries, changes in road locations, location of skid trails away from historic properties, limiting the harvest methods in certain areas, seasonal limitations, and restrictions on slash disposal or tree planting activities. Where a project has the potential to impact a property of Tribal concern, the Forest Service will consult with Tribal representatives to develop appropriate mitigation measures.

Where cultural resources or human remains are encountered during project implementation, the Forest has the authority to modify or halt project activities. The standard heritage resource protection provision, C (T) 6.24, would be included in all timber sale contracts. Other contracts would have appropriate cultural resource protection provisions. These provisions require that contractors and Forest Service representatives work together to protect historic properties. Failure of the

contractor to identify historic properties encountered during project activities may constitute a breach of contract. The provision specifically requires the contractor to notify the Forest of such discoveries.

In evaluating alternatives, the heritage specialist provides the project leader with information on all of the historic properties within the area of potential effect, their location, character, the nature of potential effects, and the mitigation possibilities for those effects.

Nearly one half of the proposed project area is considered as high-probability for cultural resource occurrence as per the Fremont National Forest Cultural Resource Inventory Plan. This was due to the relatively gentle slope of much of the area, and numerous water sources, meadows, scab-rock flats, and occurrence of natural obsidian sources in portions of the project area. A total of 93 sites had been previously recorded within the boundaries of the Toolbox Project Area boundary. Extensive surveys were undertaken in late September through mid December 2002 of over 11,000 acres of land within the fire perimeter. Surveys concentrated on stands identified for treatment at that time, which were identified in the project scoping letter of November 2002. An additional 150 sites were recorded in these three months of survey.

December 2002 snows initially halted survey of the proposed salvage units. Survey on nearly 2,000 acres of proposed units began again in the spring and summer of 2003. Alternative development, including the location of some prescribed burn locations, aspen planting locations, road decommissioning, planting and fuels treatment outside harvest units was not completed prior to the onset of December 2002 snowfall. An additional 3,000 acres were identified during alternative development as in need of inventory in these project areas. Attempts will be made to locate several historic features as yet unrecorded. These include the Yreka Trail (1861-1865) from Yreka, California to Canyon City, Oregon, the locale of Fremont's 1843 discovery of Winter Ridge and Summer Lake and his trail, and several historic roads of local historical importance where they may be in jeopardy from this project's ground disturbing activities. Areas not surveyed in 2002, within the high-probability category for site occurrence, as described in the Forest's Cultural Resource Inventory Plan, are being surveyed in the spring and summer of 2003. All previously located significant cultural resources and significant sites located in the 2002 and 2003 surveys will be protected through avoidance or other project design methods. It is expected that some modification of proposed activities, including reducing the size of some proposed harvest units, would occur between the issuance of the DEIS and the Final EIS.

Existing Condition

The Fremont-Winema National Forests has conducted cultural resource inventories of National Forest System lands since 1978. The project area is stratified into areas of greater or lesser likelihood for the existence of historic or prehistoric activity areas and associated artifacts or sites. These probability zones are stratified based on topography, occurrence of basic resources such as water, food, or locations of raw materials, areas of activity known from histories, maps, records, or oral traditions, areas of known or suspected travel routes, and areas with known or suspected spiritual significance. This strategy was developed on the Fremont National Forest and approved by the Oregon State Historic Preservation Office (Kaiser, 1984). The landscape is broken into areas of High, Moderate, and Low probability for cultural resources. Nearly 60 percent of the Silver Fire and 40 percent of the Toolbox Fire were in High Probability areas.

Historic properties found in the Silver Lake area reflect the wide variety of human activity occurring here over the past 13,000 years. Prehistoric period properties include seasonal occupation sites (i.e., camps associated with hunting or plant gathering), tool stone quarries, small single event lithic reduction sites, game kill and butcher sites, and spiritual sites. Properties related to the Historic Period include those associated with homesteading, irrigation or other agricultural development, logging, transportation, recreation, and Forest Service administrative history.

The history of human occupation in the Great Basin of South-Central Oregon has been traditionally broken down into six major periods: (1) The Paleo-Indian Period from 13,000 (or earlier) to about 8,000 years ago, (2) Early Archaic Period from 8, 000 to 6,000 years ago, (3) Middle Archaic from 6,000 to 2,000 years ago, (4) Late Archaic from 2,000 to 200 years ago, (5) Proto-Historic from 250 to 150 years ago and (6) the Historic Period covering the last 150 to 200 years. The first five periods concern the history of the Native American (American Indian) people. The Paleo-Indian period occurs in the late Pleistocene and early Holocene at the end of the last ice age. It includes the earliest settlement in the Americas by a people that hunted mega-fauna (giant bison, mammoth, ground sloth), horse, and camel. In the Great Basin, these people were adapted to a lake-side life style, around the massive lakes of the late glacial and early post-glacial period. The prehistoric Fort Rock Lake reached its highest lake level 17,500 years ago and was about three quarters full 13,000 years ago, (Freidel, 1994). Large thrusting spears typify the Paleo-Indian hunting toolkit, although atl-atl darts were also used. Occupation at Fort Rock Cave (a.k.a. Cow Cave) date to 13,200 years ago (Bedwell, 1973). This is one of the earliest dated occupation

sites in the Western Hemisphere. At the end of the Pleistocene, the mega-fauna, the horse, and camel became extinct in the Americas, forcing change of the people who hunted on them.

The Archaic periods cover the post-Pleistocene (post-glacial or Holocene) period in which we now live. The Archaic traditions were centered on hunting, fishing, shellfish gathering, plant gathering, and other collection of food and goods from the "natural" world. Later post-archaic traditions are based on plant and animal domestication, farming, irrigation, and related activities. The grand societies of the Andes, Central America, the Mississippi Basin, and the Southwest were dependent on these farming activities. The cultures in the arid and seasonally cold Great Basin and resource rich Pacific Coast and Colombia Basin never depended, in any great sense, on domesticated animals and plants or a farming lifestyle. The Archaic is split into the Early, Middle and Late periods. The Early Archaic is an adaptation to an arid landscape following the drying of the Great Basin lakes. The extinctions of favored prey forced the people to adapt to hunting smaller game. Spears or javelins thrown with an atl-atl, (spear thrower) are the typical hunting tool of the Early and Middle Archaic. The dependence on plant foods increased during the Early Archaic, as does the increased use of small game such as jack rabbit, fish, and smaller herd animals.

The Middle Archaic was a time of fluctuating water regimes. It starts in the driest period or Altithermal, drier than today's average. In Central Oregon, Altithermal aridity was aggravated by the pumice ash deposits from the Mount Mazama collapse of 6,800 years ago. The later part of this period was wetter than today, and the Great Basin was a more lush habitat, with a reappearance of standing water in the Fort Rock Valley, to a depth of at least 11 feet. Fishing became much more prominent, and there are the beginnings of sedentary life styles at some areas. The Late Archaic covers the last 2,000 years, and is earmarked with the development and dissemination of bow and arrow technology. Arrow points typify the hunting tools of this period, and plant foods dependence reached its zenith. In this period, regional variations in culture are more pronounced, and the ancestral roots of ethnographic tribes can be seen.

The Proto-Historic period concerns the Native American cultures as their life-ways, and material culture was influenced by trade, exchange of ideas, acquisition of the horse, and disease epidemics that pre-dated Euro-American arrival. During this time, many tribes across the west abandoned sedentary lifestyles to realize the potential of the horse in hunting bison. Horses became an important item of trade as well. The diseases that swept through the west drastically reduced numbers in the heavily populated areas. By the time Lewis and Clark had reached the Northwest (1805), many of the villages had been ravaged by disease. The Proto-Historic period ended at different times for the various tribes in the Great Basin, but generally, in this area, the date those tribes were removed to reservations (1865) can be seen as the end of this period. The historic period includes the exploits of the early trappers, explorers, and hunters of the early 1800s, early settlement by Euro-Americans and other foreigners, activities of Native Americans on reservations, industrial resource extraction (logging, mining, stock), and National Forest Administration, to the activities of the present.

The Toolbox Project lies within a part of the Yahooskin Paiute and Klamath traditional use area. The Yahooskin Paiutes occupied and used areas around Silver, Summer, Goose, and Abert Lakes, the Chewaucan River Valley, and the uplands tributary to these lakes (Stewart, 1939). Some archaeological evidence indicates that people with Klamath cultural traits occupied Lake Abert, Silver Lake, and the Chewaucan River area in the Middle Archaic Period (Oetting, 1989, Wingard, 2001). The Klamath and Yahooskin Band of Paiute relinquished most the project area under an 1864 Treaty, which created the Klamath Indian Reservation. A small portion of the Toolbox project was a part of this reservation until 1961.

The exploits of the Hudson Bay Company trappers, and the American trappers and explorers are the first historic period activities in the Silver Lake area. Lewis and Clark passed far to the north of this area in their 1804-06 exploration. It was not until Peter Skeen Ogden passed through the Malheur River area in 1825-26, and Klamath area in 1826-27 that exploration of Eastern and South Central Oregon was well documented. He followed the Crooked River and Malheur Rivers into the Malheur-Harney Lake basin. In 1826, Ogden and his troop crossed from Malheur Lake to the Deschutes River near Newberry Crater. They then followed the Deschutes and Little Deschutes Rivers, south, following an earlier reconnaissance route of the McDonald-McKay group of 1825. Ogden crossed into the Klamath River Drainage near Chemult, Oregon and continued south along the Klamath Marsh, Klamath Lake, and Klamath River into California, then back into southwestern Oregon in the Rogue River area. Later, the Ogden party headed east, traveled up the east side of Goose Lake, crossed the Warner Mountains, and headed northeast to the Snake River. They did not venture into the Silver Lake country on either expedition (Ogden 1926-27). Several other explorers passed through portions of Klamath and Lake Counties but not through the Silver Lake Ranger District area (Reading, 1843, Nielsen, Newman, and McCart, 1985).

John C. Fremont explored Central Oregon, and crossed into the Silver Lake Ranger District near Sycan Marsh in December 1843. He was in search of the mythic Buena Ventura River that was thought to drain the interior west into the Pacific Ocean. A Klamath Indian pointed him and his group to the east-northeast from the Williamson River, toward "the land of

no snows." Trudging through three feet of snow, the group arrived at Fremont Point from which Fremont could see a snow free lake from the frozen, snowy summit. He named the two features Summer Lake and Winter Ridge, (Fremont 1845, Smucker 1856). They passed down the face of the ridge and camped at the edge of Summer Lake. Fremont's route across the Silver Lake Ranger District lies south of the area burned in 2002. From Fremont Point, the troop headed north along the rim of Winter Ridge several miles before traversing down the steep slope to Summer Lake. This segment of their route is in the Toolbox project area. The steep portion down to Summer Lake was burned over in the 2002 fires, but is not a part of this EIS.

In 1861-1862, gold strikes in the John Day country enticed the miners in Yreka, California to head north. Their trail crossed north-south through the east side of the Silver Lake Ranger District. The route was reported to have had very little improvement, with very few rocks moved out of the path, (Nielsen, Newman, and McCart, 1985). The actual on-the-ground location of the wagon road is not now known, but will be searched for in 2003 and protected where found. Trails were developed in the 1870s to 1890s from ranches on Summer Lake to rangelands in the heart of Silver Lake Ranger District. In addition, the Winter Rim trail was built in the late 1890s. Parts of these trails can be seen with trail blazes still existing. More formal forest roads had to wait the creation and management of the National Forests. The Forest Wagon Road connected Lakeview to Silver Lake, and approximately follows Road 28 through much of the District (Bach, 1979). A road from Silver Lake to Foster Flat Ranger Station also passes through the project area, as do a few minor roads near Duncan Creek, West Fork Silver Creek, and Hager Mountain.

Concerns about watershed protection, prevention and containment of wildfire, and long-term lumber availability led to the creation of Forest Reserves in the 1890s and early 1900s. The Fremont Forest Reserve was created in 1906 from public lands that now include the north half of the Fremont National Forest, (including the lands within the Toolbox Project area), the Deschutes National Forest east of the Deschutes River, and the Winema National Forest north of the Klamath Indian Reservation. The Goose Lake Forest Reserve was created the same year and covered the south half of the modern Fremont National Forest. The two forests covered 1, 865,750 acres, (Pinchot, 1907).

In 1907, all Forest Reserves were renamed as National Forests. In 1908 the Fremont and Goose Lake Forests were combined under the Fremont name, and the northwestern portion was transferred to the Deschutes and Umpqua National Forests, (Bach, 1979). In 1911, the Paulina National Forest was created out of portions of the Deschutes, Fremont, Crater, and Umpqua National Forests, including some portions of the project area, with its headquarters at Crescent, Oregon. The Paulina National Forest did not last long. By 1912, a portion of the new forest had been returned to the Fremont National Forest, including the project area. By 1914, the Paulina National Forest existed only in name, with portions administered by the Crater, Deschutes, and Fremont National Forests. In 1915, the forest was formally eliminated, and split between the other three, (Bach, 1979, Baker, 1949). In 1961, the Winema National Forest was created out of portions of the Fremont, Deschutes, Rogue River (originally called Crater), and portions of the former Klamath Indian Reservation. In addition, lands from the reservation were added to the Fremont National Forest, including some of the project area.

The Forest Service quickly began improvements on the Fremont National Forest. Trails, phone lines, roads, bridges, and guard stations were built to improve access and fire fighting effectiveness. In addition, some timber was sold prior to 1910, but not in great quantity. Within the project area, a ranger station was planned at Silver Creek Marsh by 1907, which was later the site and a CCC camp, and now, a campground. At Foster Flat, an additional ranger station was built in 1909. Lookout sites in the project area included Dead Indian Mountain (1934), Fremont Point (1930), Deerhead (1932), and Foster Butte (1934), (Kresek, 1985). All but Fremont Point lookout had been abandoned and removed prior to the fire. The Fremont cabin (used as a recreation rental) was burned by the fire, as was all the wood stair treads, and floor of the metal tower. In 1933 the Civilian Conservation Corps (CCC) occupied Silver Creek Marsh Campground area as a tent city. In 1935, buildings were constructed after a year of no use. In 1936, the Grazing Service occupied the camp with a CCC crew. It was not reoccupied after that. The CCCs brought about many improvements, such as guard stations, office buildings, lookouts, roads, bridges, and phone lines, in addition to fighting forest fires and forest diseases.

Raising stock was, and still is, a significant economic activity in the Silver Lake area. Prior to the creation of the Fremont National Forest in 1906, cattlemen and sheepherders ran stock over the public domain with no concerns for paying for use or ensuing damage by overgrazing. In the late 1800s and early 1900s, conflicts between sheep and cattle owners resulted in range wars. In the Silver Lake area, nearly 5,000 sheep were killed by cattlemen, and one local merchant was killed for giving out information of the activity. Following the creation of the Fremont National Forest, the range wars died out. Early efforts of the Forest Service range program limited the number of sheep on the range (Bach, 1979). In the 1920s, local farming benefited from the creation of Thompson Reservoir. This reservoir helped in timing the release of Silver Creek water downstream so that more was available during the drier growing season. The water diversions from Silver

Creek were located outside of the National Forest. Logging was not undertaken on a large scale in the project area until the 1940s.

Markets were far from Silver Lake, and until the 1930s, timber access roads and rail systems were not well developed. "The present annual cut on the Fremont is undoubtedly less than it should be. The cause for this is as follows. 1. Lack of market for timber products. 2. Rough Country makes logging very expensive. 3. Our present stand is very thin and scattered… 3. The timber is of a very poor grade." (Fremont NF 1910). No large sawmills were built in the Silver Lake area, although two mills were located northwest of Silver Lake. The Embody Mill operated from about 1910 to late 1920s and was located near Bald Mountain. The Auger Valley Mill operated on private land in Auger Valley, just outside the fire perimeter, from about the 1910s to mid-1930s, (Fremont NF, 1910). The Williams Mill was located at the north end of Oatman Flat and operated from the mid-1930s to the late 1950s. A logging railroad was constructed into the southwest corner of the project area in the early 1950s. This was a truck to rail system where the logs were moved to the railhead (reload stations) by truck, then hauled to the mill in Bly, Oregon by railroad. Most of these grades are now automobile roads. The only railroad grades in the project area are near Indian Creek and Strawberry Creek.

Toolbox Portion

The Toolbox Fire area includes portions of Duncan Creek, East Fork Duncan Creek, Willow Creek, Graham Creek, Benny Creek, Hawk Creek, McCall Creek, and Welker Creek, as well as Foster Lake, Foster Flat Meadow, La Brie Lake, New England Flat, Buckaroo Lake, and The Frog Ponds, all likely areas for site locations. The fire area stretches from the toe of Hager Mountain, east to the rim of Winter Ridge. The south central portion of the fire is dominated by Foster Butte and Deer Head Butte. The north end and southwest corner are dominated by open scab flats crossed by incised creek beds and timber stringers. Dead Indian Mountain and the rim of Winter Ridge are prominent features on the east edge of the project area. Meadows, aspen groves, and rocky treeless openings are scattered throughout the project area. These rocky openings are often associated with root crops favored by Native American tribes of the Great Basin. In addition, a source of obsidian is located near the fire area at the lower slopes of Hager Mountain. Graham, Benny, Hawk, and Welker flow into Silver Creek, which empties into Paulina Marsh, near the town of Silver Lake, and eventually drains into Silver Lake. McCall, Duncan, East Fork of Duncan, and Willow Creek flow directly into Silver Lake. Large village sites have been recorded on the shores of Silver Lake and Paulina Marsh. The fire burned the upland areas above these village sites. This fire area is considered, overall, to have a moderate probability for the occurrence of cultural resource sites, though some areas have very low probability and some very high probability, based on local conditions.

Previous surveys within the Toolbox fire have recorded 48 cultural sites within or near proposed activity areas. As of June 1, 2003, cultural resource inventories have covered 70 percent of the high probability areas within proposed harvest units, fuel reduction units, and other proposed activity areas. Adequate moderate and low probability areas had been covered under previous surveys, though some moderate and low areas were incidentally covered while surveying areas of higher likelihood. These new surveys have documented an additional 16 sites and expanded several previously recorded sites within or near proposed activity areas. The majority of these sites are lithic scatters associated with camps, quarries, travel routes, and single activity events, though some are historic sites. Sites were associated with water sources, meadows, rocky timber openings, rock outcrops, and potential travel routes. Significant sites will be deleted from the units, and adequate measures taken to ensure they are not inadvertently damaged.

Silver Fire Portion

The Silver Fire area includes the middle portions of the North Fork, Middle Fork, and South Fork, as well as the main stem of Silver Creek below Thompson Reservoir. Other creeks within the Silver Fire area include Auger Creek, Guyer Creek, Strawberry Creek, and Indian Creek. The upper reaches of these creeks drain the east side of Yamsay Mountain. Yamsay Mountain is a sacred place for the Klamath Indian Tribe and Yahooskin Band of Paiutes, (Spier 1930). Its significance earned it the status of a Traditional Cultural Property (TCP) in 1998. As noted earlier, "Yamsay Mountain and its environs are regarded by contemporary members of the Klamath Tribes (Klamath, Modoc, Yahooskin Paiutes) as a place of extraordinary spiritual significance essential to maintaining their cultural history and traditions," (Eligibility Notification, Keeper of the National Register of Historic Places, 12/23/1998). The maintenance of a "natural appearing landscape" is of great importance to the tribal members at sacred religious sites such as Yamsay Mountain. The project area lies 8 miles east of Buck Ridge, which is the eastern edge of the Yamsay Mountain TCP.

The creeks within the upper (southwestern) side of the project area form deeply incised canyons with broad, relatively flat to rolling ridges between the canyons. This area has a moderate density of vegetation including pine and fir. The lower (northern) portion of the project contains the very deeply incised canyons of the West Fork and main stem of Silver Creek

with flat mesa-like ridges between. This area has many open, rocky meadows often associated with root crops favored by Native American tribes of the Great Basin. In addition, a source of obsidian is located in the fire area. This resource had a great effect on the nature and distribution of sites in the project area.

The northeast edge of the fire reaches the lower slope of Hager Mountain, just south of the town of Silver Lake. This is an imposing feature rising over two thousand feet above the surrounding landscape. Silver Creek empties into Paulina Marsh near the town of Silver Lake, and eventually drains into Silver Lake. Silver Lake is an interior drainage lakebed of the Great Basin, and part of the large prehistoric Fort Rock Lake, (Allison, 1979). Other prominent features include Alder Ridge, Alder Spring, Indian Creek Flat, and Silver Creek Marsh, as well as several small knolls, unnamed springs and creeks, and ridges. This fire area was considered to have a very high probability for the occurrence of cultural resource sites, although the probability in the steeper, western portion of the fire is of lower probability.

Previous surveys within units in the Silver Creek fire have recorded 45 sites within or near proposed activity areas. As of June 1st, 2003, cultural resource inventories have covered 70 percent of the high probability areas within proposed harvest units, fuel reduction units, and other proposed activity areas. Adequate moderate and low probability areas had been covered under previous surveys. These new surveys have documented an additional 134 sites within or near proposed activity areas, and expanded some the previously recorded sites a great deal. The majority of these sites are lithic scatters associated with camps, quarries, travel routes, and single activity events. The large obsidian source area was a primary factor in the number of sites in the area, though many sites were also associated with other resources as well (water, root crops, travel routes, and rock outcrops). All significant sites will be deleted from the salvage units and other ground-disturbing activity units. Road construction, improvements, and decommissioning will avoid all significant sites, as well as ground disturbance associated with prescribed fire, fuel reduction, site preparation for planting, hydrology projects, and any other activities associated with the Toolbox Fire Restoration Project.

Environmental Consequences

Direct Effects

Alternative A

Direct impacts to known cultural resources will be entirely avoided in this no action alternative; however, indirect impacts would be greater (see Indirect and Cumulative Effects section below).

Common to All Action Alternatives

Fuel reduction/logging activities such as tree falling, skidding, decking, slash disposal on over 20,000 acres, and temporary road development could impact cultural properties within or near project units. Reforestation measures can affect cultural sites through ground disturbance during site preparation, slash disposal and replanting. Road reconstruction, culvert improvements, aspen management, and other planned watershed projects also have the potential to disturb cultural resources. Under the action alternatives, all of which contain ground-disturbing activities, heritage resources could potentially be adversely affected. These potential impacts, however, have been mitigated through site avoidance.

For all action alternatives, (Alternatives C, D, E, G, H), project activity has been designed to avoid all previously known and newly recorded sites potentially eligible to the National Register of Historic Places. Therefore, there is little differentiation between alternatives based on the direct impacts to cultural resources. Some site protection benefit is anticipated from the proposed actions, (prevention of re-burn, soil stabilization, road closure, etc.). In addition, there are some sites that have likely been missed during survey, and lie within proposed activity areas. No cultural resource survey can find 100 percent of all sites. However, any significant site discovered during project preparation and implementation will be protected from project impacts. There may be some differentiation between alternatives related to positive site protection stemming from the proposed actions and potential impacts to unfound sites. It is, however, likely that the potential damage of inaction outweighs the potential for damage of sites not found.

Direct impacts would be avoided in all action alternatives through avoidance of all known significant sites. Potential impacts would only be to those sites that were not discovered in surveys. The potential, however, is quite low in all alternatives, since all high probability areas and much of the moderate and low probability areas were surveyed. All alternatives have a number of proposed projects immediately adjacent to known site areas. Some sites are entirely surrounded by harvest units, fuel treatment units, or reforestation areas. This proximity increases the potential that one or more of these sites may inadvertently be impacted by project activity. These sites would be well identified on the ground prior to project implementation, and the sites' protection would be monitored during the activity.

Alternative C

Alternative C ranks second highest in acres of ground disturbing activity units, (31,143 acres) including 14,441 acres of salvage harvest. Based on the premise (applied below to all alternatives) that a greater number of acres treated equates to a greater danger to undocumented sites, Alternative C (and G) would have the highest potential impact on sites. Alternatives C and G have the highest number of proposed projects immediately adjacent to known site areas. Overall, due to survey design, site avoidance and monitoring , Alternative C has a low potential for site disturbance.

Alternative D

Alternative D contains the lowest amount of acres within ground disturbing activity units (19,212 acres), including 6,367 acres of salvage harvest. Alternative D would have the lowest potential impact on sites. Alternatives D and E have the lowest number of proposed projects immediately adjacent to known site areas. Overall, due to survey design, site avoidance and monitoring, Alternative D has a very low potential for site disturbance

Alternative E

Alternative E contains the fourth highest amount of acres within ground disturbing activity units, (23,442 acres) including 11,490 acres of salvage harvest. Alternative would have the second lowest potential impact on sites. Alternatives E and D have the lowest number of proposed projects immediately adjacent to known site areas. Overall, due to survey design, site avoidance and monitoring, Alternative E has a very low potential for site disturbance

Alternative G

Alternative G contains the highest amount of acres within ground disturbing activity units, (34,238 acres) including 14,419 acres of salvage harvest. Alternatives G (and C) would have the highest potential impact on sites. Alternatives G and C have the highest number of projects immediately adjacent to known site areas. Alternative G also has several thousand acres of fuels treatment in areas with low fire mortality. These areas are less likely to have had bare ground during the 2002-2003 surveys, and, therefore, more sites may have been missed during survey. The likelihood that undocumented sites would be impacted is still very low, however. Overall, due to survey design, site avoidance and monitoring, Alternative G has a low potential for site disturbance.

Alternative H

Alternative H contains the third highest amount of acres within ground disturbing activity units, (29,609 acres) including 13,031 acres of salvage harvest. The potential impact of Alternative H on sites is mid-way between Alternative C and G at the higher end, and Alternative D and E at the lower end. Alternative H also has a number of proposed projects immediately adjacent to known site areas. Overall, due to survey design, site avoidance and monitoring, Alternative G has a low potential for site disturbance.

Indirect Effects and Cumulative Effects

Cultural Resources have been subjected to a wide variety of impacts since their creation. These impacts have been caused by man and by nature. Cultural resource sites are distributions of artifacts and features around a locale. They may be accumulations of objects from centuries of occupation, or items left from a single activity taking only a few minutes. They provide information of past life-ways through the intricate spatial relationship between various artifacts, between various features, between features and artifacts, and between neighboring sites and sites further field. These relationships, the artifacts themselves, and site features can easily be destroyed through a number of actions. Natural events erase parts of this story through wildfire, landslides, water and wind erosion, bio-turbation (roots, rodents, badger, etc), earthquake, wind throw of trees, and decay of bone, wood, tule, baskets, and other perishable matter of the material culture.

The actions of humans have also had profound effects. Ground disturbance through logging, road construction, mining, grazing, building construction, waterlines, and fences, etc, has greatly impacted our historic and prehistoric sites. In 1976, the Forest Service began considering effects of proposed activities on all significant sites. In the following few years, surveys prior to project decisions became the standard operating procedure. Now, cultural resource management is well integrated into the project planning process, and sites are accepted as a valued resource. Artifact collection and unauthorized digging is another impact to these sites. Digging and collection removes many of the most significant artifacts from sites. Such artifacts may indicate dates and seasons of occupation, cultural affiliation, activities undertaken, and prehistoric travel or trade patterns. In 1979, Congress passed the Archaeological Resource Protection Act (ARPA), which made excavation of sites without approved permit illegal. Permits were given to trained and educated Archaeologists for purposes of research, or as part of mitigation to proposed projects. This has stemmed the damage to

important archaeological sites. Surface collection, while not covered under ARPA, is covered under the Forest Service regulations as theft of public property. While such protections as ARPA and project avoidance has benefited a vast number of sites, all sites will tend toward deterioration though time.

Forest fire prevention and fire suppression practices over the past century have insulated the forests from natural low intensity maintenance fires. These low intensity fires generally prevented fuel accumulation, overstocking, and spread of disease. Due to past fire prevention, a high density of fuels has now built up on the forest floor, and stands are dense with ladder fuels into overstory tree crowns. When such stands burn, they are not low intensity fires, but extreme, stand-replacing events. While many types of cultural resources can survive low-severity fires with little or no damage, high-severity burns destroy or damage a wide range of cultural sites and artifacts. Historic structures are particularly vulnerable, but even stone tools, bottles, and cans yield to the extremes of temperature in these hottest of fires. Fire impacts to lithic scatters have recently been researched by a number of Archaeologists. High temperature, long duration heating can damage obsidian flakes and tools. It was found that damage to obsidian artifacts occurred at temperatures as low as 400 degrees Fahrenheit sustained for periods of time (Deal, 2002, Benson, 2002). Temperatures above 900 degrees Fahrenheit often result in melting and frothing of obsidian. Flakes and tools of crypto-crystalline silicates (jasper, chert, flint, etc) were found to have been shattered in to small pieces by the fire in one study (Benson, 2002). Observations in the 2002 Toolbox Project field season were: 1. Obsidian flakes and tools shattered or snapped in half from the fire, 2. Obsidian flakes or tools partially melted by the fire, 3. Obsidian flakes, tools and cobbles that frothed into pieces of pumice as they was completely melted, 4. Bottles shattered or melted by the heat, 5. Historic cans that had all solder in joints melted and have fallen apart, and 6. Cans that have been partially burned away by the high heat. Historic structures also suffered. One dug-in cabin was found with all the wood posts, walls and roof burned away, and the historic Fremont Lookout Cabin was burned, as were the wooden parts of the steel framed lookout tower. The fire has had a definite detrimental effect on cultural resources in the Toolbox Project.

Traditional uses of the project area are not well documented. Fires may have impacted traditionally-used plants and animals, but such species are likely to have been adapted to fire. Willow in other areas was traditionally burned over to stimulate young straight shoots, needed in basket making. Bulbs and tubers gathered on open rocky flats of the Great Basin are also adapted to fire, and will likely benefit from the fire's removal of competitive brush. Other medicinal plants and food plants may have either benefited or been impacted by the fire. It is unclear what species these may have been and to what degree they were affected by fire.

Sites will continue to degrade regardless of any actions taken or not taken. Cumulative natural and human caused effects will eventually eliminate the significant information from some sites. Others, with sound management and protection, will retain these qualities and data for the benefit of future generations. Future uses of the forest, population pressure, needs of the public, and political realities will evolve, requiring careful planning and vigilance to save these sites for future generations.

Alternative A

Because no fuel reduction, reforestation, or watershed improvement would occur, there would be no direct effects of the project action to cultural resources. However, the failure to address problems caused by the fire may accelerate degradation of significant cultural resources. With no reforestation or watershed improvement, cultural sites in floodplains, draws, or stream terraces could be at risk from erosion and flooding over a longer period of time. Riling of side slopes may directly erode the cultural deposits on upland sites or bury the cultural material located benches at the base of these slopes. Gullying along slopes and flats adjacent to creeks could directly erode the soils in the sites and redeposit cultural material outside its original context. Noxious weed invasion is known to promote erosion and could contribute to site damage. The sites may also be subject to prolonged exposure to looting due to their exposed nature and unlimited road access due to lack of road closures.

The lack of fuel reduction under this alternative would eventually result in heavier ground level fuels throughout the project area. In the event that fire occurred in the future, these fuels would contribute to more intense fire activity. These fires could again burn over sites and further degrade and destroy the surface artifacts. Failure to implement proposed riparian improvement projects could result in destabilization of creek banks and eventual bank failure. Such degradation of creek banks may directly impact the 27 sites in the project area located immediately adjacent to these creeks. No roads are planned for closure under this alternative, leaving open road density at 3.63 miles per square mile. At present, the exposed condition of sites in the burned area, and the open access, leads to the potential for accelerated surface collection of artifacts. The no action alternative has a greater potential for causing further site degradation than any of the five action

alternatives, due to the existing unstable condition the project area is now in and the plan (in the action alternatives) to avoid any direct impacts to known sites. This potential for further indirect site impact is considered high.

Common to All Action Alternatives

The alternatives contain varying amounts of fuel reduction, road management, and soil stabilization measures that address some of the factors that could indirectly affect cultural resources. All of the action alternatives close a significant number of miles of roads. This would benefit cultural resources, including a number of sites now vulnerable to surface collection, by limiting vehicle access to sites exposed during the 2002 fires, thereby reducing the opportunity for looting. Road closure (berms or other blocks) would be placed outside of site boundaries. Road decommissioning may require ripping or reshaping of the roadbed along part or all of its length. Where a site is crossed by a road that would be decommissioned, the ground disturbing activity would halt across the site area, but continue outside the site area.

Alternative C

Alternative C would treat a large amount of fuel through timber sales, thinning; slash disposal, and prescribed fire. This alternative would greatly reduce the likelihood that, in the event of a fire start, significant sites would experience a high intensity fire. Alternative C would reduce motorized access by decommissioning or closure of 142 miles of roads. Alternative C would maximize watershed stabilization projects. Placement of large woody debris in the creeks, hardwood planting, and aspen management would provide protection to the sites located near streams from erosion, bank de-stabilization, and flooding. Overall, the potential for further indirect site impact is considered low.

Alternative D

This alternative would treat a moderate amount of fuel through timber sales, thinning, slash disposal, and prescribed fire. This alternative would reduce the likelihood that, in the event of a fire start, significant sites would experience a high intensity fire, although not the extent that Alternative C does. Alternative D would reduce motorized access by decommissioning or closure of 147 miles of roads, the most of any alternative. Alternative D, with the same amount of riparian projects as Alternative C, would maximize watershed stabilization projects. Overall, the potential for further indirect site impact is considered low.

Alternative E

Alternative E would treat a large amount of fuel through timber sales, with lesser quantities of thinning, slash disposal, and no prescribed fire. This alternative would somewhat reduce the likelihood that, in the event of a fire start, significant sites would experience a high intensity fire. Alternative E would reduce motorized access by decommissioning or closure of 82 miles of roads. Alternative E provides the minimum of watershed stabilization projects. Placement of large woody debris in the creeks may provide some protection to the sites located near streams from erosion, bank de-stabilization, and flooding. The benefits that Alternatives C, D, G, and H would realize from hardwood planting and aspen management would not occur. Overall, the potential for further indirect site impact is considered low.

Alternative G

This alternative would treat a large amount of fuel through timber sales, with greater quantities of thinning, slash disposal, and prescribed fire. This alternative would most greatly reduce the likelihood that, in the event of a fire start, significant sites would experience a high intensity fire. Alternative G would reduce motorized access by decommissioning or closure of 82 miles of roads. Alternative G, with the same amount of riparian projects as Alternative C, would maximize watershed stabilization projects. Overall, the potential for further indirect site impact is considered low.

Alternative H

Alternative H would treat a large amount of fuel through timber sales, with greater quantities of thinning, slash disposal, and prescribed fire. This alternative would reduce the likelihood that, in the event of a fire start, significant sites would experience a high intensity fire. This alternative would reduce motorized access by decommissioning or closure of 144 miles of roads. Alternative H, with the same amount of riparian projects as Alternative C, would maximize watershed stabilization projects. Overall, the potential for further indirect site impact is considered low.

Alternative Comparison

The no action and five action alternatives differ in their potential to affect cultural resources. Alternative A (no action) has the highest potential to impact sites through indirect actions following future fires, erosion, and free access to sites by artifact collectors. Alternative E has the next highest potential for effect due to some potential to impact undocumented

sites, combined with a lesser amount of access restriction, and lesser amount of erosion prevention activities. Alternative C, D, G and H all have about the same likelihood of impacting sites. Three alternatives (C, D, and H) all have about the same potential in each category. Alternative G would prevent future fires exhibiting highly intense behavior more effectively than C, D or H, but Alternative G leaves more roads open, allowing greater collector access. The difference in potential impact between these four alternatives is negligible.

Table 3.163 Comparison of Direct and Indirect Effects on Cultural Resources by Alternative (1)

Alternative	Future Harvest/ (2) Fuel Treatment	Intensive Fire (3)	Illegal Surface (3) Collection	Riparian (3) Degradation	Total Score
A	0	3	3	2	**8**
C	1	1	1	1	**4**
D	1	1	1	1	**4**
E	1	1	2	2	**6**
G	1	0	2	1	**4**
H	1	1	1	1	**4**

(1) Score is based on lesser or greater potential to impact sites directly or indirectly
(higher Score = more potential impact)
0 = No potential or very low potential for impact
1 = Low potential for impact
2 = Moderate potential for impact
3 = High potential for impact
(2) direct effect of ground disturbance on potential undocumented sites
(3) indirect effects from future fire, artifact collection, and bank de-stabilization

Consistency with Forest Plan and Other Regulatory Direction

Heritage and Tribal interests are regulated by federal laws that direct and guide the Forest Service in identifying, evaluating, and protecting heritage resources. All of the alternatives would comply with federal laws. The Fremont Forest Plan tiers to these laws, therefore the proposed action alternatives would all meet Forest Plan standards.

Mitigations

A complete list of mitigations for Toolbox activities that may affect cultural resources can be found in Chapter 2.

RECREATION

- Introduction
- Regulatory and Policy Framework
- Key Issue – Changes in Motorized Access
- Analysis Methods
- Area of Analysis
- Existing Condition
- Environmental Consequences,
    - Direct and Indirect Effects
    - Cumulative Effects
- Consistency with Forest Plan

Introduction

The Toolbox Fire Recovery project area is a popular recreation area for both local residents and a destination recreation area for forest visitors from elsewhere seeking a variety of outdoor experiences. Recreational attractions include: hunting, fishing, camping, scenic driving, backcountry trail travel, birding, wildlife viewing, snowmobiling, cross-country skiing, snowshoeing, mountain biking, ATV riding, and a variety of other outdoor-related activities. The recreation emphasis in this area is based on the general "Outback" theme common to the Fremont portion of the recently combined Fremont-Winema National Forests. This theme promotes outdoor activities offering more self-reliance and less development than is commonly found on National Forests located closer to population centers. The developed recreation facilities within, or closely adjacent to, the Toolbox project area consist of: three campgrounds, three trailheads, one snow-park, one developed dispersed site, one summer trail system, and one winter trail system. One other popular developed recreation facility, Fremont Point Lookout rental cabin, was lost to fire in July 2002. Numerous undeveloped, but highly used, dispersed campsites are also scattered randomly throughout the project area.

For the purposes of this analysis when describing "historic" background information regarding recreation activities, only activities after 1952,or approximately fifty years prior to the Toolbox Complex Fire, are being considered. Detailed information pre-dating that time would not have any real relevance to the intent of this document and are more appropriately displayed within the context of the Cultural Resources Specialist report in the project record. The 1952 date also coincides closely with what we commonly regard as the beginning of the developed recreation program in this vicinity of the Forest.

Recreation activities within the Toolbox project area of the Fremont-Winema National Forests have historically been focused on camping, big-game hunting, and angling. Camping sites have conventionally been located randomly over the general forest area, as decided by the campers' priorities, with a preference toward sites near water. The primary quarry sought by big-game hunters in this vicinity has traditionally been mule deer. However, since the early-1970s, a growing population of Rocky Mountain elk has attracted the hunting public to this area as well. Anglers of all ages visiting this area have traditionally enjoyed excellent fishing opportunities for both native redband trout and eastern brook trout in all of the area's perennial streams. Thompson Reservoir has also historically been a well-known magnet for anglers as a notable source for large rainbow trout. This reservoir has been the subject of articles in popular national sportsmen's magazines at times in the past.

Among the most obvious influential factors leading to the current use patterns by this growing number of visitors has been the development, proliferation, and significantly increased public use of high-clearance four-wheel-drive vehicles, the similarly increased popularity of the large live-in vehicles commonly referred to as "motor-homes" or "recreational vehicles", and the significant increase in use of all terrain vehicles, and snowmobiles. As a general rule, we now have many recreation visitors staying on the forest in their motor-homes or fifth-wheel trailers and radiating throughout the general forest area from that base utilizing a variety of motorized vehicles of all sizes, seasonal, and cross-country capabilities.

As the equipment available for the recreating public has improved technologically, and as the general economy, until very recently, has provided the assets for the growing population of retirees in this country to acquire those amenities; there has been a noticeable increase in recreation use in this region by better equipped and more self-contained and mobility-oriented visitors than in the past. We are seeing more sophisticated equipment every year. The heavily laden family sedans, station wagons, or old two-wheel-drive pickups of yesteryear have been almost completely replaced in today's recreation setting by four-wheel-drive (4WD) trucks, sport utility vehicles, or large self-contained recreational vehicles, usually towing even more equipment. For example, a recreating group of today may be camped in East Bay Campground and have some of their members fishing that lake from a boat while, at the same time, others of their party may be out with all-terrain vehicles (ATVs), 4WDs, motorcycles, or, even, snowmobiles pursuing a variety of interests in areas far removed from their base camp, and, yet, still others of their group may be hiking and fishing the canyons of the area's small streams.

This evolution of camping equipment and of motorized transportation has, of course, had effects on developed recreation use and management. However, visitors who are seeking the more traditional rustic tent camping and foot- or horse- travel recreational experience will also find ample recreation opportunities that meet their expectations on the Fremont-Winema National Forests and, specifically, within the Toolbox project area. Others recreational visitors, also seeking a rustic experience, but desiring some creature comforts and amenities, will also find their needs met. As a rule, developed camping areas on this Forest have expanded, over time, in both overall area and available campsites.

During this expansion and modernization, the Forest has made a conscious effort to provide facilities appropriate for a range of camping and recreational experiences within the developed sites. Since the early 1990s, improvements to the recreational infrastructure have also been made to meet the accessibility standards of the Americans with Disabilities Act (ADA). These improvements, such as easily accessible low-odor technology vault toilets, expanded parking areas, and ease of site access, have contributed to the increased use of those developed sites, not only by visitors needing such accommodations, but by the general recreating populace as well. In some developed sites, portion of the campsites have been enlarged to accommodate the larger vehicles and trailers in use today.

Another noteworthy recent trend is that forest dispersed sites (isolated sites, lacking improvements beyond a relatively clear flat spot to park) have become increasingly more attractive and utilized by today's visitors equipped with self-contained trailers and recreational vehicles. These sites occur in abundance throughout the project area and are a contributing factor, albeit a difficult one to track, when considering the overall recreation use of the Toolbox area.

The two existing trail systems within the project area, Pole Butte winter trail and Fremont National Recreation Trail #160 (NRT), and their associated trailheads, having been developed within the past ten years, are relatively recent additions to the recreation infrastructure on the Silver Lake Ranger District.

The Pole Butte winter trail was intended to be, and has served as, the primary winter access route to Fremont Point Lookout recreational rental cabin. Prior to the cabin being destroyed by wildfire in July 2002, it was very popular with the public and was occupied almost daily on a year-round basis. At the time of the fire, work was underway to get easements across private lands to improve this winter trail by moving portions of it off the road system; the objective being to provide a more direct route to the cabin with better trail-experience qualities than the road. The loss of the Fremont Point rental cabin destination point has caused that easement work to be put on indefinite hold until the future of the cabin is decided.

The NRT is a long-distance summer trail with a hiker, equestrian, and mountain bike management emphasis. The construction of this trail has provided access into some regions of the Toolbox Fire Recovery Project area that were not frequently visited by recreating forest visitors in the past. Likewise, the Pole Butte winter trail system has expanded both the season and extent of visitor use in some portions of the project area.

All of the developed recreation facilities within the Toolbox project area have evolved, as described, over the past forty to fifty years from their very rudimentary origins to their current state as well-maintained, modern facilities that fit well into their respective Recreation Opportunity Spectrum (ROS) settings of "Roaded Natural" and "Roaded Modified." The recreation development within the project area has been primarily user-need and resource protection driven as the visitor

base of the Forest has increased over time. Over the years, the Forest has responded to increased visitor numbers by providing upgrades to existing facilities and by building new facilities as long-term planning and budgets have dictated. This approach has provided the Silver Lake Ranger District with adequate recreation infrastructure to currently serve the public in an efficient and cost-effective manner.

The intentional strategy of the Forest to refrain from joining the recreation infrastructure construction boom common during the 1970s and early 80s has actually served the Forest quite well, in that it is now able to offer a more rustic, primitive and self-reliant outdoor experience than many areas that have been more developed, while not being encumbered by the costs associated with maintaining a huge recreation infrastructure. This rustic "Outback" recreation niche has become increasingly more important and desirable to a portion of the recreating public, as other areas have become more urbanized. In recent years a substantial influx of forest visitors seeking this type of recreational opportunity has been noticeable. Currently the Forest has been able to accommodate these increased numbers within the large landscape involved and the dispersed nature of the camping opportunities with little or no noticeable negative impact on the more rustic recreational experience these users are seeking.

Development of future recreation infrastructure within the project area for the foreseeable future will continue to focus primarily on maintenance and upgrades of existing facilities and trails. Increases in frequency and intensity of log-out maintenance operations are anticipated on the burned-over portions of the NRT for the next 10 to 12 years to keep it clear of fire-killed wind-thrown trees. Three minor construction projects, a small trailhead for the NRT in the vicinity of Harris Spring on Winter Rim, some minor post-fire relocations of the NRT itself, and the eventual reconstruction of the Fremont Point Lookout Rental Cabin, are planned for undetermined dates in the future.

Regulatory and Policy Framework

National Environmental Policy Act (NEPA)

NEPA requires integrated use of the natural and social sciences in all planning and decision-making that affect the human environment. The human environment includes the natural and physical environment and the relationship of people to the environment (40 CFR 1508.14)

Fremont National Forest Land and Resource Management Plan (Forest Plan) Direction

Forest Plan Management Area guidelines for developed recreation sites and trails are listed in Chapter 1.

Recreation Opportunity Spectrum (ROS)

The Recreation Opportunity Spectrum is a land classification system of seven categories, each being defined by its setting and by the probable recreation experiences and activities it affords (Forest Plan, 1989). All of the trails, developed recreation sites, and dispersed recreation sites within the Toolbox Fire Recovery Project analysis area are located within "Roaded-natural" and "Roaded-modified" ROS setting classifications. No other ROS setting are identified within the analysis area. The division of recreation use occurring between these two settings within the analysis area is approximately 75 percent in "Roaded-natural" settings and 25 percent in "Roaded-modified" settings. This use pattern closely reflects those across the entire Forest, for which statistics indicate that 72 percent of recreation use is occurring in Roaded-natural settings which make up 36 percent of the total Forest acres while 22 percent of recreation use is occurring in Roaded-modified settings which account for 53.5 percent of the total Forest acres.

Key Issue: Changes in Motorized Access

Issue Statement: Proposed road rehabilitation activities would reduce public access for recreation and personal use fuelwood gathering. The proposal would also reduce opportunities for members of the Klamath Tribes to hunt or gather Treaty Right resources within former Klamath Reservation boundaries, using motorized vehicles.

Analysis Methods

The following issue indicators were used to evaluate the effects of the activities proposed in the Toolbox project area:

- Change in Motorized Roaded Access Opportunities
- Recreation Uses

The timeframe considered in this analysis is from the fall of 2003 for several years to follow.

Analysis Area

The area of analysis consists of all National Forest System lands within the boundary of the Toolbox Fire Complex. Campgrounds and trailheads in close proximity to the burned area were also considered in this analysis.

Existing Condition

The timing of the construction of the developed recreation infrastructure discussed below is summarized in, Appendix A – *Past, Present and Reasonably Foreseeable Future Activities Within the Cumulative Effects Analysis Area,* Table A-5.

Developed Recreation

Silver Creek Marsh/Trailhead has 17 camping sites, a 5-unit day-use area, water, sanitation facilities, and horse facilities. Season of use is from April 15 to November 15.

Direct fire impacts: Loss of wooden perimeter fence, loss of a trail gate, minor vegetation loss, and loss of some signs.

Thompson Reservoir Campground has 20 campsites, a large group unit, water, sanitation facilities and a boat ramp. Season of use is from April 15 to November 15.

Direct fire impacts: None

East Bay Campground (also located on Thompson Reservoir) has 17 camping sites, a 4-unit day-use area, water, garbage service, sanitation facilities, and a boat ramp. Season of use is from May 1 to November 11.

Direct fire impacts: None

Bunyard Crossing is a developed dispersed site with 2 campsites and 2 vault toilets. Season of use is May 15 to November 15.

Direct fire impacts: Loss of one vault toilet and loss of one picnic table.

Farmwell Trailhead has 5 camping sites, water, toilets and horse facilities. The season of use is May 15 to November 15.

Direct fire impacts: *None*

Pole Butte Sno-Park has overnight and day-use parking. The season of use is November 15 to May 1.

Direct fire impacts: *None*

Fremont Point Lookout Rental Cabin and Day-use area has one rental cabin with associated vault toilet and a nearby day-use area containing one vault toilet, a parking area, a picnic table, and fire grill.

Direct fire impacts: The rental cabin, its contents, and associated vault toilet were completely destroyed; the day-use area toilet received minor damage, and some signs were destroyed within the area itself.

Trails

There are two trail systems located within the Toolbox Fire recovery Project area. These consist of portions of the summer-use Fremont National Recreation Trail #160 (NRT), also known as the Southern Oregon Intertie Trail, and portions of the winter-use Pole Butte Snowmobile/Nordic Ski Trail.

The Fremont NRT traverses most of the eastern Fremont National Forest in a generally north/south direction. The trail currently has a total length of 132 miles, with an additional 7 miles planned for completion in the future. Of those total miles, approximately 28 miles of trail are located within the burned area of the Toolbox Complex. The NRT receives moderate use from early summer to late fall, primarily by hikers, equestrians, and mountain bike riders. A Special Use Permit for an outfitter/guide operation offering mountain bike tours along portions of the NRT is pending and is expected to be in place by the summer of 2003.

Direct fire impacts: Impacts to the trail itself vary from slight to almost total obliteration, depending on the behavior and intensity of the fire as it burned through the country. Incremental mortality tables have been established which closely parallel the associated negative impacts to the trail within the areas described. Within these mortality tables, there are four categories, as follows:

- Category 1 - 0-25% mortality
- Category 2 - 26-50% mortality
- Category 3 - 51-85% mortality
- Category 4 - 86-100% mortality

The Fremont NRT has 6.4 miles in Category 1 areas, 5.2 miles in Category 2, 3.4 miles in Category 3, and 12.5 miles in Category 4. Within the Category 1 portions of the trail, the only visible damage is some loss of duff and low groundcover and a few dead trees adjacent to, or visible from, the trail. Within the Category 2 and 3 portions, much of the ground cover and low brush components are gone and the adjacent stands of trees exhibit significant mortality. Within the Category 4 portions of the trail, most, if not all, of the organic material on the ground has been consumed, surface rocks are fractured from the heat, and stands of trees have been reduced to blackened, limbless trunks sticking up out of bare mineral soil.

In many areas of higher mortality, all trail distance/directional signs and reassurance markers are gone, the trail tread is but a trace, dozens of wooden drainage structures were consumed, and four grazing allotment fence gates were destroyed. Three critical trail bridges, of 14, 34, and 42 feet in length, were also destroyed during the fires. The visual resources along the trail were affected in both positive and negative ways.

On the positive side, numerous distant scenic vista opportunities, previously screened by foreground vegetation were opened up by the fire. This is particularly the case along Winter Rim and other high ridges traversed by the trail. On the negative side, the loss of a high percentage of the vegetative component in the immediate foreground and intermediate background, combined with the stark nature of innumerable burned-over trees, has created an unappealing visual aspect, compared to what was previously available along some portions of the trail. Many of the negative impacts will be relatively short-lived as the land recovers over time and replacement vegetation fills in the current voids. The vegetation that was blocking the views from areas such as Winter Rim, however, consisted, in many cases, of mature ponderosa pine, white fir, and lodgepole pine trees from 80 to 150+ feet tall. These types of fire-generated visual openings will require multiple decades to return to pre-fire condition.

The Pole Butte Snowmobile/Nordic Ski Trail receives moderate use in the winter by snowmobile enthusiasts and cross-country skiers. This trail is the primary access route to the Fremont Point Cabin site, once a very popular year-round recreation rental cabin perched on the edge of Winter Rim. This cabin was destroyed by wildfire in July 2002. This fact has led to a reduction of use of the Pole Butte winter trail system at this time, but it is still receiving use by winter visitors wishing to access the forest for other reasons. Approximately 3.5 miles of this winter trail are actually within the burned area. The remaining 9.5 miles of this trail are in close proximity to the burned area as well.

Direct fire impacts: A high proportion of this winter trail follows the route of a system road used for passenger vehicles during the snow-free months. The only damage to the trail itself consists of the loss of some reassurance signs and creation of an abnormally high hazard tree concern. The visual aspects from the trail are impacted much the same as those of the NRT, as described above.

Dispersed Recreation

Winter Activities - Overall, winter use in this area is light to moderate. There are no groomed winter trails and winter recreation visitors have to take their recreation opportunities as they find them. The primary winter activity throughout this area is snowmobiling. This activity primarily utilizes the Forest system roads with some cross-country activity taking place in open areas. Cross-country skiing and snowshoeing are also popular winter activities in this area, but they are, at best, a distant second in terms of numbers of participants, compared to snowmobiling.

Spring/Summer Activities - Spring and summer dispersed recreational activities within the project area are primarily focused on camping, fishing, and recreational driving with a sightseeing objective. Fishing activities are, predictably, focused in areas having perennial water such as Silver Creek and Thompson Reservoir. The camping and recreational driving aspects of dispersed recreation use in this area, however, are much less focused since they can and do occur basically through out the entire area, wherever terrain and access allow. There are several popular dispersed camping areas

that were burned over by the fires. Most of these sites are along the main roads and adjacent to secondary side roads or spurs.

Fall Activities - The Toolbox area lies within the Silver Big-Game Hunting Unit #76. This area receives moderate use during the fall mule deer and elk seasons. Other fall activities that draw visitors to the area are firewood collection, cone and greens gathering, mushroom picking, recreational driving, ATV riding, and sightseeing.

Environmental Consequences

Direct and Indirect Effects

Alternative A

Selection of the No Action alternative would result in no changes in regards to the activities proposed. However, in the absence of fuel management, the intensity and severity of another fire event would not be reduced. If another fire event were to occur, depending on the magnitude, the impacts to recreation could be similar to those of 2002.

There would be no change to motorized access. A total of 271 miles of road will remain open.

Recreation Uses

Dispersed recreation use such as fishing, hiking, camping, and picnicking may be displaced from burned areas to areas that did not burn. There may be an increase in cross-country travel due to less vegetation and debris on the ground. Access to some areas would become blocked by wind-thrown fire-killed trees. Increased trail maintenance frequency and intensity would be required to keep the Fremont NRT open.

Alternative C

This alternative would decommission 69 miles of road, close 72.9 miles, and leave 129.1 miles open. It would also temporarily re-open 21.4 miles of unclassified existing road and construct 16 miles of temporary new road. The long-term impact of Alternative C, with regard to the key issue of changes in motorized access, would be the elimination of 141.9 miles of existing road currently open for recreational use. Since fewer roads would be open, vehicle access year-around would decrease, including during hunting seasons. This would have an effect on the recreational hunting experience. Road closures or obliterations would decrease opportunities for “road hunting.” Road closures and obliterations would increase “roadless” recreational opportunities, including those associated with wildlife.

Recreation Uses

The necessary project-related temporary closures of trails, roads and active salvage areas would impact activities such as hiking, skiing, snowmobiling, mushroom picking, firewood gathering, camping, fishing and seasonal hunting. Forest visitors who want to recreate at a specific location may find they cannot access the location, and their recreation experience could be diminished. Other visitors, who do not have a site-specific location they want to use, would likely be displaced to unaffected areas of the Forest, resulting in little or no negative effect on their experience. Harvest activities would generate an increase in short-term localized noise throughout, and adjacent to, the active salvage units. Helicopter use would generate noise that could be heard further away from the local sale area. Temporary roads re-opened or constructed for this project would receive occasional use by recreating Forest visitors as they discover them. This use is expected to be light and short-lived. Trails and developed camping areas adjacent to or within a salvage unit could be impacted both physically and visually. Logging would remove vegetation, leave stumps and slash piles, and could impact the Fremont NRT with skidding activities. However, mitigating measures designed to avoid or minimize these impacts include:

- Material to be salvaged within 150 feet of the NRT or a developed recreation site will be directionally felled, skidded, or yarded away from the constructed feature wherever practical.
- Crossings of the NRT with skidding equipment will be minimized, with the optimum number of crossings being none.
- If crossings of the NRT are unavoidable within practical limits, the impacted portions of the trail tread will be rehabilitated.
- Use existing landings or new landings 200 feet or further away from the NRT or developed recreation sites, preferably screened by residual forest or topography from the trail, unless no practical options exist.

- Areas of light project-generated slash in close proximity to trails will be lopped and scattered a minimum of 15 feet off the trail tread.
- Heavier concentrations of project-generated slash requiring piling in the vicinity of trails or developed recreation sites will be piled a minimum of 50 to 75 feet away from the trail or constructed feature of a recreation site utilizing natural visual screening wherever practical.

Helicopter salvage operations could generate safety concerns for recreational users in developed recreation facilities or along the NRT. The mitigating measures designed to avoid or minimize this potential concern are:

- All developed recreation sites and any portions of the NRT adjacent to helicopter units or located under flyover routes to be used for aerial log retrieval operations will be temporarily closed until such operations are completed.

Reforestation and pre-commercial thinning activities could impact the NRT with unwanted slash, vegetation, and ground disturbance. Mitigations to avoid these impacts include:

- Reforestation site preparation activities will avoid impacting the NRT with slash accumulations or ground disturbance.
- Planting will not occur within the constructed eighteen to thirty-six inch width of the NRT tread and within 6 feet of either side of the centerline of the NRT.
- Pre-commercial thinning of areas immediately adjacent to the trails or developed recreation sites will avoid impacting the constructed features with slash by directional felling and dispersal of material away from the constructed feature.

Alternative D

This alternative will decommission 71.6 miles of road, close 75.5 miles, and leave 123.9 miles open. It will also temporarily re-open 5.7 miles of existing unclassified road. The long-term impact of Alternative D, with regard to the key issue of changes in motorized access, would be the elimination of 147.1 miles of existing road currently open for recreational use. Since fewer roads would be open, vehicle access year-around would decrease, including during hunting seasons. This would have an effect on the recreational hunting experience. Road closures or obliterations would decrease opportunities for "road hunting." Road closures and obliterations would increase "roadless" recreational opportunities, including those associated with wildlife.

Recreation Uses

The number of miles of permanent road left open to the recreating public is lowest and the number of miles of existing road proposed for closure is highest in this alternative. This alternative would decrease the possible effects related to recreational use of temporary roads in the project area in comparison to all other alternatives with the exception of Alternative A, the "no action" alternative. The "limited-intervention" emphasis of this alternative would leave a markedly higher proportion of the fire-killed trees standing along the length of the Fremont National Recreation Trail #160. A proportion of those trees would eventually come down on or across the trail and create barriers for users that may diminish their recreational experience. Trail management activities such as maintenance would also be impacted by the increased frequency and intensity of log-out operations to keep the trail open. Other effects of this alternative would be common to Alternative C.

Alternative E

This alternative would decommission 14.6 miles of road, close 67.4 miles, and leave 188.9 miles open. It would also temporarily re-open l5.8 miles of existing unclassified road and construct 13.3 miles of new temporary road. The long-term impact of Alternative E, with regard to the key issue of changes in motorized access, would be the elimination of 82 miles of existing road currently open for recreational use. Since fewer roads would be open, vehicle access year-around would decrease, including during hunting seasons. This would have an effect on the recreational hunting experience. Road closures or obliterations would decrease opportunities for "road hunting." Road closures and obliterations would increase "roadless" recreational opportunities, including those associated with wildlife.

Recreation Uses

Alternative E and Alternative G would both leave the highest number of miles of permanent road (188.9 mi.) open of any action alternative. The recreational use of these roads would generate greater impacts to the area than the other alternatives,

with the exception of Alternative A, the no action alternative. Alternative E would have the least impact and need for mitigation related to helicopter logging systems of any alternative that includes helicopter use. It is the only alternative with helicopter units that has none within the immediate vicinity of the Fremont NRT, eliminating temporary trail closure and closure enforcement impacts. Other effects of this alterative on recreation would be common to Alternatives C.

Alternative G

This alternative would decommission 71.6 miles of road, close 10.4 miles and leave 188.9 miles open. It would also temporarily re-open 21.4 miles of existing unclassified road and construct 16 miles of temporary new road. The long-term impact of Alternative G, with regard to the key issue of changes in motorized access, would be the elimination of 82 miles of existing road currently open for recreational use. Since fewer roads would be open, vehicle access year-around would decrease, including during hunting seasons. This would have an effect on the recreational hunting experience. Road closures or obliterations would decrease opportunities for "road hunting." Road closures and obliterations would increase "roadless" recreational opportunities, including those associated with wildlife.

Recreation Uses

Alternative G would have effects to recreation resources relative to miles of permanent road left open identical to Alternative E, as discussed above. The "active management" emphasis of this alternative, which includes high salvage volume and more aggressive fuels reduction, would significantly reduce the fire-killed material along the Fremont NRT corridor that is anticipated to generate increased impacts to trail access and maintenance. This same "active management" emphasis could increase the impacts on recreating forest visitors from smoke, other fuels treatment activities, and salvage activities in the vicinity of developed recreation sites and along the Fremont NRT corridor, more in this alternative than any other. Other effects of this alternative would be common to Alternative C.

Alternative H

This alternative would decommission 71.6 miles of road, close 72.9 miles, and leave 126.5 miles open. It would also temporarily re-open 19.7 miles of existing classified road and construct 14.9 miles of temporary new road. The long-term impact of Alternative H, with regard to the key issue of changes in motorized access, would be the elimination of 144.5 miles of existing road currently open for recreational use. Since fewer roads would be open, vehicle access year-around would decrease, including during hunting seasons. This would have an effect on the recreational hunting experience. Road closures or obliterations would decrease opportunities for "road hunting." Road closures and obliterations would increase "roadless" recreational opportunities, including those associated with wildlife.

Recreation Uses

This alternative does not propose any helicopter salvage, thereby eliminating impacts and mitigation measures relative to helicopter logging systems on recreation resources, such as trail/site closure and closure enforcement. Other impacts associated with this alternative are common to Alternative C.

Cumulative Effects

Change in Motorized Access Opportunities

Alternative A

Alternative A, the no action alternative, would effectively close many secondary roads much of the time. Such closures would be due to the tremendous numbers of fire-killed trees adjacent to all roads that would continuously deteriorate and fall. The resulting over-abundance of downed debris would, in all probability, exceed the Forest's ability to keep anything other than the main roads open.

Alternatives C, D, E, G, and H

All of the action alternatives would have effects on motorized access opportunities. Each of the action alternatives would close varying amounts of miles of existing road as part of the fire recovery project.

Cross-country motorized access opportunities have been increased in some areas due to vegetation and debris barrier removal by the fire. This condition could be further exacerbated by various proposed project activities. The potential for environmental resource damage from irresponsible motorized travel through these areas does exist. Monitoring since the fires indicates that, at this time, no notable increase in off-road travel or associated resource damage has been observed. Current Forest policy does not prohibit motorized cross-country travel within any of the Management Areas found within the Toolbox Fire Recovery Project Area. However, regulations, including area closure orders, are in place to deal with resource damage from motorized use if it should become a problem.

Recreation Uses

Alternatives A, C, D, E, G, H

Developed recreation sites would be affected by higher recreation visitor numbers than in the past. Visitors displaced from the many dispersed camping sites by the effects of the fires and the salvage harvest on both public and private land would be attracted to the unburned developed facilities. (See Appendix A – *Past, Present, and Reasonably Foreseeable Future Activities within the Cumulative Effects Analysis Area,* Table A-13 and A - 16)

Mushroom and forest product gathering may increase in burned areas. This would raise the demands on the dispersed camping areas, campgrounds, and trailheads in, and adjacent to, the analysis area. This effect is expected to be of relatively short duration, possibly lasting only one or two harvest seasons. There are separate Forest policies and regulations in place to manage mushroom harvest.

The Fremont National Recreation Trail (NRT) crosses approximately one and a half miles of private land in the vicinity of Lewis Spring. These lands are crossed by the trail on an easement that extends out to five feet of either side of the centerline of the trail, creating a trail corridor ten feet wide. The lands crossed by the easement are owned by United States Timberlands Company. This company already has harvested, or will soon be harvesting, all of the lands adjacent to the trail. (See Appendix A – *Past, Present, and Reasonably Foreseeable Future Activities within the Cumulative Effects Analysis Area,* Table A-13) The only protection to the trail through the area covered by the easement is the agreement to, "… restore the trail to the same condition that immediately preceded closure," "closure," in this case, being for harvest activities. Taking into consideration the more aggressive techniques and reforestation site preparation methods often employed by private industry, and considering the probable absence of mitigation measures to protect the recreation values along the trail, it is anticipated that the trail experience will be considerably altered for users along this trail segment. Timber harvest and other land management practices associated with maximized wood fiber production will be obvious and dominate the fore and middle-ground scenery for many years into the future along this relatively short segment of the NRT corridor.

Other Activities

Alternatives A, C, D, E, G, H

Other activities that would have effects on the portion of the Fremont NRT within the Toolbox Fire Recovery Project area include the following:

The pre-commercial and commercial thinning activities scheduled for 2004 and 2007 within 800 acres of the Upper Silver Creek watershed associated with the Triad Thinning Project will have visual impacts when viewed from the trail. These impacts will be relatively short lived. (See Appendix A – *Past Present and Reasonably Foreseeable Future Activities within the Cumulative Effects Analysis Area* Table A – 16)

Seven helicopter harvest units planned for the Winter Fire Rehabilitation Project on the Paisley Ranger District are located approximately four miles south of the southern portions of the NRT, within the analysis area. Helicopter log retrieval operations associated with these units will have audible effects on the NRT and Fremont Point day-use area. Impacts will be minimal and short-term.

The planned construction of Harris Spring Trailhead will have effects on the NRT and the access roads in the northern portions of Winter Rim. (See Appendix – *Past, Present, and Reasonably Foreseeable Future Activities within the Cumulative Effect Analysis Area,* Table A – 5)

The planned reconstruction of Fremont Point Lookout Rental Cabin will have the short-term effect of additional noise and traffic to this relatively isolated portion of the NRT during actual reconstruction, and the long-term effect of re-introducing increased human presence on a regular basis in the form of live-in visitors to this relatively isolated portion of the NRT. (See Appendix A – *Past Present and Reasonably Foreseeable Future Activities within the Cumulative Effects Analysis Area,* Table A – 5)

Implementation or non-implementation of the planned Fremont Point Cabin reconstruction project would also have effects on the Pole Butte Winter Trail. If the cabin is reconstructed, the Forest would likely proceed on the currently curtailed easement work, which is necessary to implement the planned relocation and improvement of the route from Pole Butte Sno-Park to Fremont Point. If the cabin is not reconstructed, it is unlikely that the Forest would expend the funds necessary to complete this easement work and the trail, without its popular destination attraction, would become a lower priority for future improvements.

Monitoring

Monitoring of the developed recreation sites and the portion of the Fremont National Recreational Trail within the toolbox Fire Recovery Project to track the short- and long-term effects of the project activities and associated mitigation measures on these recreation resources will be accomplished according to methods listed in Appendix D – Monitoring.

Consistency with Fremont National Forest Land and Resource Management Plan

The proposed activities would be consistent with Forest Plan standards and guidelines.

SCENERY

- Introduction
- Regulatory Framework
- Area of Analysis
- Existing Landscape Character
- Analysis Methods
- Environmental Consequences,
    - Direct and Indirect Effects
    - Cumulative Effects
- Consistency with Forest Plan and Other Regulatory Framework

Introduction

"Scenic attractiveness is the primary indicator of the intrinsic scenic beauty of a landscape and of the positive responses it evokes in people. It helps determine landscapes that are important for scenic beauty, based on commonly held perceptions of the beauty of landform, vegetation pattern, composition, surface water characteristics, and land use patterns and cultural features" (*Landscape Aesthetics: A Handbook for Scenery Management,* Agriculture Handbook 701 (Scenery Management System Handbook), USDA, 1995, Chapter 1-14). Scenic attractiveness indicates varying levels of long-term beauty of the landscape character. Scenic attractiveness is ordinarily very stable. However, in rare instances, scenic attractiveness may change because of natural disasters or human (cultural) alteration of the landscape. Change may increase the potential for a "typical or common" landscape to become "distinctive (Scenery Management System Handbook, USDA, 1995, Chapter 1-14)." Travelers through the Toolbox Fire Recovery Project are afforded a variety of natural appearing views and human-altered landscapes. Natural disturbances such as past wildfires, insect and disease infestation, or storm damage are evident. Past timber harvest and road systems are the most obvious alterations to the natural landscape. As a result of the Toolbox Complex Fires, the area is currently characterized by a mosaic of burned forest conditions, ranging from unburned to fire-killed ponderosa pine, lodgepole pine, and mixed confiner stands, interspersed with young fire-damaged plantations.

Regulatory Framework

The Silver Lake Ranger District scenic resource is managed by direction provided in the Fremont National Forest Land and Resource Management Plan (1989). In the Forest Plan, Visual Quality is assessed and evaluated under direction found in National Forest Landscape Management, Volumes 1 and 2 in the Department of Agriculture Visual Management System Handbook, in effect when the Forest Plan was published. Since the Forest Plan was published, new direction for scenery management has been distributed that supersedes the Visual Management System Handbook. The newer Scenery Management System Handbook uses Scenic Integrity Objectives (SIOs) rather than Visual Quality Objectives (VQOs), for measuring achievement of scenic integrity (Scenery Management System Handbook, USDA, 1995, Chapter 2-4). For the purposes of this scenery analysis, the existing Forest Plan direction will be used; however, whenever possible, Scenic Integrity Objectives will also be displayed and discussed in the analysis. Further direction regarding scenery management is found in Forest Service Manual 2380 (Landscape Management).

Visual Quality Objectives for areas within the Toolbox Fire Recovery Project, as designated in the Forest Plan, are based on "visual quality levels," (Partial Retention and Maximum Modification). Scenic Integrity Objectives are based on scenic integrity levels, but closely parallel VQOs (Moderate = Partial Retention, Very Low = Maximum Modification). It is difficult to judge visual quality levels/scenic integrity levels without considering the position from which the scene is to be primarily observed.

Foreground views (1/4 to 1/2 mile from the center of the road) allow visual scrutiny of details. In the immediate foreground, it is virtually impossible for roads, structures, etc., not to be evident.

Middleground and background (3-5 miles) views do not permit the visual scrutiny of details, but they usually provide conditions in which the management activity can be seen in perspective with its surroundings. It is entirely possible that management activities may stand out in sharper contrast from middleground views than from foreground, thus not meeting the same visual quality level. Generally, as the distance increases, contrasts soften (Fremont National Forest Land and Resource Management Plan, 1989; 114, 153-158).

The previous direction for the Visual Quality Objective for Partial Retention is the same as the Scenery Integrity Objective for Moderate (Slightly Altered) and provides that management activities remain visually subordinate to the characteristic landscape. For example, the average public would detect the presence of a management activity without having it pointed out to them, but it would not have enough contrast to form a new focal point or focal area when viewed from a middleground distance. When viewed from background distances, the same management activity should not be evident.

Within the project planning area there are approximately 7 miles of scenic corridor, along FS Roads 27 and 28 that are allocated to Management Area (MA) 6 (Scenic Viewsheds). The overall objective in MA 6 is to provide an attractive, natural appearing forest visual character. An objective in MA 6 visual corridors is to "provide high to moderately high visual quality concerns within selected viewsheds on the Forest, " and to "retain or create the desired forest character in an attractive sequential arrangement over time and space." Among the important landscape elements listed in the Forest Plan for MA 6 are "large trees with distinctive bark." Specifically, this means large orange-barked ponderosa pine trees (Forest Plan Appendix 4, 39-40).

Management Area 6 standards for Visual Quality require that scenic corridors would generally have visual foreground zones extending ¼ to ½ mile out from the centerline of the road and would be managed for Retention or Partial Retention. Harvesting methods meeting the needs for foreground Partial Retention (Moderate) would be used in these areas.

The previous direction for the Visual Quality Objective for Maximum Modification is the same as new direction for the Scenery Integrity Objective of Very Low (Heavily Altered) and provides that vegetative and landform alterations may dominate the characteristic landscape when viewed as background, but, even at that distance, must borrow heavily from natural form, line, color, and texture. Maximum Modification (Very Low) may dominate as obviously man-caused alterations in foreground and middleground. However, when this same management activity is viewed as background, it may be a minor focal point but should not be the primary focal point in the entire scene viewed.

Forest-wide standards for Scenic Management include guidelines to ensure the visual integrity of landscapes in the foreground viewing zones of the Fremont National Forest Recreation Trail and FS Road 2901, even though these corridors are not designated as MA 6 scenic corridors. This includes direction to "take extra care in the clean-up of logging slash, root wads, and logging debris; smooth earth over skid and tire tracks; paint or mark trees on the side of the tree facing away from the road; adjust cutting boundaries to blend into the natural indigenous landscape; and encourage uneven-aged management techniques in these areas" (Fremont National Forest Land and Resource Management Plan, 1989; 114).

The Fremont Forest Plan Visual Quality Objectives for the Toolbox Fire Recovery Project Management Areas are as follows:

MA-1, MA-2, MA-3/14, MA-5, MA-12, MA-15

- The VQOs are generally Maximum Modification (SIO = Very Low).
- Lands generally within 300 feet of major fisheries riparian areas will be managed to maintain Partial Retention VQO (SIO = Moderate).

MA-6A – Scenic Corridors (designated on Forest Plan map Alternative F, Preferred)

- The VQO is Foreground Partial Retention (SIO = Moderate) – FS Roads 27 and 28.

MA-6B – Maximum Modification; special guidelines (designated Forest Plan map, Alternative F, Preferred)

- The VQO is Maximum Modification (SIO = Very Low) with special guidelines to ensure visual integrity along the Fremont NRT and FS Road 2901.

Analysis Area

The Toolbox Fire Recovery Project area totals approximately 47,000 acres of Fremont National Forest Lands within T 29 S, R 13-16 E, T 30 S, R 13-16 E, and T 31 S, R 13-15 E, W.M, and includes both the Toolbox and Silver Fire portions. A very small portion of the Winter Fire is also included within the project area.

Existing Condition (Existing Landscape Character)

The Toolbox Fire Recovery Project area is characterized by a very gentle topography, with elevations ranging between 4,450 and 6,778 feet (top of Foster Butte) above sea level. The sideslopes are between zero and 10 percent on approximately 70 percent of the project area. Silver Creek and West Fork Silver Creek flow through canyons that are up to 450 feet deep with localized side slopes of up to 70 percent. The Fremont National Forest website states, the "diversity in temperature and precipitation on the Fremont National Forest results in a sequence of distinct climatic regimes which support a wide variety of plant and animal communities, with habitats ranging from near-desert to lush coniferous forests." (Fremont National Forest website, 2003). Abundant mixed conifer stands that occur throughout the project area include white fir, ponderosa pine (including distinctive large orange-barked trees), and lodgepole pine. Drought-tolerant tree species such as juniper also occur in the project area.

As a result of the Toolbox Complex Fires, a mosaic of burned forest conditions ranging from unburned to fire-killed ponderosa pine, lodgepole pine, and mixed conifer stands, interspersed with young fire-damaged plantations now cover the project area. An unburned strip varying between 3 and 7 miles wide runs between the Silver Fire portion of the project and the Toolbox Fire portion, and is not included in the project area boundaries.

This scenery analysis will focus primarily on effects along scenic travel routes, as designated in the Forest Plan, which states, "Travel routes crossing the Forest pass through many different landscapes, varying from dense old growth forest and stream-fed meadows to sagebrush flats and distinct rimrock bluffs. The Forest's more frequently used, visually sensitive travel corridors will be managed to maintain or enhance the natural appearance of their surroundings." (Forest Plan, 1989, 153). In the Scenery Management System handbook, scenic travel routes are managed under Scenic Attractiveness Classification B – Typical. This classification is defined as, "Areas where landform, vegetation patterns, water characteristics, and cultural features use combine to provide ordinary or common scenic quality. These landscapes have generally positive, yet common, attributes of variety, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance (Scenery Management System Handbook, USDA, 1995, Chapter 1-16)." Scenic travel routes within the Toolbox Fire Recovery Project include the Fremont National Recreation Trail (NRT), FS Road 2901, FS Road 27, and FS Road 28.

Approximately 20 miles of the Fremont National Recreation Trail are within the project area boundary. As described on the Fremont National Forest website (Fremont National Forest Trails System, 2003), this trail "passes through a variety of environments including open ponderosa pine stands, …. dense lodgepole pine stands, mountain mahogany thickets, trout-filled mountain streams, and colorful rock outcrops. It climbs to the summit of Hager Mountain for more panoramic vistas of the mountains and the deserts of the northern Great Basin. The contrasts between the green valleys and sparkling lakes and the stark vertical rock formations like Table Rock and Winter Rim are striking." The trail also provides scenic vistas of the Cascade Mountain Range. Although the bridges on the portions of the NRT within the Toolbox project area were destroyed during the fire, the fire intensity may have actually improved visual opportunities along the trail by removing dense lodgepole pine stands that were blocking scenic vistas in some cases. Table 1 displays the burn intensities along the trail following the Toolbox Fire. The Forest Plan guidelines for scenic management along the Fremont NRT also apply to FS Road 2901, which is included in Table 1.

Approximately 7 miles of FS Roads 27 and 28 are within the Toolbox project and are designated as MA 6 scenic corridors. Sections of FS Road 27 received a higher degree of burn intensity than FS Road 28. The existing scenery along these corridors, after the Toolbox Fire, ranges from unburned green trees to areas of severe burn intensity (see Table 1). As in the case of the NRT, some areas of higher burn intensity have opened up more vistas along these scenic corridors by removing dense stands of lodgepole pine and ponderosa pine reproduction.

Table 3.164 Scenic Corridor Burn Intensity Within the Toolbox Fire Recovery Project

Corridor	Number of Miles Within Project Area	Percent in 0-25 % Mortality	Percent in 26-50 % Mortality	Percent in 51-85 % Mortality	Percent in 86-100 % Mortality
FS Road 27	4.3	9	5	16	70
FS Road 28	1.5	7	87	0	6
FS Road 2901	7.8	82	1	5	12
Fremont NRT	27.9	24	19	12	45

The following photographs illustrate three of the above four categories of burn intensity within the Toolbox project area.

Figure 3.30 0–25 Percent Mortality

Figure 3.31 51-85 Percent Mortality

Figure 3.32 86–100 Percent Mortality

Analysis Methods

Management activities such as timber harvest, reforestation, thinning, fuel treatment, road construction, snag retention, mule deer habitat protection and restoration, and soil and riparian protection and restoration can affect forest scenic quality by changing the predominant form, color, line, or texture in a given viewing area. The degree of visibility of these events depends on the interaction of certain elements to the viewers such as:

- Slope and aspect of the land
- Surrounding landscape
- Frequency and duration of view
- Fuel reduction treatment methods used
- Slash disposal methods

These factors have been incorporated into the analysis of the effects of each alternative in meeting VQOs. VQOs are minimum guidelines for meeting Forest Plan visual goals.

Watershed activities were not reviewed in detail, as watershed activities such as road decommissioning would have a beneficial effect on the landscape. Road decommissioning and closure amounts are shown for each alternative later in this document.

Common to Alternatives C, D, E, G, and H

The following management activities would occur in varying degrees in all of the action alternatives:

- Commercial salvage harvest outside RHCAs
- Reforestation
- Activities fuel treatments including prescribed burning
- Snag retention
- Mule deer habitat protection and restoration
- Soil and riparian protection and restoration
- Road closure and decommissioning
- Reconstruction of some existing unclassified roads

Common to Alternatives C, D, G, H

Plantation thinning would occur in all alternatives except Alternative E.

Common to Alternatives C, E, G, H

The following management activities would occur in all alternatives except Alternative D:

- Prescribed burn outside of salvage areas
- Construction of new temporary roads

Common to Alternatives C, E, G

Commercial salvage within RHCAs would occur in all Alternatives except D and H.

Environmental Consequences

Direct and Indirect Effects

Alternative A

No harvest or reforestation activities would occur and vegetative recovery would take place at a slower rate than if planted. Road decommissioning would not take place and visible roadbeds would remain on the landscape. It may be decades before young sapling/pole size trees exist. There would be no fuel treatment to reduce the existing fuel load, which would increase the intensity of a subsequent fire. Scorched/burned trees would be evident on the landscape for decades. If a wind event occurs, blow down of the burned/scorched trees may occur which could lead to large areas of trees stacked on the forest floor. This is a natural occurrence and would meet VQOs (SILs).

Alternative C

Commercial Salvage

Harvest activities would occur on 14,441 acres within a total of 312 harvest units, including 297 ground-based units and 15 helicopter units. The project area includes 176 harvest units on the Toolbox Fire portion and 136 harvest units on the Silver Fire portion. The estimated volume for Alternative C is 73.3 mmbf (million board feet).

For units adjacent to MA-6A and MA-6B, logs would be yarded away from the roads and trails. Landings would be in the foreground-viewing zone, but toward the back of the zone as much as terrain and existing road locations allow. Helicopter logging results in very little impact to the visual resource, as there is little to no ground disturbance (no roads or skid trails). Logs would be flown away from the scenic corridor roads (see Chapter 2, Mitigation and Resource Protection Measures, "Recreation" and "Scenery Resources"). One proposed helicopter landing would be located in the switchback section of FS Road 2901, in an area of high burn intensity. Other proposed landings located outside of the Foreground Partial Retention zone may still be visible from the scenic corridor, due to the loss of vegetative screen as a result of the fire. These activities would have short-term negative impacts on the landscape.

Within 1 to 2 years after use, all landings would be scarified or sub-soiled, natural drainage patterns would be reestablished, slash accumulation would be treated, and the area would be reforested. Ten to thirty percent of the slash piles would be left on the landscape to provide habitat for small mammals. These slash piles would be located outside of MA-6A (Foreground Partial Retention) and MA-6B (Maximum Modification with special guidelines).

Roadside Hazard Treatment - Included in the total commercial salvage proposal are approximately 1,300 acres that are within 150 feet of a maintenance level 3, 4, or 5 road (covered under the Highway Safety Act) or other roads with an aggregate (gravel) surface. Clumps of dead trees would be retained in the roadside corridors within salvage units to jointly meet visual and wildlife habitat objectives. In all cases, such clumps would only include trees that are not tall enough to reach the road. General visual objectives are to leave sufficient scattered clumps to break up the potentially objectionable look of long stretches of treeless landscape in the frontage zone along roadside corridors. These clumps should be primarily in the 86-100 percent mortality areas, and secondarily in the 50-85 percent mortality areas. Areas with mortality below these levels would not require any special design to meet visual objectives.

Reforestation

Within the approximately 34,000 acres that experienced loss of stocking due to fire, it is estimated that 20,906 acres of these would actually be planted. This includes approximately 10,687 acres of planting in proposed salvage units, 8,949 acres of planting in "other" areas (such as previous overstory removal units, previous partial cut units, or areas without a commercially viable salvage component), and 1,270 acres in existing plantations. Seedlings would be planted between 130 and 250 trees per acre.

Site preparation for reforestation outside of harvest units would occur on approximately 5,301 acres. This would consist of falling dead material, lopping and scattering, and extra mastication, if needed, to minimize visual impacts. In the short term, the plantation would appear open, due to slow seedling growth. After 10 years, the plantation would appear as a fairly open stand of 10-foot tall trees at 100 trees per acre to promote the long-term development of a sustainable late and old structure (LOS) forest conditions. Within 100 years, with management of natural regeneration, the stand should appear as a LOS forest stand, with widely spaced 20-inch dbh trees.

Thinning

Approximately 2,214 acres of precommercial thinning would occur in existing plantations in order to promote the long-term development of sustainable LOS forest conditions while maintaining big game hiding cover. Thinning and slash treatment would be with either chainsaws or low ground pressure mechanized equipment. Specifically, leave stand density objective would be approximately 130 trees per acre, including one small un-thinned cover patch per acre. The objective of partial retention would be met and visual impacts would be minimal.

Fuel Treatment and Reduction

Fuel treatment and reduction for activities fuels within harvest units and for areas outside of harvest units, may consist of several methods that are discussed in detail in Chapter 2. For activities fuels, by using whole tree yarding and yarding with tops attached-to-last-log, the commercial salvage operation itself would provide the initial step of fuels reduction. The use of whole tree yarding is designed to initiate a reduction of risk from activities-generated fuels. In all salvage units, trees 21 dbh or less would be whole tree yarded. Limbs and tops piled at the landings would be disposed of later or utilized as chips or firewood.

Within salvage units, fuels treatment in addition to whole tree yarding and leaving tops attached would occur on approximately 10,244 acres. This would include reduction of fuels created by the fire and by salvage activity. These treatments are planned for salvage units in which the majority of the acres would be expected to exceed 20 tons of fuel per acre within 15 years if no action is taken. Such additional fuels treatments would occur following salvage activity, with the method to be determined through post-sale monitoring. Methods for all alternatives could include: underburning, broadcast burning, jackpot burning, machine (low ground pressure) pile and burning, grapple pile and burning, hand pile and burning, air curtain destructors, ladder fuel reduction (thinning – dead trees only), crushing, mastication, or other methods.

Prescribed fire would be used primarily outside of harvest units, but there would be some overlap into units. Approximately 3,572 acres are proposed for prescribed fire as part of an additional fuels strategy and as a means of contributing to the long-term promotion of sustainable LOS conditions. Among the criteria for proposing prescribed fire in this alternative include selecting areas that experienced low mortality during the 2002 wildfire and areas that could effectively be “blocked up” in at least 100 acre parcels. The desired condition is to produce a mosaic of shrub habitat and cover while increasing forest sustainability. The objective would be to achieve a 40-60 percent **burned** / 60-40 percent **unburned** mosaic.

The proposed types of treatment would have little impact to the visual quality of the project area. Slash piles may be on the landscape until sufficient burning factors are met. Implementation of prescribed fire, while having the temporary visual effect of blackening some low growing plants and creating brown needles on, or killing some, small ponderosa pine, should result in a healthy vegetative condition, characterized by vigorous re-growth of forbs and grasses, as well as an increased openness in pine stands. The resulting condition should more closely resemble a "natural" condition than do current conditions, which are partially the result of decades of fire suppression.

Other Activities

Temporary Roads - The salvage harvest activities in Alternative C are expected to require the use of approximately 37.4 miles of temporary road. New temporary road construction would be required for approximately 16.0 miles and approximately 21.4 miles would be re-opening of existing unclassified roads. Most of these new temporary and re-opened roads would not be visible from the scenic corridors, and those that are visible would be mostly perpendicular to the scenic corridors so the visual impact when driving past would be minimal. After salvage harvest is complete, drainage structures would be removed, ditches eliminated, the roadbed would be outsloped and the road would be blocked to normal vehicular traffic. Grass and herbaceous forbs should cover 75-80 percent of the roadbed in the first year after closure, and brush should begin adding to the cover by the second year, effectively removing visual impacts of the roadbeds from scenic corridors.

Road Closure and Decommissioning - Several roads in Alternative C would be either decommissioned or closed for purposes of promoting watershed recovery and / or reducing impacts to wildlife. Road decommissioning would accelerate a return to a more natural appearing state. In this alternative, 72.9 miles of road would be closed, 69.0 miles would be decommissioned, and 129.1 would remain open.

Snag Retention – Retention of snags for cavity dependent species would be achieved through strategies of identifying suitable blocks of habitat in no-salvage areas and retention prescriptions within salvage units. Snag retention in no-salvage areas would not change the existing landscape. Within commercial salvage units, three different criteria would be used for snag retention, depending on snag size and elevation. See Appendix B of the Toolbox Fire Recovery Project EIS for more information on snag retention criteria. Clumping and distribution would vary within harvest units to manage for clump size, snag requirements, and distribution required for different cavity-dependent species. No area greater than 10 acres would be left completely deficient of snags. In roadside hazard corridors, visual objectives would be met by leaving sufficient scattered clumps to break up the potentially objectionable look of long stretches of treeless landscape.

All cover in the mule deer winter range would be retained, and would not change the existing landscape.

Riparian Habitat Conservation Areas (RHCAs) for perennial and intermittent streams range from 300 feet (perennial) on each side of the stream to 50 (intermittent) feet. Wetlands would have a 150-foot RHCA around the wetland. In the outer 100 feet of perennial stream RHCAs (which are typically 300 feet wide on each side of the stream) salvage harvest of selected trees or clumps would occur on 37 acres. Helicopter yarding would be used. A feathered forest edge would be retained. Generally these areas these should look natural, since riparian areas usually have naturally occurring stringers of dense growth along streams that are noticeable on the landscape.

Approximately 690 acres of aspen habitat have been identified for treatments designed to protect or enhance the aspen clone. Treatments would be designed to mitigate grazing by livestock and big game or the effects of encroachment of conifers and junipers. Aspen treatments should not significantly affect the scenic quality of the landscape, as visible from the scenic corridors, however through time, the enhanced aspen clones would be expected to contribute to a richer diversity of color and form.

Placement of large woody debris in streams and deciduous planting of approximately 7 acres are also planned for riparian areas. These enhancements would not be visible from scenic corridors and should have no impacts to scenic quality.

Alternative D

Commercial Salvage

Harvest activities would occur on 6,367 acres within a total of 197 harvest units, including 189 ground-based units and 8 helicopter units. The project area includes 109 harvest units on the Toolbox Fire portion and 88 harvest units on the Silver Fire portion. The estimated volume for Alternative D is 33.7 mmbf (million board feet). Other than roadside hazard corridors, there would be no harvest within RHCAs.

Requirements to meet scenery objectives would be the same as with Alternative C, with similar visual effects, differing only in the amount of area harvested.

Roadside Hazard Treatment – Same as Alternative C.

Reforestation

Same as Alternative C, with similar visual effects, with planting within the approximately 34,000 acres that experienced loss of stocking due to fire. See Chapter 2, Alternative Descriptions, for specific acreages of planting and site preparation.

Thinning

Same as Alternative C.

Fuel Treatment and Reduction

Alternative D follows the same principle as Alternative C, but, due to less areas of harvest, there would be less fuel treatment. Fuel treatment and reduction for activities fuels within harvest units and for areas outside of harvest units, may consist of several methods that are discussed in detail in Chapter 2.

Prescribed fire would be used primarily outside of harvest units, but there would be some overlap into units. Approximately 2,450 acres, with the same mosaic objectives as Alternative C, are proposed for prescribed fire as part of an additional fuels strategy and as a means of contributing to the long-term promotion of sustainable LOS conditions.

The proposed types of treatment would have little impact to the visual quality of the project area. Slash piles may be on the landscape until sufficient burning factors are met. Implementation of prescribed fire, while having the temporary visual effect of blackening some low growing plants and creating brown needles on, or killing some, small ponderosa pine, should result in a healthy vegetative condition, characterized by vigorous re-growth of forbs and grasses, as well as an increased openness in pine stands. The resulting condition should more closely resemble a "natural" condition than do current conditions, which are partially the result of decades of fire suppression.

Other Activities

Temporary Roads – No new temporary roads would be developed with Alternative D. The salvage harvest activities in Alternative D are expected to require the re-opening of approximately 5.7 miles of existing unclassified roads. Most of these re-opened roads would not be visible from the scenic corridors, and those that are visible would be mostly perpendicular to the scenic corridors so the visual impact when driving past would be minimal. After salvage harvest is complete, drainage structures would be removed, ditches eliminated, the roadbed would be outsloped and the road would be blocked to normal vehicular traffic. Grass and herbaceous forbs should cover 75-80 percent of the roadbed in the first year after closure, and brush should begin adding to the cover by the second year, effectively removing visual impacts of the roadbeds from scenic corridors.

Road Closure and Decommissioning - Several roads in Alternative D would be either decommissioned or closed for purposes of promoting watershed recovery and / or reducing impacts to wildlife. Road decommissioning would accelerate a return to a more natural appearing state. In this alternative, 75.5 miles of road would be closed, 71.6 miles would be decommissioned, and 123.9 would remain open.

Snag Retention and other Activities – Same as Alternative C.

Alternative E

Commercial Salvage

Harvest activities would occur on 11,490 acres within a total of 236 harvest units, including 233 ground-based units and 3 helicopter units. The project area includes 131 harvest units on the Toolbox Fire portion and 105 harvest units on the Silver Fire portion. The estimated volume for Alternative E is 66.1 mmbf (million board feet).

Requirements to meet scenery objectives would be the same as with Alternative C, with similar effects, differing only in the amount of area harvested.

Roadside Hazard Treatment – Same as Alternative C.

Reforestation

Same as Alternative C, with similar effects, with planting within the approximately 34,000 acres that experienced loss of stocking due to fire. See Chapter 2, Alternative Descriptions, for specific acreages of planting and site preparation.

Thinning

No precommercial thinning would occur in this alternative.

Fuel Treatment and Reduction

Alternative E follows a modification of the design principle used in Alternative C. First, due to somewhat less areas of harvest, there would be less fuel treatment. In addition, the "threshold" that would be used to determine if additional fuels treatments within harvest units (beyond yarding or yarding tops attached) would be used, differs from the other action alternatives. With Alternative E, such additional fuels treatments would only occur within those units where there would be a predicted fuel loading of greater than 30 tons per acre, if left untreated. This is 50% higher than the threshold used in the other alternatives. As a result, there would be a higher proportion of the units without additional fuels treatments. The visual effect of this would be more untreated slash in the units. Fuel treatment and reduction for activities fuels within harvest units and for areas outside of harvest units, may consist of several methods that are discussed in detail in Chapter 2.

No prescribed fire would be used in this alternative beyond the fuels treatments described above.

The proposed types of treatment would have little impact to the visual quality of the project area. Slash piles may be on the landscape until sufficient burning factors are met.

Other Activities

Temporary Roads - The salvage harvest activities in Alternative E are expected to require the use of approximately 29.1 miles of temporary road. New temporary road construction would be required for approximately 13.3 miles and approximately 15.8 miles would be re-opening of existing unclassified roads. Most of these new temporary and re-opened roads would not be visible from the scenic corridors, and those that are visible would be mostly perpendicular to the scenic corridors so the visual impact when driving past would be minimal. After salvage harvest is complete, drainage structures would be removed, ditches eliminated, the roadbed would be outsloped and the road would be blocked to normal vehicular traffic. Grass and herbaceous forbs should cover 75-80 percent of the roadbed in the first year after closure, and brush should begin adding to the cover by the second year, effectively removing visual impacts of the roadbeds from scenic corridors.

Road Closure and Decommissioning - Several roads in Alternative E would be either decommissioned or closed for purposes of promoting watershed recovery and / or reducing impacts to wildlife. Road decommissioning would accelerate a return to a more natural appearing state. In this alternative, 67.4 miles of road would be closed, 14.6 miles would be decommissioned, and 188.9 would remain open.

Snag Retention and other Activities – Same as Alternative C, except no aspen treatments would occur, so the enhanced scenery associated with that treatment would not occur.

Alternative G

Commercial Salvage

Harvest activities would occur on 14,419 acres within a total of 311 harvest units, including 297 ground-based units and 14 helicopter units. The project area includes 176 harvest units on the Toolbox Fire portion and 135 harvest units on the Silver Fire portion. The estimated volume for Alternative G is 73.2 mmbf (million board feet).

Requirements to meet scenery objectives would be the same as with Alternative C, with similar effects, with no noticeable difference due to the very similar amount of area harvested.

Roadside Hazard Treatment – Same as Alternative C.

Reforestation

Same as Alternative C, with similar effects, with planting within the approximately 34,000 acres that experienced loss of stocking due to fire. See Chapter 2, Alternative Descriptions, for specific acreages of planting and site preparation.

Thinning

Same as Alternative C.

Fuel Treatment and Reduction

Similar to Alternative C, except Alternative G includes proposals for fuels treatment in areas that would not receive fuels treatment under the criteria used in Alternative C. These include areas within harvest units (within ¼ mile of the boundary between National Forest System lands and private lands) in which the majority of the acres would not be expected to exceed 20 tons of fuel per acre within 15 years if no action is taken. This adds 1,132 acres within harvest units that would not receive additional treatment in Alternative C. Also added would be 5,596 acres in areas outside harvest units that are within ¼ mile of the boundary between National Forest system lands and private lands, regardless of predicted fuel loading. As a result, Alternative G would result in an overall appearance that would be "cleaner" than any of the other alternatives, over a wider area. A look of reduced ground fuels and ladder fuels, with more prominent featuring of larger, older trees, would be expected.

Prescribed fire would be the same as Alternative C, with application on 3,572 acres

Other Activities

Road Closure and Decommissioning - Several roads in Alternative G would be either decommissioned or closed for purposes of promoting watershed recovery and / or reducing impacts to wildlife. Road decommissioning would accelerate a return to a more natural appearing state. In this alternative, 10.4 miles of road would be closed, 71.6 miles would be decommissioned, and 188.9 would remain open.

All other activities would be the same as Alternative C with the same effects as described under Alternative C.

Alternative H

Commercial Salvage

Harvest activities would occur on 13,031 acres within a total of 288 ground-based harvest units. No helicopter units are proposed for this alternative. The project area includes 161 harvest units on the Toolbox Fire portion and 127 harvest units on the Silver Fire portion. The estimated volume for Alternative H is 63.8 mmbf (million board feet). Other than roadside hazard corridors, there would be no harvest within RHCAs.

Requirements to meet scenery objectives would be the same as with Alternative C, with similar effects, differing in the amount of area harvested, and in that there would be no helicopter units.

Roadside Hazard Treatment – Same as Alternative C.

Reforestation

Same as Alternative C, with similar effects, with planting within the approximately 34,000 acres that experienced loss of stocking due to fire. See Chapter 2, Alternative Descriptions, for specific acreages of planting and site preparation.

Thinning

Same as Alternative C.

Fuel Treatment and Reduction

Alternative H follows the same principle as Alternative C, but, due to slightly less areas of harvest, there would be less fuel treatment. Fuel treatment and reduction for activities fuels within harvest units and for areas outside of harvest units, may consist of several methods that are discussed in detail in Chapter 2.

Prescribed fire would the same as Alternative D with application on approximately 2,450 acres.

Other Activities

Temporary Roads - The salvage harvest activities in Alternative H are expected to require the use of approximately 34.6 miles of temporary road. New temporary road construction would be required for approximately 14.9 miles and approximately 19.7 miles would be re-opening of existing unclassified roads. Most of these new temporary and re-opened roads would not be visible from the scenic corridors, and those that are visible would be mostly perpendicular to the scenic corridors so the visual impact when driving past would be minimal. After salvage harvest is complete, drainage structures would be removed, ditches eliminated, the roadbed would be outsloped and the road would be blocked to normal vehicular traffic. Grass and herbaceous forbs should cover 75-80 percent of the roadbed in the first year after closure, and brush should begin adding to the cover by the second year, effectively removing visual impacts of the roadbeds from scenic corridors.

Road Closure and Decommissioning - Several roads in Alternative H would be either decommissioned or closed for purposes of promoting watershed recovery and / or reducing impacts to wildlife. Road decommissioning would accelerate a return to a more natural appearing state. In this alternative, 72.9 miles of road would be closed, 71.6 miles would be decommissioned, and 126.5 would remain open.

All other activities would be the same as Alternative C with the same effects as described under Alternative C.

Cumulative Effects

The Toolbox Fire Recovery Project Area is bounded on the east by the north-south trending fault block feature known as Winter Rim. An unburned strip varying between 3 and 7 miles wide runs between the Silver Fire portion of the project area and the Toolbox Fire portion of the project area. Within this unburned area are locally familiar landmarks such as Thompson Reservoir and Hager Mountain. The affected area of the fire is frequently viewed by travelers along the project area's two main scenic corridors, FS Road 27 and FS Road 28. The fire mosaic can also be seen from FS Road 2901 and the Fremont National Recreation Trail, as well as other corridors not designated for special scenery considerations. For most resources, the area of cumulative effects analysis for the Toolbox project is defined by the eight hydrologic subwatersheds in which the project occurs (listed below), extended beyond the project boundary to include the entirety of the eight subwatersheds, regardless of ownership.

Silver Creek Watershed (five subwatersheds)

- Middle Silver Creek
- West Fork Silver Creek
- Upper Silver Creek
- Thompson Reservoir
- Benny Creek

Silver Lake Watershed (three subwatersheds)

- Upper Duncan Creek
- East Duncan Creek
- Lower Duncan Creek

The activities that have occurred or would occur within these eight subwatersheds are analyzed for cumulative effects pertaining to scenery resources of the portions of the four main scenic corridors within, or immediately adjacent to, the project area.

Actions With Possible Visuals Cumulative Effects

Past Wildfire Activity

Effects of wildfire on scenery, whether by human or natural ignition, are usually perceived as natural. Some activities associated with prescribed fire, such as slashing and fire line construction, are perceived as human-caused and may

adversely affect scenic quality. Past fires, including the Alder Fire of 1996 and the Toolbox Complex Fire of 2002, add to the fire mosaic on the Toolbox project area. The lack of visual evidence of past suppression actions as well as suppression actions from the fire of 2002 help retain a natural-appearing (although significantly changed) character throughout most of the Toolbox project area.

Timber Harvest

FS Road 27

Past harvest on the Fremont National Forest that is partially visible from this corridor includes the Alder Timber Sale of 1992, which retained substantial overstory, and the Ridge Timber Sale, a salvage harvest with snag retention. The West Fork Timber Sale was an active contract at the time of the Toolbox Complex Fire; however, many of the West Fork units were burned over and the timber sale contract was cancelled. The remaining West Fork units are currently being evaluated with regard to future harvest activity.

On industrial private land within the project area, extensive logging occurred throughout the twentieth century. During the 1940s through the 1990s, harvest included substantial overstory removal. By 2000 nearly all commercial forest stands on private land were harvested at least once. During this same period sporadic logging occurred on non-industrial private lands in order to remove some of the larger trees to supplement incomes or for stand management. From 2000 through July of 2002 the remaining merchantable timber was harvested from private holdings near the 500 Reload along FS Road 27. Some salvage of fire-killed and large green timber on private non-industrial land occurred in the fall and winter of 2002-2003, and would continue to occur until 2005. Harvest on private industrial and non-industrial lands along this scenic corridor would have fairly long-term detrimental impacts to the scenic qualities of the corridor. The visual effect would be one that is in contrast to the objectives that are embodied in the MA 6 guidelines that apply to adjacent National Forest. Retention of large old ponderosa pines and snag retention are not likely to be objectives on this private land.

FS Road 28

Past harvest on the Fremont National Forest that is partially visible from this corridor includes the Hogleg Timber Sale of 1988, in which substantial overstory removal occurred. The Feast Timber Sale was an active contract at the time of the Toolbox Complex Fire. Partial harvest was completed before the contract was cancelled due to the fire. A small portion of harvest units are visible from FS Road 28. The harvest activity is only slightly noticeable, however, as this was a project to remove trees under 21 inch dbh to promote development of late and old structure stands in keeping with Forest Plan Standards and Guidelines, and very little harvest was accomplished before the fire occurred. The remaining Feast units are currently being evaluated with regard to future harvest activity. Other future timber harvest activity would include the Triad Timber Sale, with thinning of less than 21 inch dbh trees to promote development of late and old structure stands. Portions of units in the Triad Sale would be visible from a 1-mile section of FS Road 28, but should not affect scenic quality to any great extent. If anything, these projects should enhance visual resources as they are would enhance the development of large orange-barked ponderosa pine trees.

The portion of FS Road 28 that occurs within the Toolbox project area lies within National Forest Lands, so harvest activities on private lands are not a factor, visually, for this corridor.

FS Road 2901

Past harvest on the Fremont National Forest include the Rocpie Timber Sale of 1989 in which substantial overstory removal occurred. Only a small portion of this past harvest is visible from FS Road 2901, so the effects of this harvest activity on the scenery resource are minimal.

The portion of FS Road 2901 that occurs within the Toolbox project area lies mostly within National Forest Lands, so harvest activities on private lands are not a factor, visually, for this corridor.

Fremont National Recreation Trail (NRT)

Past harvest on the Fremont National Forest include the Rocpie Timber Sale of 1989 in which substantial overstory removal occurred. Only a small portion of this past harvest is visible from the NRT, so the effects of this harvest activity on the scenery resource is minimal. Portions of the Farm and Alder Timber Sales harvest activities are visible from the NRT; however, both retained substantial overstory and the visual impacts to users of the NRT are minimal.

The West Fork Timber Sale, portions of which are visible from the NRT, was an active contract at the time of the Toolbox Complex Fire; however, many of the West Fork units were burned over and the timber sale contract was cancelled. The remaining West Fork units are currently being evaluated with regard to future harvest activity.

A few segments of the NRT overlook the Winter Fire on the Paisley Ranger District. Salvage activity on that fire could occur as early as 2003. Most of that activity would involve helicopter yarding. The visual effect would be similar to that described for the action alternatives for this project (See "Commercial Salvage" for Alternative C).

The portion of the NRT that occurs within the Toolbox project area lies mostly within National Forest Lands, so harvest activities on private lands are not a factor, visually, for this corridor.

Reforestation

FS Road 27

Generally, planting has occurred to reestablish forested stands when harvest and wildfire occurred on National Forest Lands. Planting occurred in the Alder Fire burn area in 1997. This plantation is visible from FS Road 27, and the vexar tubing currently on the seedlings would remain for another two years. Other plantations are screened by taller tree stands and not visible from the scenic corridor. Most of the recent planting for harvest areas has been very light, as stocking levels were not reduced to the point of requiring planting.

In the 1970s, planting increased on private harvested lands within the Toolbox project area. By 2000, approximately 17 percent of the industrial private land was in plantations. In the fall and winter of 2002-2003, UST completed site preparation for planting on 5,000 acres and may do more site preparation in 2003. In the period from 2003 through 2005, UST plans to plant approximately 18,000 acres. During this same period, planting to State of Oregon density requirements would occur on private non-industrial lands. These plantations would be visible from the scenic corridor and would have a detrimental impact on scenic quality. The stands would take approximately 50 years to reach 14 inches dbh. On the positive side, the open areas would provide more opportunities for distant scenic vistas for travelers along the corridor.

FS Road 28

Generally, planting has occurred to reestablish forested stands when harvest and wildfire occurred on National Forest Lands. Plantations are screened by taller tree stands and not visible from the scenic corridor. Most of the recent planting for harvest areas has been very light, as stocking levels were not reduced to the point of requiring planting.

The portion of FS Road 28 that occurs within the Toolbox project area lies within National Forest Lands, so planting activities on private lands in association with harvest activities and wildfire are not a factor, visually, for this corridor.

FS Road 2901

Generally, planting has occurred to reestablish forested stands when harvest and wildfire occurred on National Forest Lands. Plantations are screened by taller tree stands and not visible from the scenic corridor. Most of the recent planting for harvest areas has been very light, as stocking levels were not reduced to the point of requiring planting.

The portion of FS Road 2901 that occurs within the Toolbox project area lies mostly within National Forest Lands, so planting activities on private lands in association with harvest activities and wildfire are not a factor, visually, for this corridor.

Fremont National Recreation Trail (NRT)

Generally, planting has occurred to reestablish forested stands when harvest and wildfire occurred on National Forest Lands. Plantations are screened by taller tree stands and not visible from the scenic corridor. Most of the recent planting for harvest areas has been very light, as stocking levels were not reduced to the point of requiring planting.

The portion of the NRT that occurs within the Toolbox project area lies mostly within National Forest Lands, so planting activities on private lands in association with harvest activities and wildfire are not a factor, visually, for this corridor.

Thinning

FS Road 27

Past thinning activities, on National Forest Lands within the Toolbox project area, were "tight" (not much removal) and resulted in dense stands. Past thinning has occurred in advanced reproduction (60-80 year old stands of natural regeneration). Thinning activities now and in the future are designed to develop late and old structure components, reduce hazard stand replacement fire, and facilitate more intense underburning, and occur in plantations or younger natural regeneration stands.

Current and future thinning activities designed for fuels considerations and to develop late and old structure consist of a lop and scatter method, resulting in a considerable amount of debris on the ground which is visible from scenic corridors.

However, juvenile wood decays much faster than advanced reproduction so the visual impacts from thinning would decrease fairly rapidly.

By 2000, almost all commercial forest stands on private lands within the Toolbox project area were harvested at least once. Almost no precommercial thinning activities took place on the private lands. At this time, future thinning activities are not planned on private lands within the project area.

FS Road 28
Thinning effects on scenery resources for this corridor are similar to those for FS Road 27.

FS Road 2901:
Thinning effects on scenery resources for this corridor are similar to those for FS Road 27.

Fremont National Recreation Trail (NRT):
Thinning effects on scenery resources for this corridor are similar to those for FS Road 27.

Fuel Treatment and Reduction

A variety of fuel reduction methods have been used in the past to reduce accumulated ladder fuels, duff, and brush, and to reverse a trend of overly dense stands in order to develop late and old stand structure components. Methods include prescribed burning, pretreatment (thinning by size and species rather than spacing, in preparation for burning), mowing (and mulching manzanita and other brush in order to reduce fuel depth), piling slash (some piles are burned while others are left for small mammal habitat), crushing (pretreatment followed by crushing with heavy machinery to break up and reduce the fuel depth).

Fuel reduction activities on National Forest System lands that occurred on the eight project area subwatersheds between 1985 and 2000 are, for the most part, no longer noticeable from the four scenic corridors. In areas of the more recent controlled burns, the viewer may see a blackening of low growing plants and creation of brown needles on small ponderosa pine. However, this should result in a healthy vegetative condition, characterized by vigorous re-growth of forbs and grasses, as well as an increased openness in pine stands. The resulting condition should more closely resemble a "natural" condition than do current conditions, which are partially the result of decades of fire suppression.

FS Road 27
Future fuel reduction activities are planned on 6000 acres in Benny, Thompson Reservoir, and Middle Silver Creek subwatersheds. These activities would not be visible from FS Road 27 and would have no effect on the scenic quality of that corridor.

No fuel reduction activities are planned on private lands adjacent to this corridor.

FS Road 28
The future fuel reduction activities mentioned above would be visible from FS Road 28; however, the proposed types of treatment would have little impact to the visual quality of the project area.

No fuel reduction activities are planned on private lands adjacent to this corridor.

FS Road 2901:
The future fuel reduction activities mentioned above would not be visible from FS Road 2901 and would have no effect on the scenic quality of that corridor.

No fuel reduction activities are planned on private lands adjacent to this corridor.

Fremont National Recreation Trail (NRT):
The future fuel reduction activities mentioned above would be visible from the NRT; however, the proposed types of treatment would have little impact to the visual quality of the project area. The fuel treatment activity may open up more scenic vistas for users of the trail by reducing stand densities.

No fuel reduction activities are planned on private lands adjacent to this corridor.

Actions Not Expected To Have Cumulative Visual Effects

Past, ongoing, and future firewood gathering activity would not have cumulative visual effects within or adjacent to the project area due to the dispersed nature of the activity.

Consistency with Fremont Forest Plan

All of the alternatives described in this analysis would meet Forest Plan standards and visual quality goals as long as mitigating measures are adhered to.

Pertinent Forest-wide Standard would be met, as follows:

MA-1, MA-2, MA3/14, MA-5, MA-12, MA-15:

The VQO of Maximum Modification (SIO = Very Low) would be met.

Lands generally within 300 feet of riparian areas would be managed to maintain the Partial Retention VQO (Moderate SIL). This standard would be met, as a 300-foot RHCA, with specific helicopter yarding requirements, would apply alongside major fisheries stream in all alternatives.

MA-6A:

The VQO of Foreground Partial Retention (SIO = Moderate) would be met.

MA-6B:

The VQO of Maximum Modification (SIO = Very Low) with special guidelines would be met.

ECONOMICS

- Introduction
- Key Issue
- Purpose and Need
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- Environmental Consequences for Economic Impact
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Introduction

Economic concepts were used throughout the development of this Draft Environmental Impact Statement (DEIS). On a daily basis, Interdisciplinary Team members debated ways of achieving the objectives of the various alternatives in a cost-effective manner and developed activities that would achieve desired effects at the least cost. The units proposed for timber harvest in Alternative E were selected on the basis of their positive contribution to net present value. That process is described in a separate report entitled *Developing Alternative E*, by Haugen and Pierce, in the Toolbox Fire Recovery Project record.

This analysis will address the broader issues of economic efficiency and economic impact.

The economic efficiency analysis examines the long-term costs and returns associated with managing the study area under the various alternatives as well as other benefits and costs associated with implementing each alternative. It includes the costs and returns of all connected, reasonably foreseeable future actions and even future actions that are so distant in time that they may not be considered "reasonably foreseeable" in the National Environmental Policy Act (NEPA) sense. While these future actions may not be reasonably foreseeable, they are consistent with long-term management of the area in accordance with the Fremont National Forest Land and Resource Management Plan, as amended. The costs and returns that can be expressed in dollars derived from market transactions are combined and expressed as a **present net value** (PNV) for each alternative. That is the focus of this analysis. There are additional costs and benefits that cannot be reasonably expressed in dollar terms. These are discussed subjectively in other sections of this EIS and in specialist reports. The decision-maker will consider these **net subjective values** (NSV), along with the present net value, when choosing the alternative with the largest **net public benefit** (NPB) for implementation. In a manner of speaking, the net public benefit is the sum of present net value and net subjective value. Present net value is one of many considerations being analyzed.

The economic impact analysis will address the issues of economic impact of the various alternatives in the short term. Economic impact analysis is, in some ways, similar to social impact analysis. However, it focuses on jobs, employee

compensation and other economic effects on the people, primarily during the period that project activities are underway. Economic impact is not part of the present net value analysis. Rather it is one of the many subjective values that are considered in determining which alternative has the best net public benefit.

While the analysis strives to estimate impacts in as realistic a way as possible, there is little likelihood that a detailed post-project analysis would prove these estimates to be particularly accurate. This is due to the necessity of dealing with many possible variables in the economy by making realistic assumptions. The issue of absolute accuracy does not affect the utility of this analysis in the comparison of alternatives. The alternatives are all analyzed in an identical manner using identical assumptions. Thus, the relative economic impacts of the various alternatives can be accurately described and used in formulating a decision.

In the Toolbox Fire Recovery Project, where a large area has burned, future management can be affected by the way in which the area is managed in the short term. Most alternatives include salvage harvest in units that may be uneconomical, on their own, from a timber purchaser perspective. The cost for a purchaser to harvest these units is offset by the profits made on other units, so that a timber sale is a viable option. This allows more acres to be harvested and treated for fuels and reduces costs of planting and future management. The question then is, "Which alternative is the most economically efficient for long-term management of the area?"

The no-action alternative includes no harvest in the short term and would maximize the cost of long-term management due to the large amount of large down wood that will cover the area in a few years. However, the cost and returns of short-term management are minimized. Alternative C would harvest the largest acreage and would minimize the expense of future management, but would not necessarily maximize returns in the short-term. Alternative E was designed to maximize returns in the short-term, but it would not minimize costs in the long run. Because the series of alternatives address these extremes, as well as intermediate points in this range, one of the alternatives will be revealed as most efficient for long-term management in terms of present net value.

Key Issue: Economic Efficiency and Economic Opportunities

Issue Statement: The overall economic viability of the project could be reduced by including restoration proposals other than commercial salvage, and by including helicopter yarding for a portion of the commercial salvage.

Some people want the Forest Service to maximize economic opportunities by timely salvage of fire-killed trees. They urge the Forest Service to, "Harvest as much of the merchantable timber as quickly as possible." This element did not influence alternative development, because, regardless of alternative construction, the legally mandated process and required timeframes for project planning on National Forests remains the same. There were also specific concerns about how the economics of helicopter yarding would affect the overall timber sale economics, including the concern that, "By next year, due to deterioration, the value won't support (use of) helicopter." There was concern that the watershed, riparian and wildlife restoration projects, the plantation thinning, site preparation and planting at over 300 trees per acre, or extensive non-commercial fuels reduction could incur very high costs, while the only actual "return" producing activity was the commercial salvage. There was concern that the proposed action included salvage of merchantable material more as a "reluctant inclusion" rather than as the "underpinning" of the action. This group of concerns, some of which relate directly to timber sale economic viability and some that do not, will be examined by comparing the alternatives, in terms of overall economic factors, and for a subset of these factors - timber sale economics.

Measurement Indicators: The following indicators will be evaluated for each of the alternatives:

1. *Estimated Salvage Harvest Volume (Million Board Feet (MMBF))*
2. *Percentage of Harvest Volume by Ground-Based Yarding System/Helicopter Yarding System*
3. *Comparative Timber Sale Economics (Net Timber Value/thousand board feet (mbf) and Total)*
4. *Job Support (Total, including Direct and Indirect)*
5. *Present Net Value (PNV - Current Projects only, at 4 Percent Discount)*

Purpose and Need

A purpose and need for the Toolbox Fire Recovery Project is to salvage burned timber for merchantable value, per direction listed in the following Regulatory Framework section.

Regulatory Framework

The Fremont National Forest Land and Resource Management Plan (LRMP), 1989, includes Forest-wide management goals to:

- Provide sawtimber and other wood products (including firewood for personal or commercial use) to help sustain a viable local economy.
- Strive for economically efficient management.

The LRMP also includes Forest-wide management objectives to offer affordable sales. In addition, Forest-wide standards supplement national and regional policies, standards, and guidelines found in Forest Service manuals and handbooks relevant to timber harvesting include:

- Providing well-designed timber sales to be affordable under average market condition at time of sale.
- Increasing the use of available wood fiber consistent with management objectives and economic principles.

The Code of Federal Regulations (CFR) is a codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Government. Management requirements to be met in accomplishing goals and objectives for the National Forest System are set forth in *36 CFR 219.28, Determination of land suitable for timber harvest*, as follows:

- (b) Lands where timber may be harvested for timber production (if the costs of timber production are justified by the ecological, social, or economic benefits).
- (c) Lands where timber may be harvested for other multiple-use values (if such timber harvest would contribute to achievement of desired conditions and ecological sustainability).

Other management requirements to be met are set forth in *36 CFR.219.29, Limitation on timber harvest*, as follows:

- (c) Exceptions to limitations of timber harvest (from areas that are substantially affected by fire, wind, or other events, or for which there is an imminent threat from insects or disease).

Forest Service policy sets a minimum level of financial analysis for project planning (Forest Service Handbook 1909.17).

Analysis Method

The purpose of this analysis is to develop an economic comparison of the alternatives. The analysis is from the point of view of the U.S. Forest Service and should not be construed as an indicator of whether or not any proposed timber sales will sell at the indicated rates. Review of the alternatives and the likely behavior of wildfire suggests that the alternatives will vary in the need for wildfire suppression over time. Variations in fuels on the ground are the primary indicator of this likelihood. This further suggests that costs for suppression activities would vary over time and from alternative to alternative. However, we do not have a sufficient historic perspective to be able to predict variations in acres burned across the alternatives to the degree necessary to incorporate that information into this analysis. Instead, others will discuss these relationships subjectively elsewhere in this DEIS, so that they may be considered in the decision-making process.

Economic impact is a concern in the Toolbox Fire Recovery Project. This concern can be expressed in the number of jobs estimated to be supported in the local area by the various alternatives. Both the production of timber and the restoration activities contribute to economic activity. In addition to an estimate of the number of jobs associated with the various activities, the costs of the restoration activities are addressed here. The type of analysis used here will not produce extremely accurate job numbers, however the numbers will be most useful in comparing the relative impact of the alternatives.

Existing Condition

The fires of 2002 created enormous acreages of fuel for future fires. Fuel reduction, watershed improvements, wildlife habitat improvements and restoration, and reforestation are the main purposes for this analysis. At the same time, there is an opportunity to capture the economic value of the fire-killed timber by selling some of the valuable wood. Capitalizing on this opportunity would accomplish two very important things. It would help to accomplish the fuel reduction, both directly by removing the fuel and converting it to a useable product, and indirectly by providing revenue returns to reduce the total

cost of the project. Commercial timber sale contracts or stewardship contracts (or combinations of both) could include provisions that would accomplish some of the watershed restoration, fisheries, and reforestation work as well. Secondly, stewardship contracts, service contracts with embedded timber sale provisions, commercial and non-commercial fuel reduction, tree planting, and watershed and wildlife habitat improvements could provide jobs and income to local and regional economies.

Fuel reduction through timber harvest is a viable consideration for this project. However, delays in processing fire-damaged timber will cause the value to decline rapidly and dramatically. Firewood (both personal-use and commercial quantities) will hold its value considerably longer than the sawlog material will. Time is an important consideration in the economic analysis of this project. As time goes on, both the volume available for consideration and the value of the products will decrease, thereby reducing the cost effectiveness or eliminating the opportunity altogether.

Inherent in the economic setting for this project is the fact that certain practical limitations must be recognized. When using machinery of any kind for fuel reduction, distance is a variable that can have profound effects on the ultimate feasibility of a project. This is true for all systems, but it is especially critical for helicopter operations. Even relatively small changes in distances can dramatically change the economic feasibility of a project.

Stumpage prices are affected by changes in both the world and national economies, as well as local economic conditions. It is not possible to predict with certainty what stumpage bid prices will be in the future. The U.S. economy has slowed and may be moving toward recession and the terrorist attacks in Washington and New York in 2001 have added a great deal of uncertainty about future economic conditions.

The U.S. Forest Service annual *Cut and Sold Convertible Products Report* contains a more detailed analysis of the lumber market on the Fremont-Winema National Forests. According to this report, timber sale volumes for the Fremont-Winema National Forests were 86 percent lower in 2001 than in 1981. Total volume for the Forest dropped from 333 million board feet (mmbf) in 1981 to 44 mmbf in 2001.

Lake County unemployment rates are somewhat improved from a year ago, with 60 additional jobs in February 2003 compared to February 2002. These additional jobs are primarily in service and trade, transportation, and utilities. The unemployment rate is still very high at 14 percent.

Economic Efficiency

Unit Costs

All costs in this analysis are in 2003 dollars. The following table displays the total costs associated with non-timber sale activities. Some of those costs were developed by the specialists associated with the affected resource and are used here as a lump sum, rather than unit cost.

Table 3.165 Costs of Other Activities

Activity	Years of Activity	Estimated Total Cost By Alternative					
		Alt. A	Alt. C	Alt. D	Alt. E	Alt. G	Alt. H
Aquatic Habitat Restoration	2	-	$26,840	$26,840	$26,840	$26,840	$26,840
Road Reconstruction	1	-	$108,400	$60,100	$108,400	$108,400	$108,400
Pre-Commercial Thinning	1-3	-	$287,820	$287,820	-	$287,820	$287,820
Fuels Treatment w/in units	2	-	$1,721,000	$954,000	1,129,000	$1,907,000	$1,524,000
Fuels Treatment o/s units	1	-	-	-	-	$1,119,000	-
Reforestation	1-6	-	$8,318,000	$8,891,000	$8,183,000	$8,096,000	$8,136,000
Prescribed Fire	3	-	$357,200	$245,000	-	$357,200	$245,000
Riparian Planting	1	-	$158,400	$158,400	-	$158,400	$158,400
Aspen Enhancement	2 - 4	-	$103,500	$103,500	-	$103,500	$103,500
Road 2917413 Improvement	1	-	$1,821	$1,821	-	$1,821	$1,821

Other costs include components that vary by alternative and are more clearly displayed on a unit cost basis. Those costs are displayed as unit costs in the following table as well as in Appendix A of the Economic Efficiency Report in the project record. In some cases, the total costs for activities proposed in the DEIS are shown in the table above and the associated unit costs are shown in the following table.

Table 3.166 Unit Costs

Activity	Unit Cost
Reforestation	
Site Prep	$140/ac
Fuels (additional)	$30/ac
Planting	$350/ac
Pre-commercial Thinning	$130/ac
Additional Fuel Treatment in Salvage Units*	$168/ac
Additional Fuel Treatments Outside of Salvage Units within ¼ Mile of Private Boundary	$200/ac
Prescribed Fire	$100/ac
Road Decommissioning	$695/mile
Road Closures	$125/closure or $375/mile

* Fuel treatment is based on application of a variety of treatments, including jackpot burning, broadcast burning, under burning, mastication, crushing, buncher piling and burning, machine piling and burning, grapple piling and burning and landing pile burning. An estimate of $150 per acre reflects a typical combination of these activities. In addition, within salvage units, it is estimated that 5% of the acreage will be treated by handpiling and burning at $500 per acre. Thus, the overall average is $168/acre [(0.95 X 150) + (0.05 X 500) = $168]. Since the units outside of salvage units, adjacent to private lands will involve more of the expensive treatments, the cost is estimated at $200/acre.

Unit Returns

All returns in the analysis are in 2003 dollars and are based on current market conditions. Market conditions are certain to change in the future and raise or lower returns from timber sales. While these changes are expected, they cannot be reasonably predicted. The relative economic performance of the alternatives should be fairly constant regardless of changing market conditions.

Dollar returns come in the form of timber sale receipts. The receipts depend on the price bid for the sale in a competitive bidding process. Bidders typically look at the value of the timber and subtract their costs to arrive at a bid price that allows them a reasonable profit. The values used here come from the *Logging Systems and Logging Economics* specialist report in the project record (Pierce, 2003). In that report, the process described determined that, overall, the value of the timber on

tractor ground is $300/mbf and on helicopter ground is $315/mbf. These values vary because the type of timber on the helicopter ground is more valuable that the typical timber found on the flatter, tractor ground. Logging costs vary, on a per-acre basis, by alternative because yarding distances and volumes per acre vary. In addition, the alternatives have varying amounts of helicopter logging that costs more, per acre, than tractor logging. Logging costs from stump to mill, (except fuels treatment and road reconstruction, but including temporary road work) are subtracted from the values to arrive at the $/mbf values shown in the following table. Since costs and values are based on transaction evidence, purchaser profit and risk are incorporated within the figures shown.

Table 3.167 Net Timber Value

ALTERNATIVE	TOTAL VOLUME	NET VALUE	TOTAL NET RETURNS
A	0	-	$0
C	73,300 mbf	$82.25/mbf	$6,247,000
D	33,700 mbf	$91.09/mbf	$3,070,000
E	66,100 mbf	$95.95/mbf	$6,344,000
G	73,200 mbf	$85.40/mbf	$6,248,000
H	63,800 mbf	$85.81/mbf	$5,478,000

Future management is also expected to produce timber sales. Based on Forest Plan direction for the desired future condition of the area, it is expected that commercial thinning, followed by individual tree selection harvest, will be used. The North Zone Silviculturist estimates that commercial thins at about age 60 will produce 6.5 mbf per acre with an average diameter of about 13 inches (Puddy, personal communication, 2003). This is similar to the timber being harvested in Alternative G, so a net value of $85/mbf will be used in this analysis. About 100 years in the future, when individual tree selection harvests occur, it is expected that they will produce 8.8 mbf per acre of trees with an average dbh of 20 inches. Current data indicates a value of $525/mbf for this kind of material. Logging costs, as described in *Developing Alternative E* (Haugen and Pierce, 2003) in the project record, are approximately $159/mbf. Thus, the net value is estimated at $366/mbf. the following table provides a summary.

Table 3.168 Future Timber Volume and Value

HARVEST TYPE	AGE	AVERAGE DBH	MBF/ACRE	$/MBF
Commercial Thin	60	13 inches	6.5 mbf/acre	$85
Selection Harvest	100	20 inches	8.8 mbf/acre	$366

Value Decline Due to Deterioration

Due to drying, decay, and staining by fungus, trees killed by the fires will lose a substantial portion of their economic value as a source of forest products if they are not salvaged promptly. The speed at which deterioration occurs depends on several factors, including tree species and size. Smaller diameter trees are more susceptible to loss of commercial value than larger diameter trees. In addition, dead trees that still contain sound wood may become infected with blue stain fungus, which does not weaken the wood, but does decrease the value and grade of lumber that can be produced.

One study entitled *Lumber Recovery from Dead Ponderosa Pine in the Colorado Front Range* (PNW Research Paper 428, 1990), found approximately a 10 percent decline in value in the first year after death, primarily because of blue stain. This study was oriented toward trees dead two years and longer and it had only a small sample of trees dead just one year. A second PNW study, entitled *Deterioration of Fire-Killed and Fire-Damaged Timber in the Western United States* (PNW-GTR-292, 1992), reviewed other literature on the subject and notes that one study found that blue stain had deteriorated 25 percent of the cubic volume. This study includes no estimate of economic deterioration in ponderosa pine. A third,

undated study (circa 1990) entitled *Evaluation of Fire-Killed Ponderosa Pine for Volume and Value Loss* by the Timber Quality Research Unit of the PNW Research Station revealed that timber processed within the first year saw an 18 percent decrease in value by grade. After the first year, value recovered from logs would be equivalent to grading them all at the lowest pine grade. The latter study used data derived from the August/September 1988 Teepee Butte Fire in the Hells Canyon National Recreation Area.

While the rate of value decline varies by the time of year of the burn, burn intensity, weather conditions after the burn, the delay before processing, and other factors, it is clear from the above research that delays in processing fire-damaged timber will cause the value of that timber to decline dramatically and rapidly. For the purposes of this analysis, it is assumed that timber harvest will begin in 2004 and be completed in 2005. Trees that are expected to lose their value by 2005 are not included in the salvage volume estimates. Those that are not retained for other resource reasons (down woody material, snags, etc.) are accounted for in fuels treatment costs since they will remain in the forest after salvage harvest and contribute to the fuels situation.

Time Frame

This analysis examines the economic efficiency of the alternatives in three time frames. The first is the standard analysis of the activities involved in this DEIS. In the no action alternative, there are no costs or returns to consider and the PNV is zero. The other alternatives include activities out to 2009, when planting and road decommissioning and closures are completed.

The second time frame is the future beyond 2009, where management will be affected by the way in which the lands are managed in the short term. In general, this time frame starts with an established plantation and carries potential treatment costs and returns out to 2105, when the first selection harvest of mature trees can occur.

The third time frame spans the entire short and long-term from 2004 through 2105. This allows a look at the overall efficiency of converting a fire-damaged ecosystem into the desired future condition described in the Forest Plan.

Other than the reasonably foreseeable action of planting some of the burn area, described here as a variation on the no action alternative, the future management actions are distant enough in time to be considered speculative. Nonetheless, it is important for the decision-maker to consider the consequences of present actions on future generations (inter-generational equity). Assumptions about future management, as described below, are necessary to allow this consideration.

Environmental Consequences for Economic Efficiency

Direct, Indirect, and Cumulative Effects

Alternative A – No Action

No Planting. This alternative would not salvage the timber from the area or include any planting or other recovery activities, thus, its PNV is zero (no costs and no returns).

However, under direction of the Fremont National Forest Land and Resource Management Plan, timber in the area would be managed in the future. While the decision to undertake these activities is not being made at this time, long-term timber management may occur, given present management direction. Natural regeneration and development of the stand would produce a different long-term management scenario than under the action alternatives. One factor is the increased cost of future management due to the large numbers of down logs that will remain on the ground into the future. In addition, without planting, the stands would need to regenerate from natural seed sources that are sparse. These conditions would delay the development of stands that would be suitable for management.

The following table displays the long-term management scenario without future planting.

Table 3.169 Management Scenario (Alternative A – No Planting)

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
81	2085	Timber Stand Improvement	15,000 acres	$400/acre	-
101	2105	Prescribed Burn	15,000 acres	$100/acre	-

This scenario envisions periodic wildfires that burn portions of the area. By 2085, about 15,000 acres of lands scheduled for timber management would have trees of a size that management would be beneficial. Due to the rate of regeneration and growth in this scenario, there would be no opportunity for commercial timber harvest within 100 years.

Future Planting

Should future analysis and decision-making lead to an aggressive effort to achieve the desired conditions for this area, considerable effort would go into planting the area, as indicated in the following scenario. This is a plausible scenario because the National Forest Management Act emphasizes the importance of prompt reforestation.

Table 3.170 Management Scenario - Alternative A –Planting

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
18	2022	Fuels Treatment and Plant	15,000 acres	$850/acre	
21	2025	Fuels Treatment and Plant	15,000 acres	$1200/acre	
26	2030	Planting Maintenance and Replanting	30,000 acres	$300/acre	
31	2035	Planting Maintenance and Replanting	30,000 acres	$100/acre	
61	2065	Timber Stand Improvement	15,000 acres	$50/acre	
66	2070	Prescribed Burn	15,000 acres	$100/acre	
79	2083	Resource Support (NEPA)	195,000 mbf	$15/mbf	
80	2084	Sale Preparation	195,000 mbf	$15/mbf	
81	2085	Commercial Thin 30,000 ac @ 6.5mbf/ac 13” avg dbh	195,000 mbf	-	$85/mbf
81	2085	Sale Administration	195,000 mbf	$10/mbf	

This scenario also envisions some wildfire prior to the initial planting that would reduce some of the fuels in the area. It also envisions some future wildfire activity, although it is less extensive than the previous alternative due to aggressive fuels treatments. Under this scenario, some commercial timber harvest could be expected to occur at about year 81 and tree sizes would average about 13 inches dbh.

Alternative C

This alternative would implement the “other” activities, as shown in the following table. In addition, 73.3 mmbf would be harvested under this project. Because of the initial treatments, the timing of post-harvest treatments (site preparation, fuels treatment, and planting) would be spread over six years. For example, acres that had been harvested prior to the fire could be site prepped immediately while other acres could not be prepped until harvest is complete. In addition, potential future management, beyond the management activities covered by this DEIS, would vary by the way in which units would be treated now. The short- and long-term management scenario is presented in the following table.

Table 3.171 Management Scenario - Alternative C

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
0	2004	Precommercial Thin	738 acres	$130/acre	
0	2004	Riparian Planting	1 lump sum	$158,400	
0	2004	Road Reconstruction	1 lump sum	$108,400	
0	2004	Road 2917413 Improvement	1 lump sum	$1,821	
0	2004	Reforestation Site Preparation	1,000 acres	$140/ac	
0	2004	Timber Sales (Salvage)	36,650 mbf		$82.25/mbf
1	2005	Timber Sales (Salvage)	36,650 mbf		$82.25/mbf
1	2005	Fuel Treatment Within Units	10,244 acres	$168/acre	
1	2005	Aquatic Habitat Restoration	1 lump sum	$26,840	
1	2005	Precommercial Thin	738 acres	$130/acre	
1	2005	Reforestation Fuels Treatment	3,000 acres	$30/acre	
1	2005	Reforestation Site Preparation	3,301 acres	$140/acre	
1	2005	Reforestation Planting	5,003 acres	$350/acre	
1	2005	Aspen Enhancement	230 acres	$150/acre	
2	2006	Reforestation Fuels Treatment	3,974 acres	$30/acre	
2	2006	Prescribed Fire	3,572 acres	$100/acre	
2	2006	Reforestation Planting	5,000 acres	$350/acre	
2	2006	Aspen Enhancement	230 acres	$150/acre	
2	2006	Precommercial Thin	738 acres	$130/acre	
3	2007	Aspen Enhancement	230 acres	$150/acre	
3	2007	Reforestation Fuels Treatment	1,668 acres	$30/acre	
3	2007	Reforestation Planting	5,000 acres	$350/acre	
4	2008	Reforestation Site Preparation	1,000 acres	$140/acre	
4	2008	Reforestation Planting	5,102 acres	$350/acre	
5	2009	Reforestation Planting	4,801 acres	$350/acre	
5	2009	Road Decommissioning	69.0 miles	$695/mile	
5	2009	Road Closures	72.9 miles	$375/mile	

Table 3.171 Management Scenario - Alternative C (continued)

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
14	2018	Timber Stand Improvement (A+E)	9,912 acres	$50/acre	
14	2018	Timber Stand Improvement (C)	2,045 acres	$500/acre	
14	2018	Timber Stand Improvement (D)	4,648 acres	$600/acre	
14	2018	Timber Stand Improvement (D1)	4,301 acres	$100/acre	
18	2022	Prescribed Fire	20,906 acres	$100/acre	
31	2035	Prescribed Fire	20,906 acres	$100/acre	
46	2050	Prescribed Fire	20,906 acres	$100/acre	
59	2063	Resource Support (NEPA)	136,000 mbf	$15/mbf	
60	2064	Sale Preparation	136,000 mbf	$15/mbf	
61	2065	Commercial Thin 20,906 ac @ 6.5mbf/ac 13" avg dbh	136,000 mbf		$85/mbf
61	2065	Sale Administration	136,000 mbf	$10/mbf	
66	2070	Prescribed Fire	20,906 acres	$100/acre	
81	2085	Prescribed Fire	20,906 acres	$100/acre	
99	2103	Resource Support (NEPA)	184,000 mbf	$15/mbf	
100	2104	Sale Preparation	184,000 mbf	$15/mbf	
101	2105	Individual Tree Selection Cut 20,906 ac @ 8.8 mbf/ac 20" avg dbh	184,000 mbf		$366/mbf
101	2105	Sale Administration	184,000 mbf	$10/mbf	

Alternative D

This alternative would implement the "other" activities as shown in the following table. In addition, 33.7 mmbf would be harvested under this project. Because of the initial treatments, the timing of post-harvest treatments (site preparation, fuels treatment and planting) would be spread over six years. For example, acres that had been harvested prior to the fire could be site prepped immediately while other acres could not be prepped until harvest is complete. In addition, potential future management, beyond the management activities covered by this DEIS, would vary by the way in which units would be treated now. The short- and long-term management scenario is presented in the following table:

Table 3.172 Management Scenario - Alternative D

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
0	2004	Precommercial Thin	738 acres	$130/acre	
0	2004	Riparian Planting	1 lump sum	$158,400	
0	2004	Road Reconstruction	1 lump sum	$60,100	
0	2004	Road 2917413 Improvement	1 lump sum	$1,821	
0	2004	Reforestation Site Preparation	1,500 acres	$140/ac	
0	2004	Timber Sales (Salvage)	16,850 mbf		$91.09/mbf
1	2005	Timber Sales (Salvage)	16,850 mbf		$91.09/mbf
1	2005	Fuel Treatment Within Units	5,680 acres	$168/acre	
1	2005	Aquatic Habitat Restoration	1 lump sum	$26,840	
1	2005	Precommercial Thin	738 acres	$130/acre	
1	2005	Reforestation Fuels Treatment	2,776 acres	$30/acre	
1	2005	Reforestation Site Preparation	3,000 acres	$140/acre	
1	2005	Reforestation Planting	5,094 acres	$350/acre	
1	2005	Aspen Enhancement	230 acres	$150/acre	
2	2006	Reforestation Fuels Treatment	2,000 acres	$30/acre	
2	2006	Reforestation Site Preparation	2,500 acres	$140/acre	
2	2006	Prescribed Fire	2,450 acres	$100/acre	
2	2006	Reforestation Planting	5,070 acres	$350/acre	
2	2006	Aspen Enhancement	230 acres	$150/acre	
2	2006	Precommercial Thin	738 acres	$130/acre	
3	2007	Aspen Enhancement	230 acres	$150/acre	
3	2007	Reforestation Site Preparation	2,603 acres	$140/acre	
3	2007	Reforestation Planting	5,079 acres	$350/acre	
4	2008	Reforestation Site Preparation	1,000 acres	$140/acre	
4	2008	Reforestation Planting	5,500 acres	$350/acre	
5	2009	Road Closures	75.5miles	$375/mile	
5	2009	Road Decommissioning	71.6 miles	$695/mile	
5	2009	Reforestation Planting	4,000 acres	$350/acre	

Table 3.172 Management Scenario - Alternative D (continued)

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
14	2018	Timber Stand Improvement (A+E)	6,046 acres	$50/acre	
14	2018	Timber Stand Improvement (C)	363 acres	$500/acre	
14	2018	Timber Stand Improvement (D)	4,731 acres	$600/acre	
14	2018	Timber Stand Improvement (D1)	9,603 acres	$100/acre	
18	2022	Prescribed Fire	20,743 acres	$100/acre	
31	2035	Prescribed Fire	20,743 acres	$100/acre	
46	2050	Prescribed Fire	20,743 acres	$100/acre	
59	2063	Resource Support (NEPA)	135,000 mbf	$15/mbf	
60	2064	Sale Preparation	135,000 mbf	$15/mbf	
61	2065	Commercial Thin 20,743 ac @ 6.5mbf/ac 13” avg dbh	135,000 mbf	$85/mbf	
61	2065	Sale Administration	135,000 mbf	$10/mbf	
66	2070	Prescribed Fire	20,743 acres	$100/acre	
81	2085	Prescribed Fire	20,743 acres	$100/acre	
99	2103	Resource Support (NEPA)	183,000 mbf	$15/mbf	
100	2104	Sale Preparation	183,000 mbf	$15/mbf	
101	2105	Individual Tree Selection Cut 20,743 ac @ 8.8 mbf/ac 20” avg dbh	183,000 mbf		$366/mbf
101	2105	Sale Administration	183,000 mbf	$10/mbf	

Alternative E

This alternative was designed to include only units that would likely be profitable to harvest. It would implement fewer of the “other” activities as shown in the following table. In addition, 66.1 mmbf would be harvested under this project. Because of the initial treatments, the timing of post-harvest treatments (site preparation, fuels treatment and planting) would be spread over six years. For example, acres that had been harvested prior to the fire could be site prepped immediately while other acres could not be prepped until harvest is complete. In addition, potential future management, beyond the management activities covered by this DEIS, would vary by the way in which units would be treated now. The short- and long-term management scenario is presented in the following table:

Table 3.173 Management Scenario - Alternative E

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
0	2004	Road Reconstruction	1 lump sum	$108,400	
0	2004	Reforestation Site Preparation	1,000 acres	$140/ac	
0	2004	Timber Sales (Salvage)	33,050 mbf		$95.95/mbf
1	2005	Timber Sales (Salvage)	33,050 mbf		$95.95/mbf
1	2005	Fuel Treatment Within Units	6,723 acres	$168/acre	
1	2005	Aquatic Habitat Restoration	1 lump sum	$26,840	
1	2005	Reforestation Fuels Treatment	3,000 acres	$30/acre	
1	2005	Road Decommissioning	14.6 miles	$695/mile	
1	2005	Reforestation Site Preparation	1,530 acres	$140/acre	
1	2005	Reforestation Planting	5,000 acres	$350/acre	
2	2006	Reforestation Fuels Treatment	2,759 acres	$30/acre	
2	2006	Reforestation Site Preparation	1,800 acres	$140/acre	
2	2006	Reforestation Planting	5,221 acres	$350/acre	
3	2007	Reforestation Planting	5,000 acres	$350/acre	
4	2008	Reforestation Site Preparation	1,000 acres	$140/acre	
4	2008	Reforestation Planting	5,232 acres	$350/acre	
5	2009	Road Closures	67.4 miles	$375/mile	
5	2009	Road Decommissioning	14.6 miles	$695/mile	
5	2009	Reforestation Planting	4,300 acres	$350/acre	
14	2018	Timber Stand Improvement (A+E)	7,037 acres	$50/acre	
14	2018	Timber Stand Improvement (C)	3,042 acres	$500/acre	
14	2018	Timber Stand Improvement (D)	6,344 acres	$600/acre	
14	2018	Timber Stand Improvement (D1)	4,330 acres	$100/acre	
18	2022	Prescribed Fire	20,753 acres	$100/acre	
31	2035	Prescribed Fire	20,753 acres	$100/acre	
46	2050	Prescribed Fire	20,753 acres	$100/acre	
59	2063	Resource Support (NEPA)	135,000 mbf	$15/mbf	

Table 3.173 Management Scenario - Alternative E (continued)

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
60	2064	Sale Preparation	135,000 mbf	$15/mbf	
61	2065	Commercial Thin 20,753 ac @ 6.5mbf/ac 13" avg dbh	135,000 mbf	$85/mbf	
61	2065	Sale Administration	135,000 mbf	$10/mbf	
66	2070	Prescribed Fire	20,753 acres	$100/acre	
81	2085	Prescribed Fire	20,753 acres	$100/acre	
99	2103	Resource Support (NEPA)	183,000 mbf	$15/mbf	
100	2104	Sale Preparation	183,000 mbf	$15/mbf	
101	2105	Individual Tree Selection Cut 20,753 ac @ 8.8 mbf/ac 20" avg dbh	183,000 mbf		$366/mbf
101	2105	Sale Administration	183,000 mbf	$10/mbf	

Alternative G

This alternative would implement the "other" activities as shown in the following table. In addition, 73.2 mmbf will be harvested under this project. Because of the initial treatments, the timing of post-harvest treatments (site preparation, fuels treatment and planting) would be spread over six years. For example, acres that had been harvested prior to the fire could be site prepped immediately while other acres could not be prepped until harvest is complete. In addition, potential future management, beyond the management activities covered by this DEIS, would vary by the way in which units would be treated now. The short- and long-term management scenario is presented in the following table:

Table 3.174 Management Scenario - Alternative G

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
0	2004	Precommercial Thin	738 acres	$130/acre	
0	2004	Fuels Treatments Outside Units	5,596 acres	$200/acre	
0	2004	Riparian Planting	1 lump sum	$158,400	
0	2004	Road Reconstruction	1 lump sum	$108,400	
0	2004	Road 2917413 Improvement	1 lump sum	$1,821	
0	2004	Reforestation Site Preparation	1,000 acres	$140/ac	
0	2004	Timber Sales (Salvage)	36,600 mbf		$85.40/mbf

Table 3.174 Management Scenario - Alternative G (continued)

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
1	2005	Timber Sales (Salvage)	36,600 mbf		$85.40/mbf
1	2005	Fuel Treatment Within Units	11,354 acres	$168/acre	
1	2005	Aquatic Habitat Restoration	1 lump sum	$26,840	
1	2005	Precommercial Thin	738 acres	$130/acre	
1	2005	Reforestation Fuels Treatment	4,500 acres	$30/acre	
1	2005	Reforestation Site Preparation	2,180 acres	$140/acre	
1	2005	Reforestation Planting	4,928 acres	$350/acre	
1	2005	Aspen Enhancement	230 acres	$150/acre	
2	2006	Reforestation Fuels Treatment	4,351 acres	$30/acre	
2	2006	Prescribed Fire	3,572 acres	$100/acre	
2	2006	Reforestation Planting	4,950 acres	$350/acre	
2	2006	Aspen Enhancement	230 acres	$150/acre	
2	2006	Precommercial Thin	738 acres	$130/acre	
3	2007	Aspen Enhancement	230 acres	$150/acre	
3	2007	Reforestation Fuels Treatment	1,499 acres	$30/acre	
3	2007	Reforestation Planting	5,000 acres	$350/acre	
4	2008	Reforestation Fuels Treatment	1,000 acres	$30/acre	
4	2008	Reforestation Planting	4,850 acres	$350/acre	
5	2009	Reforestation Site Preparation	400 acres	$140/acre	
5	2009	Road Closures	10.4 miles	$375/mile	
5	2009	Road Decommissioning	71.6 miles	$695/mile	
5	2009	Reforestation Planting	5,000 acres	$350/acre	
14	2018	Timber Stand Improvement (A+E)	12,620 acres	$50/acre	
14	2018	Timber Stand Improvement (C)	1,638 acres	$500/acre	
14	2018	Timber Stand Improvement (D)	3,290 acres	$600/acre	
14	2018	Timber Stand Improvement (D1)	3,180 acres	$100/acre	
18	2022	Prescribed Fire	20,728 acres	$100/acre	
31	2035	Prescribed Fire	20,728 acres	$100/acre	
46	2050	Prescribed Fire	20,728 acres	$100/acre	

Table 3.174 Management Scenario - Alternative G (continued)

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
59	2063	Resource Support (NEPA)	135,000 mbf	$15/mbf	
60	2064	Sale Preparation	135,000 mbf	$15/mbf	
61	2065	Commercial Thin 20,728 ac @ 6.5mbf/ac 13" avg dbh	135,000 mbf		$85/mbf
61	2065	Sale Administration	135,000 mbf	$10/mbf	
66	2070	Prescribed Fire	20,728 acres	$100/acre	
81	2085	Prescribed Fire	20,728 acres	$100/acre	
99	2103	Resource Support (NEPA)	182,000 mbf	$15/mbf	
100	2104	Sale Preparation	182,000 mbf	$15/mbf	
101	2105	Individual Tree Selection Cut 20,906 ac @ 8.8 mbf/ac 20" avg dbh	182,000 mbf		$366/mbf
101	2105	Sale Administration	182,000 mbf	$10/mbf	

Alternative H

This alternative would implements the "other" activities as shown in the following table. In addition, 73.3 mmbf would be harvested under this project. Because of the initial treatments, the timing of post-harvest treatments (site preparation, fuels treatment and planting) would be spread over six years. For example, acres that had been harvested prior to the fire could be site prepped immediately while other acres could not be prepped until harvest is complete. In addition, potential future management, beyond the management activities covered by this DEIS, would vary by the way in which units would be treated now. The short- and long-term management scenario is presented in the following table:

Table 3.175 Management Scenario - Alternative H

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
0	2004	Precommercial Thin	738 acres	$130/acre	
0	2004	Riparian Planting	1 lump sum	$158,400	
0	2004	Road Reconstruction	1 lump sum	$108,400	
0	2004	Road 2917413 Improvement	1 lump sum	$1,821	
0	2004	Reforestation Site Preparation	1,000 acres	$140/ac	
0	2004	Timber Sales (Salvage)	31,900 mbf		$85.81/mbf

Table 3.175 Management Scenario - Alternative H (continued)

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
1	2005	Timber Sales (Salvage)	31,900 mbf		$85.81/mbf
1	2005	Aquatic Habitat Restoration	1 lump sum	$26,840	
1	2005	Fuel Treatment Within Units	9,070 acres	$168/acre	
1	2005	Precommercial Thin	738 acres	$130/acre	
1	2005	Reforestation Fuels Treatment	4,000 acres	$30/acre	
1	2005	Reforestation Site Preparation	2,295 acres	$140/acre	
1	2005	Reforestation Planting	4,950 acres	$350/acre	
1	2005	Aspen Enhancement	230 acres	$150/acre	
2	2006	Reforestation Fuels Treatment	3,535 acres	$30/acre	
2	2006	Prescribed Fire	2,450 acres	$100/acre	
2	2006	Reforestation Site Preparation	1,000 acres	$140/acre	
2	2006	Reforestation Planting	4,903 acres	$350/acre	
2	2006	Aspen Enhancement	230 acres	$150/acre	
2	2006	Precommercial Thin	738 acres	$130/acre	
3	2007	Aspen Enhancement	230 acres	$150/acre	
3	2007	Reforestation Planting	5,000 acres	$350/acre	
4	2008	Reforestation Site Preparation	400 acres	$140/acre	
4	2008	Reforestation Planting	5,168 acres	$350/acre	
5	2009	Road Decommissioning	71.6 miles	$695/mile	
5	2009	Road Closures	72.9 miles	$375/mile	
5	2009	Reforestation Planting	4,700 acres	$350/acre	
14	2018	Timber Stand Improvement (A+E)	8,805 acres	$50/acre	
14	2018	Timber Stand Improvement (C)	1,950 acres	$500/acre	
14	2018	Timber Stand Improvement (D)	5,671 acres	$600/acre	
14	2018	Timber Stand Improvement (D1)	4,295 acres	$100/acre	
18	2022	Prescribed Fire	20,721 acres	$100/acre	
31	2035	Prescribed Fire	20,721 acres	$100/acre	
46	2050	Prescribed Fire	20,721 acres	$100/acre	
59	2063	Resource Support (NEPA)	135,000 mbf	$15/mbf	

Table 3.175 Management Scenario - Alternative H (continued)

MODEL YEAR	YEAR	ACTIVITY	QUANTITY	UNIT COST	UNIT RETURN
60	2064	Sale Preparation	135,000 mbf	$15/mbf	
61	2065	Commercial Thin 20,721 ac @ 6.5mbf/ac 13" avg dbh	135,000 mbf		$85/mbf
61	2065	Sale Administration	135,000 mbf	$10/mbf	
66	2070	Prescribed Fire	20,721 acres	$100/acre	
81	2085	Prescribed Fire	20,721 acres	$100/acre	
99	2103	Resource Support (NEPA)	182,000 mbf	$15/mbf	
100	2104	Sale Preparation	182,000 mbf	$15/mbf	
101	2105	Individual Tree Selection Cut 20,906 ac @ 8.8 mbf/ac 20" avg dbh	182,000 mbf		$366/mbf
101	2105	Sale Administration	182,000 mbf	$10/mbf	

Costs and returns are in 2003 dollars.

Discount Rates

Discount rates account for the time value of money. Costs and returns now have larger impacts on our lives that costs and returns far in the future. The discount rate adjusts future costs and returns, so that they have appropriately less value than present costs and returns. The basic discount rate used by the Forest Service to evaluate long-term investments and operations in land and resource management is a real rate of 4 percent, which does not include an inflation factor. Since 1969, the basic rate for all federal agencies not covered by specific legislative requirements or guidelines has been 10 percent. This rate is used to test the sensitivity of analyses to changes in discount rates. This analysis will use discount rates of 4 and 10 percent.

Comparison of Alternatives

The table below displays the key economic parameters for each alternative. The economics associated with the activities addressed in the DEIS are separated from the economics of future management, so that the relative efficiency of the different short-term management alternatives can be compared to the potential long-term effects of implementing each alternative.

Present Net Value (PNV) is the factor that summarizes the economic efficiency of each alternative. Given a discount rate greater than zero, PNV is maximized when returns are achieved early in the time period and costs are delayed as long as possible. Here, the salvage of fire-damaged timber is the only significant source of returns early in the time frame. Restoration efforts, such as habitat improvements and planting trees, are quite costly and would best be delayed for as long as possible, from a purely economic efficiency standpoint. Alternative A (No Action) would eliminate the costs, but also eliminates the potential returns. Alternative E would eliminate many of the short-term costs while capturing as much timber value as possible.

The discounted "future management" PNV for each alternative is very low simply because there are no up-front returns to offset the up-front costs of managing the forest.

All of the calculated PNVs are displayed in the following table. The sections after the following table discuss the implications.

Table 3.176 Economic Comparison of Alternatives - Millions of Dollars

	Discount Rate = 4%			Discount Rate = 10%		
Alternatives	**PV Returns**	**PV Costs**	**PNV**	**PV Returns**	**PV Costs**	**PNV**
A- No Action	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A- Planting	0.69	19.60	-18.91	0.01	6.21	-6.20
A-No Planting	0.00	0.29	-0.29	0.00	0.00	0.00
C-Current	5.91	11.86	-5.95	5.75	10.99	-5.24
C-Future	2.34	5.87	-3.53	0.04	1.96	-1.92
C-Total	**8.25**	**17.73**	**-9.48**	**5.79**	**12.95**	**-7.16**
D-Current	3.01	11.50	-8.49	2.93	10.61	-7.68
D-Future	2.32	5.57	-3.25	0.04	1.82	-1.78
D-Total	**5.33**	**17.07**	**-11.73**	**2.97**	**12.43**	**-9.47**
E-Current	6.22	10.22	-4.00	6.05	9.40	-3.35
E-Future	2.32	6.67	-4.35	0.04	2.35	-2.31
E-Total	**8.54**	**16.90**	**-8.35**	**6.09**	**11.76**	**-5.67**
G-Current	6.13	12.93	-6.80	5.97	12.07	-6.10
G-Future	2.32	5.24	-2.93	0.04	1.67	-1.63
G-Total	**8.45**	**18.18**	**-9.73**	**6.01**	**13.74**	**-7.73**
H-Current	5.37	11.39	-6.02	5.22	10.54	-5.31
H-Future	2.32	6.15	-3.83	0.04	2.10	-2.06
H-Total	**7.6**	**17.53**	**-9.85**	**5.26**	**12.64**	**-7.37**

Current Project Only

The PNV of each alternative when considering only the activities being considered in this project are displayed below by alternative.

Table 3.177 PNV Current Projects Only – 4 Percent

ALTERNATIVE	PNV AT 4% DISCOUNT
A	$0.00 million
C	-$6.53 million
D	-$9.13 million
E	-$4.54 million
G	-$7.37 million
H	-$6.59 million

The preceding table shows that the PNV is negative for all action alternatives. This is a result of significant costs associated with reforestation, timber stand improvements, fuels treatments, road reconstruction and decommissioning, and habitat improvements. These costs simply exceed the net return expected from the salvage sales. Alternative E performs the best because it was designed to maximize the net returns from timber management while reducing some of the other costs. Alternative D performs poorly because it would harvest the smallest amount of timber, and would generate the lowest returns while still including most of the activities included in the other alternatives.

Table 3.178 PNV Current Projects Only – 10 Percent

ALTERNATIVE	PNV AT 10% DISCOUNT
A	$0.00 million
C	-$5.24 million
D	-$7.68 million
E	-$3.35 million
G	-$6.10 million
H	-$5.31 million

The above table shows the same type of PNV calculation except that a 10 percent discount rate is used. The fact that Alternative E still performs best of the action alternatives and Alternative D still performs poorly reveals that the results of the analysis are not sensitive to the discount rate.

Future Management Analysis

Concerns about economic returns to society from future management of this area cannot be addressed in the analysis discussed above. In addition to the information about the current project, some assumptions about future management are necessary. Due to the time frame involved (100+ years), the assumptions must be considered speculative. It is simply impossible to be certain that future actions will actually occur that far into the future. This speculation is, nonetheless, required if we are to consider the consequences of present actions on long-term management of the area. The no action alternative is a bit different. It is reasonably foreseeable, given direction in the National Forest Management Act, that some reforestation effort would take place in a future project even if the no action alternative were selected at the conclusion of this analysis.

The table below includes activities that define the anticipated future management of the area.

Table 3.179 PNV Long Term Management – 4 Percent

ALTERNATIVE	PNV AT 4% DISCOUNT
A	$-18.91 million
C	-$9.48 million
D	-$11.73 million
E	-$8.35 million
G	-$9.73 million
H	-$9.85 million

Again, Alternative E performs best. When long-term management is considered, the modified no action alternative becomes the least efficient alternative. This is a result of no up-front returns from salvage followed by a series of costly

management activities that only culminate in a commercial thinning 81 years in the future. While Alternative D performs better than Alternative A, it still does poorly, as the result of relatively low returns early in the time frame.

Conclusions for Economic Efficiency

Alternative E is the most economically efficient of the action alternatives because the harvest units were selected to maximize net returns from the initial salvage harvest, and some other activities (timber stand improvements, restoration activities, etc.) were dropped. While the No Action alternative does the best when only the activities of this DEIS are considered, it does very poorly when future management of the land is considered. The other action alternatives vary in their economic efficiency, primarily by the size of the salvage harvest. Alternative G, with the nearly same sale salvage volume as Alternative C, is a bit less efficient because it includes additional fuels treatments adjacent to private lands.

The contributions that various activities make to the PNV are displayed in the following table.

Table 3.180 Components of Long-Term Present Net Value – 4 Percent Discount Rate

Component	PNV Contribution By Alternative - Millions of Dollars					
	Alt. A	Alt. C	Alt. D	Alt. E	Alt. G	Alt. H
Fuels Treatments	$0.00	-$1.72	-$0.95	-$1.13	-$3.03	-$1.52
Prescribed Fire	-$0.12	-$2.67	-$2.55	-$2.31	-$2.65	-$2.55
Reforestation	-$19.06	-$9.05	-$9.61	-$8.93	-$8.84	-$8.89
Restoration	$0.00	-$0.29	-$0.28	-$0.03	-$0.28	-$0.28
Roads						
Closure	-$0.00	-$0.03	-$0.03	-$0.02	-$0.01	-$0.02
Decommission	-$0.00	-$0.04	-$0.04	-$0.01	-$0.04	-$0.04
Reconstruction	-$0.00	-$0.11	-$0.06	-$0.11	-$0.11	-$0.11
Drainage Repair	-$0.00	-$0.00	-$0.00	$0.00	-$0.00	-$0.00
TOTAL ROADS	**$0.00**	**-$0.18**	**-$0.13**	**-$0.14**	**-$0.16**	**-$0.17**
Timber Sales						
Resource Support	-$0.14	-$0.27	-$0.27	-$0.27	-$0.27	-$0.27
Sale Preparation	-$0.13	-$0.26	-$0.26	-$0.26	-$0.26	-$0.26
Sale Administration	-$0.08	-$0.16	-$0.16	-$0.16	-$0.16	-$0.16
Sale of Timber	+$0.69	+$8.25	+$5.34	+$8.55	+$8.45	+$7.69
TOTAL SALES	**+$0.34**	**+$7.56**	**+$4.65**	**+$7.86**	**+$7.76**	**+$7.00**
Timber Stand Improvement	-$0.07	-$3.13	-$2.86	-$3.67	-$2.53	-$3.44
TOTAL PNV	**-$18.91**	**-$9.48**	**-$11.73**	**-$8.35**	**-$9.73**	**$-9.85**

The preceding table clearly shows that activities associated with timber sales result in a positive PNV while all of the other activities have only a cost component. These costs result in the overall PNV being negative under all alternatives. The largest cost is for reforestation under all of the alternatives. This is common with large fires where natural regeneration will not result in timely reforestation. If natural regeneration could eliminate the need for reforestation, only Alternatives A and E would have a positive PNV. Timber stand improvement activities that enhance timber values in the future are necessary to achieve the sale values shown in the table. Other than prescribed fire, the remaining activities have relatively low costs.

Economic Impact

Timber Sale Impacts

Background for the process used here is included in Appendix A of the Economic Impact Assessment in the project record. The calculations are displayed in Appendix B of the Economic Impact Assessment. The estimated direct and total jobs supported by the various alternatives are as follows:

Table 3.181 Economic Impact of Timber Sale Activities

ALTERNATIVE	DIRECT JOBS	TOTAL JOBS
A – No Action	0	0
C	550	825
D	253	379
E	495	744
G	549	824
H	479	718

Direct jobs are those that are directly related to the activity in question. For timber harvest, this involves the jobs associated with logging and milling.

The calculation of direct jobs is based on statewide estimates of log consumption by industry and employment for 1998. The calculations are displayed in Appendix B of the Economic Impact Assessment.

Total jobs are the sum of direct, indirect, and induced jobs. Indirect jobs are jobs that are closely related to the item that generates the direct impact, but do not deal with initial processing. This may, for example, include lumber haul (which deals with lumber rather than logs), purchases made by the mill to keep it operating, and so on. Induced jobs are those that are one step farther removed. These impacts are associated with expenditures made by the people that benefit from the direct and indirect activities. These would include services (grocery stores, gas stations, telephone, electricity, etc.), retail and wholesale trade, and anything manufactured or processed that these people might buy.

The number of total jobs is determined by expanding the number of direct jobs by a multiplier. Multipliers can be determined in economic base studies and are generally quite similar in certain kinds of economies. The multiplier of 1.5, used here, is typical of rural Oregon communities. Higher multipliers are indicative of more broad-based economies where more of the indirect and induced jobs occur within the local area. In the case of rural areas like Lake County, many indirect and induced purchases, such as parts for equipment, come from outside the area, so their manufacture generates jobs elsewhere.

The estimates of jobs supported by the various alternatives, as noted above, reflect jobs across the state of Oregon and not just the local area. The direct jobs that might actually get filled by local workers is limited by the available local workforce rather than by the activity generated by these potential timber sales. In 2001, Lake County was home to eight logging firms with a total of fewer than 30 employees (Williams, Personal Communication, 2003). The sawmill in Lake County is limited to purchasing timber from within the Federal Sustained Yield Unit and is not eligible to process the timber from the Toolbox project area. That mill is likely to have some timber harvest activities underway at the same time as the activities in the Toolbox area, so many of the local workers would already be employed. In April of 2003, for example, there were a total of seven fallers and five logging tractor operators looking for work in the entire area encompassing Fort Rock, Christmas Valley, Silver Lake, Summer Lake, Paisley, Lakeview, Bly, and LaPine. In 13 other logging occupations, there were no individuals looking for work in this area (Williams, Personal Communication, 2003). Thus, it is reasonable to conclude that none of the sawmill workers will come from Lake County and the immediate area around Silver Lake. Further, it is reasonable to conclude that all local individuals that are qualified in logging occupations and able to work will be working during the period these potential sales would be active.

Since there are not enough local workers to perform the direct work associated with harvesting and hauling the timber, purchasers will need to bring workers into the area from other communities. Most log truck drivers are likely to come from

locations near the mill where the logs are processed. Thus, they can be expected to live outside the Silver Lake area during timber sale activities. Woods workers, on the other hand, are likely to want to stay near the operations. In some cases these workers may bring their families with them during the period in which timber is being harvested. This will benefit the local economy through local sales of products and services. Restaurants, motels, recreational vehicle parks and other accommodations, grocery stores, gas stations, and related firms in the area are likely to see a significant rise in business and will probably hire more, relatively low-paid workers to serve this business.

According to Steve Williams, Regional Economist, Workforce and Economic Research, Oregon Employment Department:

> "The local economy of Lake County could use a boost. News from the area has not been great lately with the Warner Creek Correctional Facility being put on the waiting list, and potential projects such as the enlarging of the Safeway in Lakeview also on hold. The most current data available shows that the county is performing somewhat better than a year ago, with 60 additional jobs in February 2003 compared to February 2002. These jobs are primarily in services and trade, transportation, and utilities. The unemployment rate is still very high at 14 percent in February, and was 9.3 percent on average for all of 2002. The county saw no net job growth in 2002, as its population dropped by 50 people or 0.7 percent." (Williams, Personal Communication, 2003).

The economic impact of these potential timber sales will benefit local woods workers as well as local retail and service businesses. That impact will, however, be limited to the period during which logging operations are active. That period is expected to be one year, although some work may go on for up to two years. There are no reasonably foreseeable activities that would continue a significant economic stimulus beyond this period, although some stimulus would be expected from the other activities listed below. The duration of these economic stimuli is not sufficient to induce local businesses to expand their facilities or commit to long-term employment. Thus, the impacts of these potential timber sales will be important in the short term, but not of great importance to the long-term economic stability of the area.

Local Impacts of Logging and Other Activities

There are a number of activities that will be undertaken in this project beyond the timber harvest activities. Typically, contractors will be hired to perform this work. These activities, along with their estimated costs are displayed in the following table. These cost estimates include the cost of Forest Service contract administration and monitoring, as well as contract costs. The same costs are reflected in the economic efficiency analysis presented in Table 3.165. Details about these projects are provided in various specialist reports in the project record.

Table 3.182 Economic Impact of Other Activities

Activity	Years of Activity	Estimated Total Cost By Alternative					
		Alt. A	Alt. C	Alt. D	Alt. E	Alt. G	Alt. H
Aquatic Habitat Restoration	2	-	$26,840	$26,840	$26,840	$26,840	$26,840
Road Reconstruction	1	-	$108,400	$60,100	$108,400	$108,400	$108,400
Pre-Commercial Thinning	1-2	-	$287,820	$287,820	-	$287,820	$287,820
Fuels Treatment	1-2		$1,721,000	$954,000	$1,129,000	$3,027,000	$1,524,000
Reforestation	1-6	-	$8,318,000	$8,891,000	$8,183,000	$8,096,000	$8,136,000
Prescribed Fire	3		$357,000	$245,000	-	$357,000	$245,000

Table 3.182 Economic Impact of Other Activities (continued)

Activity	Years of Activity	Estimated Total Cost By Alternative					
		Alt. A	Alt. C	Alt. D	Alt. E	Alt. G	Alt. H
Riparian Planting	1	-	$158,400	$158,400	-	$158,400	$158,400
Aspen Enhancement	2 - 4	-	$103,500	$103,500	-	$103,500	$103,500
Road Decommissioning	6	-	$48,000	$50,000	$10,000	$50,000	$50,000
Road Closure	6	-	$27,000	$28,000	$25,000	$4,000	$27,000
Road 2917413 Improvement	1	-	$1,821	$1,821	-	$1,821	$1,821
TOTAL			**$11,158,000**	**$10,806,000**	**$9,842,000**	**$12,221,000**	**$10,669,000**
TOTAL Forestry			**$10,973,000**	**$10,666,000**	**$9,699,000**	**$12,057,000**	**$10,482,000**
TOTAL Road Work			**$185,000**	**$140,000**	**$143,000**	**$164,000**	**$187,000**

The Forest Service recently developed models for several National Forests that estimate the number of jobs associated with this kind of work. Additional details are included in the Economic Impact Assessment in the project record. These analyses also developed response coefficients for the portion of the timber harvest associated with logging camps and contractors. These reflect the jobs and associated workers that are more likely to be working in the immediate vicinity of the project and are a subset of the total jobs discussed above. These coefficients include indirect and induced jobs, some of which will be located outside of the local area. Totals are displayed in the following table:

Table 3.183 Total Jobs by Localized Sector

Sector	Alt. A	Alt. C	Alt. D	Alt. E	Alt. G	Alt. H
Forestry Services	0	675	656	596	742	645
Road Construction	0	3	2	3	3	3
Logging Camps	0	288	132	260	288	251
Total	**0**	**966**	**790**	**859**	**1,033**	**899**

It is important to understand that not all of these jobs occur continuously throughout the duration of the activities. They are associated with the expenditures that flow from or into the activities. For example, the $8,318,000 spent on reforestation in Alternative C would be spent over a period of six years, so about one sixth of the total jobs would be in place in a given year.

Environmental Consequences for Economic Impact

Direct, Indirect, and Cumulative Effects

Alternative A – No Action

The no action alternative continues the economic situation as it has been for the last few years. The most recent employment information for Lake County (Oregon Employment Department, 2003) indicates that of the 3,342 people in the labor force, 451 or 13.5 percent are unemployed. Of the 2,891 employed people, 771 (27 percent) are in farming, 1,250 (43 percent) are in other private enterprises and 870 (30 percent) are in government jobs. Employment in March 2003 (2,891) showed some increase over employment a year ago (2,799). Some of this improvement is associated with logging,

reforestation, and related activities on private lands in the vicinity of the Toolbox and Winter Fires, and can be expected to diminish over time.

Alternative C

Alternative C has the largest timber salvage program and would produce the most jobs in that industry. A total of 835 jobs would occur as a result of salvage. This figure represents total direct, indirect, and induced employment across the state, not just in the local area. An estimated 288 jobs would occur in the local area as a result of salvage harvest, but even more jobs (678) would be involved with related activities. Most of the jobs would be associated with planting and would occur over a five to six year period during and after harvest activities. If roughly one sixth of the total jobs were in place at one time (161 jobs), and there are very few qualified local people to take these jobs, we would expect to see Lake County employment rise to 3,052 and the labor force rise to 3,503. Thus, the number of unemployed would stay about the same, but the unemployment rate would drop to about 13 percent. It may drop further, since some of the currently unemployed people are likely to find jobs, mostly in retail services.

Alternative D

Alternative D has the smallest timber salvage program and would produce the fewest jobs in that industry. A total of 379 jobs would occur as a result of salvage. This figure represents total direct, indirect, and induced employment across the state, not just in the local area. An estimated 132 jobs would occur in the local area as a result of salvage harvest, but even more jobs (658) would be involved with related activities. Most of the jobs would be associated with planting and would occur over a five to six year period during and after harvest activities. If roughly one sixth of the total jobs were in place at one time (132 jobs), and there are very few qualified local people to take these jobs, we would expect to see Lake County employment rise to 3,023 and the labor force rise to 3,474. Thus, the number of unemployed would stay about the same, but the unemployment rate would drop to about 13percent. It may drop further, since some of the currently unemployed people are likely to find jobs, mostly in retail services.

Alternative E

A total of 744 jobs would occur as a result of salvage in Alternative E. This figure represents total direct, indirect, and induced employment across the state, not just in the local area. An estimated 260 jobs would occur in the local area as a result of salvage harvest, but even more jobs (599) would be involved with related activities. Most of the jobs would be associated with planting and would occur over a five to six year period during and after harvest activities. If roughly one sixth of the total jobs were in place at one time (143 jobs), and there are very few qualified local people to take these jobs, we would expect to see Lake County employment rise to 3,034 and the labor force rise to 3,485. Thus, the number of unemployed would stay about the same, but the unemployment rate would drop to about 13 percent. It may drop further since some of the currently unemployed people are likely to find jobs, mostly in retail services.

Alternative G

A total of 824 jobs would occur as a result of salvage in Alternative G. This figure represents total direct, indirect, and induced employment across the state, not just in the local area. An estimated 288 jobs would occur in the local area as a result of salvage harvest, but even more jobs (745) would be involved with related activities. Most of the jobs would be associated with planting and would occur over a five to six year period during and after harvest activities. If roughly one sixth of the total jobs were in place at one time (172 jobs), and there are very few qualified local people to take these jobs, we would expect to see Lake County employment rise to 3,063 and the labor force rise to 3,514. Thus, the number of unemployed would stay about the same, but the unemployment rate would drop to about 13 percent. It may drop further since some of the current unemployed people are likely to find jobs, mostly in retail services.

Alternative H

A total of 718 jobs would occur as a result of salvage in Alternative H. This figure represents total direct, indirect and induced employment across the state, not just in the local area. An estimated 251 jobs would occur in the local area as a result of salvage harvest, but even more jobs (648) would be involved with related activities. Most of the jobs would be associated with planting and would occur over a five to six year period during and after harvest activities. If roughly one sixth of the total jobs were in place at one time (150 jobs), and there are very few qualified local people to take these jobs, we would expect to see Lake County employment rise to 3,041 and the labor force rise to 3,492. Thus, the number of unemployed would stay about the same, but the unemployment rate would drop to about 13 percent. It may drop further since some of the currently unemployed people are likely to find jobs, mostly in retail services.

Conclusions for Economic Impact

All of the action alternatives will contribute to the local economy, but more of the impact is likely to be associated with reforestation and activities other than the 1 to 2 year impact of timber harvest. Accordingly, Alternative G would have the largest impact on the economy because it includes both high timber harvest levels and the largest amount of other activity. It is unique in that it includes more fuels treatment than the other alternatives. Due to the nature of the economy and the source of the workers, there are likely to be more people working, but not a very significant drop in the unemployment rate. Many of the workers will take the bulk of their income out of the county, but, while they are working in Lake County, they will be spending money for food and lodging, to the benefit of local businesses that can supply their needs.

Consistency with Forest Plan

This analysis displays the effects to economic efficiency and impact of a large project. In this regard, all action alternatives are consistent with the Forest Plan in that they lead to economic activity. All economic elements are consistent with current regulation.

SOCIAL RESOURCES AND ENVIRONMENTAL JUSTICE

- Introduction
- Regulatory Framework
- Analysis Method
- Analysis Area
- Key Issue: Changes in Motorized Access
- Existing Condition
- Environmental Justice
- Environmental Consequences
- Direct and Indirect Effects
- Cumulative Effects
- Consistency with Regulatory Framework

Introduction

This analysis will address effects of the Toolbox Fire Recovery Project on social resources and environmental justice. Social impact analysis is, in some ways, similar to economic impact analysis. However, it focuses on social issues beyond the economic effects upon the people, primarily during the period that project activities are underway. The Civil Rights Impact Analysis addresses social impacts in another way. Social impact considerations are some of the many subjective values that are considered in determining which alternative has the best net public benefit.

Some comments received during the scoping period for this EIS raised issues related to social impacts. These comments expressed concerns regarding environmental justice, economic opportunities for small contractors, personal use firewood gathering, and Klamath Tribal access to former reservation lands within the project area.

A separate Civil Rights Impact Assessment has been developed for this project and is available in the Toolbox Fire Recovery Project analysis file at the Silver Lake Ranger District.

Generally, the comments were oriented more toward the potential positive economic effects of the project on small businesses rather than particular social impacts on the people potentially affected by the project. The way in which contracts are developed and made available can affect whether or not smaller businesses can participate. A visitor to an open house in La Pine on May 13, 2003 discussed a proposal under development for contracting reforestation activities. He generally agreed with the idea of larger reforestation contracts that included more contractor responsibility while freeing Forest Service employees to focus on contract administration and inspection.

Regulatory Framework

The National Environmental Policy Act (NEPA) required integrated use of the natural and social sciences in all planning and decision-making that affect the human environment. The human environment includes the natural and physical environment and the relationship to the environment (40 CFR 1508.14). Forest Service land management planning regulations require the integration of social science knowledge into Forest and Regional planning processes (36 CFR 219.5).

Executive Order 12898 (1994), ordered federal agencies to identify and address the issue of environmental justice (i.e. adverse human health and environmental effects of agency programs that disproportionately impact minority and low income populations).

Analysis Method

An economic profile was developed for Lake County using the Economic Profile System (see http://www.sonoran.org/programs/si_se_program_page_3.html). This system compiles county level data from a wide variety of sources including the 2000 Census, County Business Patters, Regional Economic Information System, Bureau of Economic Analysis and others.

Demographic information was compiled from 1980, 1990 and 2000 Census Bureau Information, using the Forest Service's Natural Resources Information System Human Dimensions Module (NRIS-HD) (see: http://www.fs.fed.us/emc/nris/hd/abouthd.html) and the U.S. Census Bureau's County Quickfacts system (see http://quickfacts.census.gov/qfd/states/41/41037.html). Additional information came from the Toolbox Civil Rights Impact Analysis (Pierce, 2003) and other sources as noted below.

Analysis Area

While social impacts may occur over a broad area, they tend to diminish with distance from the activities associated with the project. Thus this analysis will focus upon the small rural communities closest to the project area. These communities are Silver Lake and Paisley, in northern Lake County. Impacts on other communities such as Chemult, Gilchrist, and Chiloquin are expected to be similar in form, but less intense than those seen in Silver Lake and Paisley.

Key Issue: Changes in Motorized Access

Issue Statement: Proposed road management activities (closure and decommissioning) would reduce public access for recreation and personal use fuelwood gathering. The proposed would also reduce opportunities for members of the Klamath Tribes to use motorized vehicles to hunt or gather Treaty Right resources within former Klamath Reservation boundaries, using motorized vehicles.

Measurement Indicators: The following indicators will be evaluated for each of the alternatives:

1. Open Road Density (miles per square mile), including separate reporting for former Klamath Reservation land
2. Miles of Road Left Open, Closed and Decommissioned, including separate reporting for former Klamath Reservation lands

Existing Condition

Detailed information and discussion of population, age structure, educational attainment, gender mix, racial mix, housing, mobility, economic structure, cross-country effects, work, lifestyles, and social institutions are included in the Social Impact Assessment in the Toolbox Fire Recovery Project analysis file at the Silver Lake Ranger District. Overall, the analysis describes a county with a very rural, somewhat isolated and impoverished community with a social structure served by a wide variety of churches and other institutions. Residents live close to their work. Work is primarily in service and support to the base natural resource industries of agriculture and forestry. The population is aging, thus drawing more heavily on income from pensions while having increasing demands on the health care system.

The Forest and its road system is used by the residents in their work, as well as for a variety or recreational and subsistence purposes. Additional details on uses of the Forest can be found in the Social Impact Assessment in the analysis file.

Klamath Tribes

The southern portion of the Silver Lake Ranger District includes portions of former Klamath Tribes reservation lands. Through a Memorandum of Agreement between the U.S. Forest Service and the Klamath Tribes, certain traditional uses of the Fremont National Forest lands are guaranteed. Most of the Klamath Tribe cultural uses, such as camping, hunting, fishing, berry picking, plant gathering, and firewood cutting follow use patterns similar to uses for the general public (USDA, Forest Service and USDI, Bureau of Land Management, 1997). There are, however, differences in purpose, as related to the culture of the Klamath Tribes. The Klamath Tribes use the existing National Forest System (NFS) roads to access those portions of the former reservation for those traditional cultural and subsistence uses.

Access

The issue of access on National Forest System roads was raised during public scoping. Fremont National Forest Land and Resource Management Plan (LRMP) Standards and Guidelines state, "Road density will be the most economical system necessary to meet the land management objectives. Overall density for the roaded area of the Forest will not exceed 2.5 miles per square mile" (LRMP, 1989). There are currently 271 miles of classified roads within the project area. Of these 271 miles, 12.4 are within the former reservation lands on the project area. A roads analysis was completed for all roads in the project area, and, following direction in the LRMP, road management objectives were designed for each alternative, as shown below under Environmental Consequences.

Environmental Justice

Environmental justice is defined as the pursuit of equal justice and equal protection under the law for all environmental statutes and regulations, without discrimination based on race, ethnicity, or socioeconomic status. The minority and low-income groups living in Lake County work in diverse occupations. Some minorities, low-income residents, and Native Americans may rely on forest products or related forest activities for their livelihood. These individuals most likely reside in the rural communities adjacent to NFS lands.

Environmental Consequences

Direct and Indirect Effects

Within the social context presented above, the action alternatives developed for this project inject a perturbation in the social fabric by bringing in workers from outside the area to perform the logging, reforestation, and related activities. As discussed in the Economics section in Chapter three of this DEIS, there are few Lake County residents available to take on this type of work. That economic assessment reveals that the various action alternatives would bring in about 130 to 170 workers at one time, assuming activities are dispersed over a six-year timeframe. Some of these workers would be involved in logging operations, but even more would be involved in other activities, primarily reforestation.

The activities involved have been a basis for economic activity in the area for many years, so the types of workers and the jobs they do would not be surprising to the community. The community is also set up to service these types of activities, although the action alternatives inject more workers into the area than have been seen in the recent past.

While the outside workforce is likely to be more racially diverse than the local resident population, the residents have worked effectively with and supported workforces like this in the past and can be expected to do so in the future. The primary services needed by the workers would be food and shelter. Local businesses that can supply lodging, space for recreational vehicles, food (grocery stores and restaurants) and other services would capture most of the money spent by the workers in the area. Businesses would likely need to increase their employment, either by adding employees or giving present employees more hours. This should result in increased local household incomes during project activities. Since these businesses have supported similar, although not quite as large, workforces in the past, it is not likely that much capital expansion would be needed.

Since reforestation activities are expected to span a period of six years, it is reasonable to expect some of the workers to move to the area with their families for most of that period. Given the wide variety of churches in the area, these families can be easily brought into the social fabric of the community if the churches seek them out or the families choose to participate.

Local residents use forest roads to access the project area for a variety of purposes. In general these residents would prefer to have all roads open for their use. All alternatives were developed following an interdisciplinary Roads Analysis process that evaluated opportunities, determined priorities, and made recommendations for road management actions, including closure or decommissioning, for the purpose of promoting watershed recovery, reducing impacts on wildlife habitat, or protecting cultural resource sites. In response to input from Klamath Tribe representatives, the alternatives respond, to varying degrees, to retention of access on former Klamath Indian Reservation lands. The alternatives vary in the sum of road closures and decommissionings ranging from 82 miles in Alternatives E and G to 147 miles in Alternative D. Opponents to road closures often take the position that no closure is a good closure. These individuals will oppose road closures in all of the alternatives. Other local individuals are likely to take a more pragmatic view although they may oppose certain road closures.

Effects for Alternative A

For Alternative A, the no action alternative, there would be no change to motorized access. A total of 271 miles of road would remain open, including all roads (12.4 miles) within the former reservation lands. This alternative would have no impact on forest subsistence and recreation uses, but would continue the economic situation as it has been for the last few years (see the Economics section of this DEIS).

Effects Common to All Action Alternatives

Some minorities, low-income residents, and Native Americans may be impacted by the alternatives restricting timber or range management options if the groups are economically tied to one of those industries. However, these effects would be localized, are not measurable, and would not be disproportionate to low income or minority groups. It is difficult to assess the degree of impact each action alternative presents to these groups due to other variables that allow for a variety of income options. In addition, individuals or groups dependent on income related to NFS lands are considered during site-specific, project level decisions that assess the continual effect to the human environment. For these reasons, the best available information suggests that when assessing the effects of each action alternative on minority and low-income groups, the effects are minimal and not disproportionate to these groups when compared to other groups. Additional details on environmental justice and civil rights impacts can be found in the Toolbox Fire Recovery Project Civil Rights Impact Analysis in the project record.

Effects for Alternative C

Alternative C would decommission 69 miles of road, close 72.9 miles, and leave 129.1 miles open. The long-term impact of this alternative, with regard to the key issue of changes in motorized access, would be the elimination of 141.0 miles of existing road currently open for recreational and subsistence use. Since fewer roads would be open, vehicle access year-around would decrease for uses such as hunting and firewood cutting. Road closure and decommissioning would decrease opportunities for road hunting. The fires of 2002 increased the total amount of dead timber available for firewood cutting, so decreased access would have no effect on the ability of permit holders to harvest firewood (Pierce, 2003). Road closure and decommissioning would increase “roadless” recreational opportunities (Hills, 2003). Alternative C would retain all access within the former reservation lands. Firewood cutting by Tribal members rarely occurs in the project area because of the distance from their homes. Former Tribal lands west of the project area on the Chiloquin Ranger District are considerably closer to most members’ residences.

Although the fires of 2002 may increase potential for mushroom growth in other areas of the Fremont-Winema National Forests, specialists do not foresee an increase on the Silver Lake District. Historically, mushroom populations have not increased in burned areas on the Silver Lake District (personal communication, J.Wilson, Silver Lake District Botanist, 03/2003). Therefore, Alternative C would have little or no impact on mushroom gathering opportunities within the project area.

Effects for Alternative D

Alternative D would decommission 71.6 miles of road, close 75.5 miles, and leave 123.9 miles open. The long-term impact of this alternative, with regard to the key issue of changes in motorized access, would be the elimination of 147.1 miles of existing road currently open for recreational and subsistence use. Since fewer roads would be open, vehicle access year-around would decrease for uses such as hunting and firewood cutting. Road closure and decommissioning would decrease opportunities for road hunting. The fires of 2002 increased the total amount of dead timber available for firewood cutting, so decreased access would have no effect on the ability of permit holders to harvest firewood (Pierce, 2003). Road closure and decommissioning would increase “roadless” recreational opportunities (Hills, 2003). For this alternative, which responds to watershed restoration, wildlife habitat, and cultural resource objectives, the criteria used in developing road management proposals did not include retention of access within former reservation lands. Alterative D would close 2.33 miles of road, decommission 2.65, and leave 7.42 miles open. Firewood cutting by Tribal members rarely occurs in the project area because of the distance from their homes. Former Tribal lands west of the project area on the Chiloquin Ranger District are considerably closer to most members’ residences.

Although the fires of 2002 may increase potential for mushroom growth in other areas of the Fremont-Winema National Forests, specialists do not foresee an increase on the Silver Lake District. Historically, mushroom populations have not increased in burned areas on the Silver Lake District (personal communication, J.Wilson, Silver Lake District Botanist, 03/2003). Therefore, Alternative D would have little or no impact on mushroom gathering opportunities within the project area.

Effects for Alternative E

In Alternative E, only those roads recommended for decommissioning during the roads analysis process would be decommissioned. Other roads that have a less pressing need for treatment and were recommended for simple closure would remain open. This alternative would decommission 14.6 miles of road, close 67.4 miles, and leave 188.9 miles open. The long-term impact of this alternative, with regard to the key issue of changes in motorized access, would be the elimination of 82 miles of existing road currently open for recreational and subsistence use. Since fewer roads would be open, vehicle access year-around would decrease for uses such as hunting and firewood cutting. Road closure and decommissioning would decrease opportunities for road hunting. The fires of 2002 increased the total amount of dead timber available for firewood cutting, so decreased access would have no effect on the ability of permit holders to harvest firewood (Pierce, 2003). Road closure and decommissioning would increase "roadless" recreational opportunities (Hills, 2003). Within former reservation lands, 2.65 miles would be decommissioned and 9.75 miles would remain open. Firewood cutting by Tribal members rarely occurs in the project area because of the distance from their homes. Former Tribal lands west of the project area on the Chiloquin Ranger District are considerably closer to most members' residences.

Although the fires of 2002 may increase potential for mushroom growth in other areas of the Fremont-Winema National Forests, specialists do not foresee an increase on the Silver Lake District. Historically, mushroom populations have not increased in burned areas on the Silver Lake District (personal communication, J.Wilson, Silver Lake District Botanist, 03/2003). Therefore, Alternative E would have little or no impact on mushroom gathering opportunities within the project area.

Effects for Alternative G

In Alternative G, only those roads recommended for decommissioning during the roads analysis process would be decommissioned. Other roads that have a less pressing need for treatment and were recommended for simple closure would remain open. This alternative would decommission 71.6 miles or road, close 10.4 miles, and leave 188.9 miles open. The long-term impact of this alternative, with regard to the key issue of changes in motorized access, would be the elimination of 82 miles of existing road currently open for recreational and subsistence use. Since fewer roads would be open, vehicle access year-around would decrease for uses such as hunting and firewood cutting. Road closure and decommissioning would decrease opportunities for road hunting. The fires of 2002 increased the total amount of dead timber available for firewood cutting, so decreased access would have no effect on the ability of permit holders to harvest firewood (Pierce, 2003). Road closure and decommissioning would increase "roadless" recreational opportunities (Hills, 2003). Within former reservation lands, 2.65 miles would be decommissioned and 9.75 miles would remain open. . Firewood cutting by Tribal members rarely occurs in the project area because of the distance from their homes. Former Tribal lands west of the project area on the Chiloquin Ranger District are considerably closer to most members' residences.

Although the fires of 2002 may increase potential for mushroom growth in other areas of the Fremont-Winema National Forests, specialists do not foresee an increase on the Silver Lake District. Historically, mushroom populations have not increased in burned areas on the Silver Lake District (personal communication, J.Wilson, Silver Lake District Botanist, 03/2003). Therefore, Alternative G would have little or no impact on mushroom gathering opportunities within the project area.

Effects for Alternative H

Alternative H would decommission 71.6 miles of road, close 72.9 miles, and leave 126.5 miles open. The long-term impact of this alternative, with regard to the key issue of changes in motorized access, would be the elimination of 144.5 miles of existing road currently open for recreational and subsistence use. Since fewer roads would be open, vehicle access year-around would decrease for uses such as hunting and firewood cutting. Road closure and decommissioning would decrease opportunities for road hunting. The fires of 2002 increased the total amount of dead timber available for firewood cutting, so decreased access would have no effect on the ability of permit holders to harvest firewood (Pierce, 2003). Road closure and decommissioning would increase "roadless" recreational opportunities (Hills, 2003). Within former reservation lands, 2.65 miles would be decommissioned and 9.75 miles would remain open. Firewood cutting by Tribal members rarely occurs in the project area because of the distance from their homes. Former Tribal lands west of the project area on the Chiloquin Ranger District are considerably closer to most members' residences.

Although the fires of 2002 may increase potential for mushroom growth in other areas of the Fremont-Winema National Forests, specialists do not foresee an increase on the Silver Lake District. Historically, mushroom populations have not increased in burned areas on the Silver Lake District (personal communication, J.Wilson, Silver Lake District Botanist,

03/2003). Therefore, Alternative H would have little or no impact on mushroom gathering opportunities within the project area.

Cumulative Effects

Alternative A

The no-action alternative would not change the current conditions in this area from those described above. However, selection of that alternative is likely to increase the feelings of hopelessness and lack of control typically encountered in a contracting economy.

Alternatives C, D, E, G, and H

The action alternatives would vary only slightly in their social effects because they all propose the same types of activities and the community has supported these activities and their workforces in the past. Only the scale of the activities affects the social impacts. Given that the differences are marginal, Alternative G would have the largest social impact because it would bring the largest workforce into the area. Alternative E would have the smallest because it would bring in the smallest workforce.

The communities have already felt some impacts as private landowners have harvested damaged timber from their lands and begun reforestation activities. The activities on the Winter Salvage project are likely to begin before those on Toolbox. Thus, some of the cumulative impact would be spread over time and not be as extreme as it otherwise might be. The Winter Salvage impacts are relatively small in comparison to the Toolbox impacts, since the Winter project involves a small area and relatively little timber harvest.

Under any of the action alternatives, the communities around the project would generally see more people in stores and gas stations, more rooms filled in local motels and more spaces filled in local RV parks for the duration of the project activities. In addition, some families would move into the area and need mobile home space or some other relatively low-cost housing. There would be increased opportunity for local residents to supply these needs and improve their economic conditions.

Consistency with Regulatory Framework

The proposed activities would be consistent with the regulatory framework described earlier in this section.

TREATY RIGHTS

- Introduction
- Regulatory Framework
- Area of Analysis
- Existing Condition
- Environmental Consequences,
- Key Issue – Changes in Motorized Access
  - Direct, Indirect, and Cumulative Effects
- Consistency with Forest Plan, MOA, and Other Regulations

Introduction

The Klamath Tribes treaty rights depend upon resources such as mule deer, fish, other animals, and plants. These treaty right resources depend upon specific habitat and the opportunity to gather them. The effects on many treaty right resources have been discussed elsewhere in this EIS, and the findings reported in those sections are applicable. The potential effects on mule deer, an important treaty right resource are discussed in detail in the Wildlife section. The potential effects on redband trout and other aquatic species are discussed in detail in the Fisheries section. The potential effects on cultural and heritage resources were a key element in alternative design. All project activity was designed to avoid any direct negative impacts on cultural and heritage resources. The potential effects on cultural and medicinal plants, an important treaty right resource, are discussed in Sensitive Plants section. Effects on access within the former reservation lands are included, by alternative in the Social Resources and Environmental Justice section. However, since it was a key issue and alternative development included specific consideration for motorized access within former reservation lands, this will be re-summarized in this section.

The Toolbox Fire Recovery Project was initially introduced to Klamath Tribal representatives at the August 2002 "pre-SOPA meeting". SOPA is the acronym for "Schedule of Proposed Actions". The SOPA is an official quarterly newsletter, also know as the "Fremont-Winema Flyer", which announces new projects that are being considered and updates the status of previously listed projects. Under the terms of the 1999 "Memorandum of Agreement between The Klamath Tribes and the U.S. Forest Service", projects that will be newly listed on an upcoming SOPA are first subject to pre-public scoping consultation. Such new projects are often introduced at quarterly "pre-SOPA" meetings scheduled approximately two months prior to the public release of the SOPA. Following the introduction of the project the Klamath Tribes Natural Resource Department assigned Rick Ward, Tribal Biologist as the departments' representative for the project. Mr. Ward was involved with the interdisciplinary team during the initial drafting of the proposed action during October and November 2002. In October 2002, Elwood Miller Jr., The Klamath Tribes Natural Resources Director granted the Forest Service request to proceed with expedited public scoping as outlined in the 1999 Memorandum of Agreement. During this same time period, Gerald Skelton, The Klamath Tribes Culture and Heritage Director began direct communication with the Cultural Resource specialists on the Toolbox Interdisciplinary Team. This resulted in cultural resource field reconnaissance crews being assembled that were jointly composed of personnel from The Klamath Tribes and the Fremont-Winema National Forests. These crews performed inventories for approximately 9 weeks during the fall of 2002.

In addition to consultation with the Klamath Tribes, the proposed action was provided to the Tribal Chair and professional staff of the Burns Paiute Tribe and the Confederated Tribes of the Warn Springs Reservation of Oregon in November 2002.

In addition to ongoing technical consultation between Forest Service technical and professional staff and Klamath Tribal counterparts, updates on the project were provided to Klamath Tribal representatives at the November 2002, February 2003 and May 2003 pre-SOPA meetings. Working drafts of the five action alternatives were provided to Klamath Tribes professional staff in April 2003, prior to the public Open Houses that were used to introduce the alternatives to the public (May 12 and May 13). During internal Forest Service review of the draft version of the DEIS (June 10, 2003 to August 1,

2003), complete copies of the draft document were provided for Klamath Tribal review, concurrent with internal review. Specific concerns that were raised through the sum of all consultation with The Klamath Tribes pertained to road management considerations within former Klamath Reservation lands, cultural resource protection, and mule deer habitat (particularly winter range).

Regulatory Framework

Treaty of 1864
The Klamath Tribes entered into a treaty with the United States in 1864, reserving, among other things, the right of Tribal members to hunt, fish trap and gather on their reservation lands for their livelihood in perpetuity. These rights include interest in off reservation areas. Federal Courts have held that these rights have survived the transfer of ownership to the Federal government. The United States has a trust responsibility to protect the Klamath Tribes' Treaty Rights.
Memorandum of Agreement, The Klamath Tribes and U.S. Forest Service (February 19, 1999)
The intent of the Memorandum of Agreement (MOA) is to establish policies and procedures that implement a government-to-government consultation process between the two parties. The objective of the parties is to clarify, define, and implement the government-to-government consultation process between and USDA Forest Service on behalf of the United States, and the Klamath Tribes, regarding the resources, which Tribal members have utilized and provided stewardship for since time immemorial. The agreement **(1)** establishes a formal consultation process for agency and Tribal officials and their staffs, **(2)** details a working protocol for initial contact with The Tribes at the Forest and Districts levels, **(3)** establishes quarterly meetings for communicating natural resource information, **(4)** creates a process for the Forest Service to receive and review proposals brought forward by The Tribes, **(5)** provides a process for gathering firewood to be administered by The Tribes and coordinated with the Forest Service, **(6)** provides a system for maintaining cultural camps that are used for youth education and to perpetuate Tribal cultural activities, **(7)** creates timelines for Tribal involvement in agency planning efforts, **(8)** provides a mechanism for developing educational materials about treaty rights and Tribal priorities, **(9)** provides for policy issues to be elevated to the Regional Forester for discussion, if questions are unresolved at the Forest level, or where agency policy is directed from sources in Washington, D.C., **(10)** maintains that the actions are consistent with existing laws and regulations.

Fremont National Forest Land and Resource Management Plan (1989)
The Forest Plan (LRMP) incorporated concerns regarding fish and wildlife to meet the subsistence needs of the Klamath Tribes. For example, The LRMP directed that MA 1 (Mule Deer Winter Range) be "managed to provide the habitat needed to meet ODF&W and Klamath Tribe herd management objectives" (LRMP; 132).

American Indian Religious Freedom Act (PL 95-341), dated **August 11, 1978**
This Act establishes policy to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to, access to sites, use of possessions of sacred objects and the freedom to worship through ceremonials and traditional rites. In addition this Act requires specific sections in environmental impact statements addressing the involvement of traditional Indian lands.

Native American Graves Protection and Repatriation Act of 1990 (P.L. 101-601)
This act provides for the protection of Native American graves and establishes ownership, claim, museum, inventory, repatriation regulations and policy.

Analysis Area

The project planning area includes approximately 2,065 acres of National Forest that are within the former Klamath Indian Reservation boundary. Large portions of the project area are immediately to the west and north of the former reservation. Consideration of potential effects on treaty right resources include both effects within the former reservation boundaries and effects to treaty right resources regardless of their location.

Existing Condition

The southern portion of the Silver Lake Ranger District includes portions of former Klamath Tribes reservation lands. Through a Memorandum of Agreement between the U.S. Forest Service and the Klamath Tribes, certain traditional uses of the Fremont National Forest lands are guaranteed. Most of the Klamath Tribe cultural uses, such as camping, hunting, fishing, berry picking, plant gathering, and firewood cutting follow use patterns similar to uses for the general public (USDA, Forest Service and USDI, Bureau of Land Management, 1997). There are, however, differences in purpose, as

related to the culture of the Klamath Tribes. The Klamath Tribes use the existing National Forest System (NFS) roads to access those portions of the former reservation for those traditional cultural and subsistence uses.

Environmental Consequences

Direct, Indirect and Cumulative Effects

Key Issue: Changes in Motorized Access

Issue Statement: Proposed road rehabilitation activities would reduce public access for recreation and personal use fuelwood gathering. The proposal would also reduce opportunities for members of the Klamath Tribes to hunt or gather Treaty Right resources within former Klamath Reservation boundaries, using motorized vehicles.

The issue of access on Forest Service roads was raised during public scoping. Fremont National Forest Land and Resource Management Plan Standards and Guidelines state, "Road density will be the most economical system necessary to meet the land management objectives. Overall density for the roaded area of the Forest will not exceed 2.5 miles per square mile" (LRMP, page 116). All alternatives were developed following an interdisciplinary Roads Analysis process that evaluated opportunities, determined priorities, and made recommendations for road management actions, including closure or decommissioning, for the purpose of promoting watershed recovery, reducing impacts on wildlife habitat, or protecting cultural resource sites.

The initial proposed action (Alternative B) was "silent" on access within former Klamath Indian Reservation lands as a separate consideration, but did include proposals to decommission several sections of road that are within former reservation lands. In answer to input from Klamath Tribe staff, the alternatives respond, in varying degrees, to retention of access on former reservation lands.

Table 3.184 Road Access within Former Klamath Indian Reservation Lands

Alternative	Miles of Existing Road Left Open	Miles of Existing Road Closed	Miles of Existing Road Decommissioned
A	12.4	0.0	0.0
C	12.4	0.0	0.0
D	7.4	2.3	2.7
E	9.7	0.0	2.7
G	9.7	0.0	2.7
H	9.7	0.0	2.7

Firewood cutting by Tribal members is not known to be common in the project area because of the distance from their homes. Former Tribal lands west of the project area on the Chiloquin Ranger District are considerably closer to most members' residences. It is unknown to what extent the roads within the project area are used for motorized subsistence hunting. With the exception of Alternative D, road management activities would have none to minimal adverse impacts on motorized access to former reservation lands by Tribal members, as nearly 80% of existing roads would be left open.

Consistency with Fremont Forest Plan, MOA, and other Regulations

All of the alternatives described in this analysis would meet Forest Plan standards and meet the direction contained in other regulations and laws including the MOA.

ENDANGERED, THREATENED, PROPOSED, OR SENSITIVE PLANTS

- Introduction
- Regulatory Framework
- Analysis Method
- Area of Analysis
- Toolbox Portion
- Existing Condition
- Environmental Consequences
- Direct and Indirect Effects
- Cumulative Effects
- Determination of Effects – Toolbox Portion Biological Evaluation
- Silver Portion
- Existing Condition
- Environmental Consequences
- Direct and Indirect Effects
- Cumulative Effects
- Determination of Effects – Silver Portion Biological Evaluation
- Consistency with Forest Plan and Other Regulatory Framework
- Consistency with Forest Plan and Other Regulatory Framework

Introduction

On July 12, 2002, a lightning storm ignited numerous fires on the Fremont National Forest. Two of those fires, the Toolbox and Silver, continued to grow, creating the Toolbox Complex Fire. The west section of the Toolbox project is the Silver Fire portion and the east section is the Toolbox Fire portion. An evaluation of threatened, endangered, and sensitive plant species for the Toolbox Fire Recovery Project was conducted in order to determine species most likely to be affected by proposed activities. The purpose of this evaluation is to comply with requirements of the Endangered Species Act of 1973, as amended.

Regulatory Framework

The Endangered Species Act requires that the Forest Service conserve endangered and threatened species. The National Forest Management Act and direction in the Forest Service Manual (FSM) require that habitats for all existing native and

desired nonnative plants, fish, and wildlife should be managed to maintain at least viable populations for each species (USDA Forest Service, 1995a). A viable population consists of a number of individuals adequately distributed throughout their range necessary to perpetuate the existence of the species in natural, genetically stable, self-sustaining populations (Phillips and Wooley, 1994).

The Forest Service Manual (USDA Forest Service, 1995b) and the Land and Resource Management Plan for the Fremont National Forest (LMRP) (USDA Forest Service, 1989, 109) both state that habitat for sensitive plant and animal species shall be Managed or Protected to ensure that the species do not become threatened or endangered due to Forest Service actions. To ensure sensitive species do not become threatened or endangered, the LMRP states management guides (referred to as conservation strategies) are to be developed and used. A conservation strategy is the Forest Service's documentation for the management actions necessary to conserve a species, species group or ecosystem. A conservation strategy uses information in the Conservation Assessment to establish conservation objectives and develop the management actions needed to accomplish those objectives. Conservation strategies help recommend management strategies which, when applied, ensure long-term species viability.

Analysis Method

Field Reconnaissance

On August 27, 2002, a field examination was conducted on Winter Rim in occupied *Castilleja chlorotica* habitat. On Winter Rim, the principle core population on the Silver Lake Ranger District did not burn. However, the field examination revealed that the mountain big sagebrush communities experienced a mosaic burn with 40 percent black and 60 percent unburned. On this field examination trip, although all populations of *Castilleja chlorotica* were not visited, it appeared the fires damaged only a small portion of the existing mountain big sagebrush/*Castilleja chlorotica* habitat.

Field examinations after the burn were only conducted in *Castilleja chlorotica* habitat due to the lack of occupied or suitable habitat present for other sensitive plant species. Surveys were not conducted for *Iliamna bakeri* because this species does not usually appear until 5 to 10 years post-burn.

Area of Analysis

Toolbox Fire Portion

The Toolbox Fire portion lies within the Lower, East, and Upper Duncan Creek, Benny Creek, Middle Silver Creek, and a small portion of Thompson Reservoir and Upper Silver Creek subwatersheds. Within the Toolbox Fire portion, the Forest Service manages the National Forest System lands and the Bureau of Land Management (BLM) manages the remainder of the federal land. All industrial forestland is owned by U.S. Timberlands, Co., L.P. (UST). There is a small portion of non-industrial forestlands within the Toolbox Fire portion as well.

Existing Conditions

As of December 1, 2002, the Fremont and the Winema National Forests were combined creating the Fremont-Winema National Forests. However, the Region 6 Sensitive Species Plant List currently in effect recognizes each forest individually. Therefore, any sensitive plant species Documented or Suspected to occur on the Winema side of the Forest that is not Documented or Suspected to occur on the Fremont side will not be addressed in this section.

Documented or Suspected habitat for threatened or endangered plant species does not occur on the Fremont portion of the Fremont-Winema National Forests. However, there is habitat that is required to meet Forest Service objectives for sensitive plant species. The April 1999 version of the Region 6 Sensitive Species Plant List was reviewed and any species with suspected or documented occurrences within the Fremont side of the Fremont-Winema National Forests are shown in the following table.

Table 3.185 Sensitive Plant Biological Evaluation Pre-field Review (USDA Forest Service, Region 6, 1999)

R6 Sensitive Plant Species Documented or Suspected on the Fremont National Forest	Range	Local Habitat	Occupied Habitat in Planning Area	Suitable Habitat in Planning Area
Botrychium pumicola	South-Central Oregon. Deschutes, Fremont, Winema NF and Crater Lake NP. On Fremont NF, found on northern third of Silver Lake RD.	Alpine peaks and lodgepole basins in pumice zones	No	No
Calochortus longebarbatus var *longebarbatus*	South-Central Oregon and adjacent Northern California, South-Central Washington and adjacent north-central Oregon. Includes Fremont, Winema, and Modoc NF. On Fremont, it occurs primarily on the Bly RD, with a few populations on the Paisley and Lakeview RD.	*Poa/Danthonia/Deschampsia* associations occurring in drier areas of moist meadows located in pine habitat	No	No
Castilleja chlorotica	Endemic to Deschutes, Klamath and Lake Co, OR. On Fremont NF, found on Bly, Paisley, and Silver Lake RD primarily on the Winter Rim north to Summer Lake, and Gearheart Mountain Wilderness Area.	Shrub openings on exposed, well-drained slops and summits in sagebrush, bitterbrush, or pine communities	Yes	Yes
Eriogonum prociduum	Endemic to Klamath and Lake Co, OR; northeast CA; and NW Nevada. On Fremont NF, found on Lakeview RD in Dry Valley	Areas of barren rocky, or gravelly volcanic soils with juniper or sagebrush habitat	No	No
Galium serpenticum var *warnerense*	South-Central Oregon into NE California; Populations also in Eastern Oregon, Washington, Nevada and Idaho; On the Fremont NF, found on Lakeview RD in the Warner Mountains	Rocky scree areas and talus slopes at elevations ranging from 5,000 to 8,400 feet	No	No
Iliamna bakeri	Southern OR and Northern CA. Fremont, Winema, and Rogue River NF. On Fremont, found in Lakeview and Bly RD	Hot, exposed sites like lava flows, barren south-facing slopes, or along dried creeks or harsh road beds, or burned areas	No	Yes, but outside known range
Ivesia shockleyi	East-Central CA in the Sierra Nevada and White Mountains (Placer and Inyo Co), South-Central OR on the Fremont NF on the Lakeview RD along the NE slope of Drake Peak	Rocky and gravelly areas with an elevation of 8,000 to 13,000 feet	No	No

Table 3.185 Sensitive Plant Biological Evaluation Pre-field Review (USDA Forest Service, Region 6, 1999) (continued)

R6 Sensitive Plant Species Documented or Suspected on the Fremont National Forest	Range	Local Habitat	Occupied Habitat in Planning Area	Suitable Habitat in Planning Area
Mimulus evenescens	SW Idaho west through eastern Oregon, and south into NE California. Only two extant populations: Lake Co, OR and Lassen Co, CA. Suspected to occur on the Fremont NF.	Sagebrush/juniper vegetation zones scattered among rock fragments and along side small boulders. Plants were found in moist, heavy gravel	No	No
Mimulus tricolor	California, Willamette Valley and south Central Oregon; Fremont and Winema NF in OR; On Fremont NF, found on Silver Lake RD	Seasonally flooded depressions, channels, and streambanks located in openings in pine and sagebrush habitats. Relatively heavy soils.	No	No
Penstemon glaucinus	Endemic to Klamath and Lake Co, OR. On Fremont NF, located on Lakeview, Bly, Paisley, and Silver Lake RD. On the Silver Lake RD, found in the West-Central part of the district.	Openings in mid to high elevation pine, fir, and mountain hemlock communities. Well-drained volcanic soils along rocky points and ridges.	No	No
Phacelia minutissima	Occurrences are known for WA, ID, OR, and NV. In OR, extant population known by Buckhorn Springs. Suspected to occur on the Fremont NF	Ephemerally moist, bare-soil areas of riparian zones and meadows in sagebrush-steppe and lower montane forests.	No	No
Pleuropogon oregonus	Endemic to OR, located in Union and Lake Co. On the Fremont NF, found on private land within the Lakeview RD boundaries.	Wet meadows, marshlands, and streambanks.	No	No
Rorippa columbiae	Columbia River Region; Klamath, Lake, and Harney Co. OR; Modoc Co, CA. Winema NF, Lakeview, Klamath and Burns BLM. Suspected on Silver Lake RD	Along intermittent and perennial streams and lakeshores: banks, sandbars, vernal pools, lakebeds, ditches	No	No
Thelypodium brachycarpum	Southern OR and northern CA. Historic site on Klamath RD, near Upper Klamath Lake. Suspected to occur on Fremont NF.	Alkaline flats, lake margins in shrub steppe and at edge of pine forest	No	No

After reviewing the GIS layer for sensitive plant species occurring within the Toolbox Fire portion, one sensitive plant species *Castilleja chlorotica*, was found to occur. *Castilleja chlorotica* is only present on National Forest System lands within the Toolbox Fire portion.

Sensitive Plants

1. *Castilleja chlorotica* Piper green-tinged paintbrush

Status: USF&WS: SoC (Species of Concern)

Natural Heritage: G3/S3

Region 6: Sensitive Species List

Castilleja chlorotica (green-tinged paintbrush) is endemic to Oregon. Occupied habitat for *Castilleja chlorotica* exists on the Fremont portion of the Fremont-Winema National Forests, Deschutes National Forest, and the Prineville District of the BLM (Phillips and Wooley, 1994). About 95 percent of the known sites of *Castilleja chlorotica* occur on the Fremont portion of the Fremont-Winema National Forests. The core population of approximately 500,000 individuals occurs on Winter Rim. Winter Rim is located on the Silver Lake and Paisley Ranger Districts on the Fremont-Winema National Forests. Disjunct populations occur in a northward extending arc from the Silver Lake Ranger District to the Fort Rock Ranger District and BLM Prineville District. Several populations exist in the Gearheart Wilderness Area and on the summit of several mountains including Bald Mountain and Hager Mountain.

Castilleja chlorotica is a perennial forb generally growing in shrub-graminoid openings on exposed, well-drained slopes and summits between mid to high elevation (Phillips and Wooley, 1994). It can also inhabit surrounding forest edges, forest openings, and sometimes grown under light to moderate canopy of mixed conifer (Phillips and Wooley, 1994). *Castilleja chlorotica* is hemiparasitic on other plants, primarily mountain big sagebrush (*Artemisia tridentata*) and bitterbrush (*Pursia tridentata*) (Phillips and Wooley, 1994). Being hemiparasitic, it derives some of its nutrition from other plants through shared root connections (Phillips and Wooley, 1994). Due to this hemiparasitic relationship, providing for *Castilleja chlorotica* means managing for both bitterbrush and mountain big sagebrush habitat.

The table below analyzes Protected and Managed *Castilleja chlorotica* habitat within the Toolbox Fire portion. The analysis breaks down the habitats into the number of sites and acres that occur within the Toolbox Fire portion, the Silver Lake Ranger District, and the Fremont portion of the Fremont-Winema National Forests. The information used for the following table was gathered and calculated using the GIS TESPHAB layer for the Fremont National Forest.

Table 3.186 Distribution of Occupied *Castilleja chlorotica* Habitat

Analysis Area	Site Description	Number of Sites	Acres
Toolbox Project Boundaries: Toolbox Fire portion	Protected	2	49
	Managed	6	34
Silver Lake Ranger District	Protected	11	959
	Managed	32	1,015
Fremont-Winema National Forests	Protected	29	1,360
	Managed	131	4,824

The above table shows approximately 49 acres of Protected *Castilleja chlorotica* habitat, and 34 acres of Managed habitat occurs within the Toolbox Fire portion. Approximately 5.1 percent of the Protected *Castilleja chlorotica* habitat and 3.3 percent of Managed habitat on the Silver Lake Ranger District are located within the Toolbox Fire portion. When looking at these numbers for the Fremont-Winema National Forests as a whole, 3.6 percent of Protected and 0.7 percent of Managed habitats are located within the Toolbox Fire portion.

2. *Iliamna bakeri* (Jepson) Wiggins Baker's globe mallow

Status: Natural Heritage: G3

Region 6: S2

Presently, 35-40 populations of this species are known to occur. The majority of these populations are found in the Great Basin area of northeastern California. However, it has been known to occur sporadically on the Fremont, Winema and Rogue River National Forests (Meinke, 2001). There have been documented occurrences on the Lakeview and Bly Ranger Districts on the Fremont portion of the Fremont-Winema National Forests.

When this species occurs in Oregon, it may persist for only a short time. *Iliamna bakeri* can be found on hot, exposed sites like lava flows, barren south-facing slopes, or along dried creeks or harsh roadbeds. However, they are primarily reported in areas that have recently experienced a burn (Meinke, 2001). The majority of the populations in Klamath County, Oregon occurred at elevations of 4,500-6,000 feet. Common plant associations for Klamath County are western juniper (*Juniperus*

occidentalis), curleaf mountain mahogany (*Cercocarpus ledifolius*), rabbitbrush (*Chrysothamnus nauseosus*), squawcarpet (*Ceanothus prostrates*), and sagebrush (*Artemesia tridentata*). Some populations were found in scattered or open ponderosa pine (*Pinus ponderosa*) habitat. On the Fremont, one population on the Lakeview Ranger District occurred within a large burned area with plant associations of ponderosa pine (*Pinus ponderosa*), green leaf manzanita (*Arctostaphylos patula*), and rabbitbrush (*Chrysothamnus nauseosus*). Preferred habitat for *Iliamna bakeri* seems to be a dry hilltop with sandy soil that has little or no overtopping canopy (Wooley, 2000).

Even though Silver Lake Ranger District is on the northern edge of *Iliamna bakeri* range, there is a minute possibility this species may show up within the Toolbox project boundaries. This species is often undiscovered until it reaches maturity and produces large flowers (Wooley, 2003). This could be 5 to 10 years after the burn (Wooley, 2000). On the Fremont portion of the Fremont-Winema National Forests, *Iliamna bakeri* populations appeared 6 to 8 years post burn. Since fire salvage activities are time sensitive due to the deterioration of the timber, harvest activities are proposed to occur for a limited period soon after the burn. Currently, recommended monitoring of the burned area annually for a period of 5 to 7 years at the field check level by a botanist/ecologist is recommended (Wooley, 2003).

3. *Eriogonum umbellatum* var *glaberrimum* (Gandg.) Reveal green buckwheat

Status: Natural Heritage: G5?/S1?

Region 6: Proposed revision to Region 6 Sensitive Species Plant List

Eriogonum umbellatum var *glaberrimum* is a potential addition to the Region 6 Sensitive Species Plant List. This list is expected to be finalized in January 2004. This species is found on the Fremont portion of the Fremont-Winema National Forests on the Bly Ranger District and in the Steens Mountains on the Lakeview Ranger District. It is also present in the Warner Mountains in northern California (Zamudio, 2001). This species seems to occur on open, gravelly loam soil with scattered basalt rocks. *Eriogonum umbellatum* var *glaberrimum* can be found on a 0 to 60 degree slope. Plant associations are *Artemisia tridentata, Gilia aggregata, Castilleja miniata, Eriogonum umbellatum*, and *Linanthus* sp. (Vrilakas, 2003). Two sites of the species have been found on the Silver Lake Ranger District. One of the two sites is located inside the Toolbox Fire portion.

Cultural and Medicinal Plants:

The table below displays some of the cultural and medicinal plants that may be found on the Fremont portion of the Fremont-Winema National Forests. These species have the potential to exist within the Toolbox project boundaries; however, the distribution and abundance of these species within the project area is unknown. Other cultural and medicinal plants may be present as well. These species tend to occur in riparian areas, wet to dry meadows, or open pine and sagebrush shrublands. Many of the species are adapted to periodic fire and will likely respond favorably to the Toolbox Fire.

Table 3.187 Cultural, Food and Medicinal Plants

Scientific Name	Common Name	Scientific Name	Common Name
Arnica cordifolia	Heartleaf Arnica	*Lomatium nudicaule*	Pestle Lomatium
Arnica mollis		*Pedicularis atollens*	Baby Elephant Head
Calochortus macrocarpus	Sagebrush Mariposa Lily	*Perideridia gairdneri*	
Cammassia quamash	Blue Camas, Quamash	*Pedicularis groenlandica*	Bull Elephant Heads
Lewisia rediviva	Bitterroot	*Perideridia oregana*	Oregon Yampah
Lomatium dissectum	Desert Parsley	*Pedicularis racemosa*	Parrots Beak
Lomatium macrocarpum	Large Fruited Lomatium	*Triteleia hyacinthine*	

Environmental Consequences

Direct and Indirect Effects

Common to All Alternatives

There is insufficient information on the location and abundance of cultural and medicinal plants within the Toolbox project boundaries to compare the effects of the action alternatives on these species. Cultural and medicinal species tend to occur in riparian, meadow, and shrubland habitats. These areas are likely to be minimally impacted by the Toolbox Fire and proposed activities. Salvage and fuels treatment activities would be concentrated in more heavily timbered areas outside of riparian zones. As a result, these plants are likely to persist after the project, regardless of which alternative is selected.

Implementation of all alternatives would be done in compliance with the existing Conservation Strategy for *Castilleja chlorotica*, which identifies Protected and Managed habitat.

For this analysis, the effects of the alternatives were assessed under the assumption that all *Castilleja chlorotica* sites survived the fire. Surveying will be done during the summer of 2003 to determine burn intensity and the probability of *Castilleja chlorotica* survival within Managed sites. If habitat does not have sagebrush remaining, then it can be assumed *Castilleja chlorotica* will vanish from the area, due to loss of the host plants. If some sagebrush habitat survived the fire, then *Castilleja chlorotica* plants can be expected to remain on the site. Mitigations described under Alternatives C, D, E, G, and H below would be applied to occupied habitat only.

Noxious weed control in the project area is ongoing, as described in the 1998 Environmental Assessment for the Management of Noxious Weeds for the Fremont National Forest. Currently, occupied *Castilleja chlorotica* habitat and the surrounding areas do not have noxious weeds present. For further information on noxious weeds, see the Noxious Weed section of this chapter.

Alternative A

The No Action Alternative would leave the proposed activity areas in their post-fire condition. Additional fire recovery activities would not occur on National Forest System lands, other than completion of activities proposed by the Burned Area Emergency Recovery (BAER) plan (Appendix A, Table A-7). No additional ground disturbance would occur in the project area.

If harvest activities do not occur, then there is a predicted increase in ground fuel accumulation due to the fire-killed trees falling down in 15 to 20 years. With this predicted increase in ground fuel accumulation comes a predicted increase in the probability of future high severity fires, especially in areas predicted to have an accumulation greater than 20 tons per acre (TPA) (Shelmerdine, 2003). Increasing the probability for future high severity fires increases the risk of sensitive plant habitat burning. For some sensitive species, this would be beneficial; however, for *Castilleja chlorotica*, this would mean eliminating the mountain big sagebrush, its hemiparasitic host. Alternative A would result in a higher risk of losing *Castilleja chlorotica* habitat than would be present under the action Alternatives C, D, E, G, and H.

With no additional ground disturbance occurring, noxious weed habitat would not be increased above the existing condition. Noxious weed invasion has the potential to create an adverse environment for sensitive plants and other native species. Currently, occupied *Castilleja chlorotica* habitat and the surrounding areas do not have noxious weeds present. The risk of noxious weed invasion in the project area is discussed in the Noxious Weed section of this chapter.

Alternatives C, G, and H

Alternatives C, G, and H are being grouped together due to their levels of proposed activities. Alternatives C, G, and H propose a range of approximately 6,700-7,800 acres of commercial salvage for the Toolbox Fire portion. The difference in commercial salvage acres between Alternatives C, G, and H is not a factor for the effects on native and sensitive plant habitat.

Ground-disturbing activities such as machine piling and burning of slash, site preparation, machine skidding, and pulling line for large diameter trees during timber harvest can uproot adult *Castilleja chlorotica* plants. This could reduce the population's ability to resprout and reseed after the disturbance. These activities can also remove *Castilleja chlorotica's* host plants (mountain big sagebrush and bitterbrush). Construction of landings, skid trails, roads or trails in existing *Castilleja chlorotica* populations could permanently eliminate habitat for this species. *Castilleja chlorotica* is a perennial, resprouting each year from a rhizome. This species would appear to benefit from light to moderate periodic fires.

However, the host species (sagebrush and bitterbrush) would probably be destroyed by fire since these species are susceptible to moderate or light burning (Phillips and Wooley, 1994).

During implementation of Alternatives C, G, and H, Protected *Castilleja chlorotica* habitat would be excluded from treatment units. Harvest activities and construction of landings, skid trails, temporary roads, activities fuels treatment, prescribed burning, site prep and reforestation, along with other ground disturbing activities would be prohibited in Protected *Castilleja chlorotica* habitat. Proposed harvest units #166, #173, and #174 border Protected *Castilleja chlorotica* habitat. Within these harvest units, a mitigation is in effect requiring trees, which could potentially reach the Protected habitat, be directionally felled to avoid *Castilleja chlorotica*. Trained botanical personnel would monitor the unit boundaries to ensure *Castilleja chlorotica* is excluded. Chapter 2 contains a list of mitigations for each resource, including the ones mentioned above and below.

Mitigation would be used to protect *Castilleja* chlorotica plants in Managed habitat. Harvesting would occur within Managed *Castilleja chlorotica* habitat in units #131, #134, #172, and #173. To minimize damage to existing plants, a mitigation requires that trained botanical personnel monitor unit layout to ensure skid trails and landings avoid plants, to the extent possible. In addition, trees within these units that could potentially reach the Managed habitat boundaries when cut would be directionally felled to avoid the Managed habitat areas.

Harvest units #131 and #134 have greater than 20 TPA predicted fuel loading and are, therefore, subject to activities fuels treatments in Alternatives C, G, and H. A mitigation requires that trained botanical personnel would mark the boundaries of the Managed *Castilleja chlorotica* habitat within harvest units #131 and #134 to ensure these areas are excluded from activities fuel treatments.

Additional fuels treatments outside of harvest units are proposed for Alternative G. Alternative G is proposing to conduct activities fuels treatment on National Forest System lands that are within a quarter mile of private lands. This would mean fuels treatments outside harvest units and additional activities fuels treatments within harvest units #131 and #134. A mitigation requires that the *Castilleja chlorotica* habitat within these harvest units be marked by trained botanical personnel to ensure the plants are not included within the burn boundary.

Proposed harvest activities in Alternatives C, G, and H would reduce ground fuels accumulation. Reducing the future ground fuels accumulations would decrease the potential for future high severity fires. In the long-term, this would reduce the risk of losing *Castilleja chlorotica* habitat to wildfire. With the additional fuels treatment occurring in Alternative G, the potential for future high severity fires is even lower than for the other alternatives.

Following harvest, reforestation would occur in units #131, #134, #172, and #173. With the current stocking standards, no more than 40 percent canopy closure is expected to occur. Therefore, habitat for *Castilleja chlorotica* would continue to exist in these units. The fall before planting is scheduled to occur, trained botanical personnel would place pin flags at each clump of *Castilleja chlorotica* in harvest units #131, #134, #172, and #173. This would allow the planters to avoid planting the trees directly on *Castilleja chlorotica* plants.

Alternatives C, G, and H propose a range of 2,400–3,500 acres for prescribed burning. Prescribed burning would not occur in Managed *Castilleja chlorotica* habitat in Alternative C and H. However, Alternative G proposes to prescribe burn a quarter mile buffer between private property and National Forest System lands. This would affect harvest unit #131 and #134. A mitigation requires that the Managed *Castilleja chlorotica* habitat within these harvest units be excluded from the burn boundary. Trained botanical personnel are required to verify the burn boundary to ensure the Managed habitats are excluded.

For Alternatives C, G, and H, a temporary road is proposed to border the edge of the Managed *Castilleja chlorotica* habitat in harvest unit #134. To ensure all *Castilleja chlorotica* plants are excluded from the proposed roadbed, trained botanical personnel would verify the temporary road location. In harvest units #172 and #173, there is a proposed temporary road going into the Managed *Castilleja chlorotica* habitat. Trained botanical personnel would verify the road layout to ensure a minimal number of plants are affected.

In summary, all Protected *Castilleja chlorotica* habitat would be excluded from treatment units. Approximately 25 acres of Managed *Castilleja chlorotica* habitat out of the 34 acres within the Toolbox Fire portion fall within treatment units, which corresponds to 2.5 percent of the Managed habitat on Silver Lake Ranger District and approximately 0.5 percent of the Managed *Castilleja chlorotica* habitat on the Fremont portion of the Fremont-Winema National Forests. With the mitigations mentioned above, and in Chapter 2, it is expected that many of the plants within the Managed habitat sites would be protected during treatment activities, and the percent of Managed habitat impacted would be even less.

Even though Silver Lake Ranger District is on the northern edge of *Iliamna bakeri* range, there is a minute possibility this species may show up within the Toolbox Fire portion. The project area would be monitored for appearance of this species and sites would be protected if they are discovered. If *Iliamna bakeri* shows up in the burned areas, it is likely to appear 5 to 10 years post burn. The sites on the Fremont portion of the Fremont-Winema National Forests have been discovered 6 to 8 years post burn. This would mean *Iliamna bakeri* might appear in 2007, but probably more like 2008 and beyond. Timber harvest should be completed in 2004 and 2005. For Alternative C, site preparation and planting are the only activities proposed to occur in 2007 and beyond (Chapter 2). In Alternatives G and H, site preparation, planting, and some fuels treatments are proposed activities to occur in 2007 and beyond (Chapter 2). For the sites found on the Fremont portion of the Fremont-Winema National Forests on Bly and Lakeview Ranger Districts, *Iliamna bakeri* appeared after harvest activities were completed. Therefore, it is apparent harvest activities would not eliminate habitat for *Iliamna bakeri*.

Eriogonum umbellatum var *glaberrimum* is a candidate for addition to the Region 6 Sensitive Species Plant List. One of the two sightings on the Silver Lake Ranger District occurs within the Toolbox Fire portion. This site is not located within a proposed harvest unit. Therefore, Alternatives C, G, and H would have No Impact on this species. However, additional field surveys may reveal new sites within the Toolbox Fire boundary. While it cannot be determined at this time what the impact of treatment activities would be on additional sites for this species, it is expected to be low. *Eriogonum umbellatum* var *glaberrimum* seems to prefer habitat having an open canopy, and is unlikely to be discovered in areas where harvest activities are proposed.

Noxious weed invasion has the potential to create an adverse environment for sensitive plants and other native species. Currently, occupied *Castilleja chlorotica* habitat and the surrounding areas do not have noxious weeds present. The risk of noxious weed invasion in the project area is discussed in the Noxious Weed section of Chapter 3.

Alternative D

In Alternative D, approximately 3,400 acres of land is proposed for commercial salvage within the Toolbox Fire portion. Harvest activities, construction of landings, skid trails, temporary roads, activities fuel treatment, prescribed burning, site prep and reforestation, along with any other ground disturbing activities, would be prohibited in Protected habitat. Proposed harvest unit #166 borders a Protected *Castilleja chlorotica* habitat. A mitigation is in effect that requires trees in harvest unit #166, which could potentially reach the Protected habitat would be directionally felled to avoid *Castilleja chlorotica*. Trained botanical personnel would monitor the unit boundary to ensure *Castilleja chlorotica* is excluded.

In Alternative D, all Managed *Castilleja chlorotica* habitat is located outside proposed harvest and prescribed burn units. Therefore, harvest activities, construction of landings, skid trails, temporary roads, activities fuel treatment, prescribed burning, site prep and reforestation, along with any other ground disturbing activities, would not occur in Managed habitat.

Of all the action alternatives, Alternative D proposes the least amount of harvest activities, meaning future ground fuel accumulation would be higher than for the other action alternatives. Increasing the potential for future ground fuel to accumulate might lead to future high severity fires. This would not be beneficial to *Castilleja chlorotica* habitat, and would provide new habitat for noxious weeds. In Alternative D, the risk of losing *Castilleja chlorotica* habitat in the long-term is less than for Alternative A, but higher than for Alternatives C, E, G, or H.

In Alternative D, construction of new temporary roads would not occur. However, 5.7 miles of unclassified roads would be re-opened. The unclassified roads proposed for re-opening would not occur within or adjacent to *Castilleja chlorotica* habitat. Therefore, the 5.7 miles of unclassified roads proposed for re-opening would not affect the *Castilleja chlorotica* habitat.

Even though Silver Lake Ranger District is on the northern edge of *Iliamna bakeri* range, there is a minute possibility this species may show up within the Toolbox Fire portion. The project area would be monitored for appearance of this species and sites would be protected if they are discovered. If *Iliamna bakeri* shows up in the burned areas, it is likely to appear 5 to 10 years post burn. The sites on the Fremont portion of the Fremont-Winema National Forests have been discovered 6 to 8 years post burn. This would mean *Iliamna bakeri* might appear in 2007, but probably more like 2008 and beyond. Timber harvest should be completed in 2004 and 2005. For Alternative D, site preparation, planting, and some fuels treatments are proposed activities to occur in 2007 and beyond (Chapter 2). For the sites found on the Fremont portion of the Fremont-Winema National Forests on the Bly and Lakeview Ranger Districts, *Iliamna bakeri* appeared after harvest activities were completed. Therefore, it is apparent harvest activities would not eliminate habitat for *Iliamna bakeri*.

Eriogonum umbellatum var *glaberrimum* is a candidate for addition to the Region 6 Sensitive Species Plant List. One of the two sightings on the Silver Lake Ranger District occurs within the Toolbox Fire portion. This site is not located within a proposed harvest unit. Therefore, Alternative D would have no impact on this species. However, additional field surveys may reveal new sites within the Toolbox Fire boundary. While it cannot be determined at this time what the impact of treatment activities would be on additional sites for this species, it is expected to be low. *Eriogonum umbellatum* var *glaberrimum* seems to prefer habitat having an open canopy, and is unlikely to be discovered in areas where harvest activities are proposed.

Noxious weed invasion has the potential create an adverse environment for sensitive plants and other native species. Currently, occupied *Castilleja chlorotica* habitat and the surrounding areas do not have noxious weeds present. The risk of noxious weed invasion in the project area is discussed in the Noxious Weed section of Chapter 3.

Alternative E

In Alternative E, approximately 6,000 acres of land is proposed for commercial salvage within the Toolbox Fire portion. As stated under Alternatives C, G, and H, ground-disturbing activities, such as machine piling and burning of slash, site preparation, machine skidding, and pulling line for large diameter trees during timber harvest, can impact *Castilleja chlorotica* plants. Additionally, underburning can cause mortality of mountain big sagebrush and bitterbrush, the host species for *Castilleja chlorotica*. Mitigation measures to address this potential impact may be found in the Mitigation and Resource Protection Measures section of Chapter 2.

For Alternative E, harvest activities and construction of landings, skid trails, temporary roads, activities fuels treatment, prescribed burning, site prep and reforestation, along with any other ground disturbing activities, would be prohibited in Protected *Castilleja chlorotica* habitat. Harvest units #166, #173, and #174 border Protected *Castilleja chlorotica* habitat. Within these harvest units, a mitigation requires that trees, which could potentially reach the Protected habitat, be directionally felled to avoid *Castilleja chlorotica*. Trained botanical personnel would monitor the unit boundaries to ensure *Castilleja chlorotica* is excluded.

Mitigations would be used to protect *Castilleja chlorotica* in Managed habitats. Harvesting is proposed to occur within Managed *Castilleja chlorotica* habitat in harvest units #131, #134, and #173. To minimize damage to existing plants, a mitigation requires that trained botanical personnel monitor unit layout to ensure skid trails and landings have minimal impacts on the plants. In addition, trees within these units that could potentially reach the Managed habitat boundaries when cut would be directionally felled to avoid the Managed habitat areas.

Harvest unit #131 has greater than 30 TPA predicted fuel loading and is, therefore, subject to activities fuels treatments. A mitigation requires that trained botanical personnel mark the boundary of the Managed *Castilleja chlorotica* habitat within harvest unit #131 to ensure this area is excluded from activities fuel treatments.

Since proposed activities fuels treatments would only occur in units that have greater than 30 TPA predicted fuel loading, instead of 20 TPA as in Alternatives C, G, and H, less area would receive fuels treatments. Therefore, the potential for future ground fuels accumulation would be lower for Alternative E than for Alternative D, but Alternative E would have a higher potential for future ground fuels accumulation than Alternatives C, G, and H.

Following harvest, reforestation would occur in units #131, #134, and #173. With the current stocking standards, no more than 40 percent canopy closure is expected to occur. Therefore, habitat for *Castilleja chlorotica* would continue to exist in these units. The fall before planting is scheduled to occur, trained botanical personnel would place pin flags at each clump of *Castilleja chlorotica* in harvest units #131, #134, and #173. This would allow the planters to avoid planting the trees directly on *Castilleja chlorotica* plants.

Alternative E does not propose prescribed burning beyond what is proposed for activities fuels treatments. Therefore, mitigations would not be needed for prescribed burning within *Castilleja chlorotica* habitat.

For Alternative E, a temporary road is proposed to border the edge of the Managed *Castilleja chlorotica* habitat in harvest unit #134. To ensure all *Castilleja chlorotica* plants are excluded from the proposed roadbed, trained botanical personnel would verify the temporary road location. In harvest unit #173, there is a proposed temporary road going into the Managed *Castilleja chlorotica* habitat. Trained botanical personnel would verify the road layout to ensure a minimal number of plants are affected.

In summary, all Protected *Castilleja chlorotica* habitat would be excluded from treatment units. Approximately 18 acres of Managed *Castilleja chlorotica* habitat out of the 34 acres within the Toolbox Fire portion fall within treatment units, which

corresponds to 1.7 percent of the Managed habitat on Silver Lake Ranger District and approximately 0.3 percent of the Managed *Castilleja chlorotica* habitat on the Fremont portion of the Fremont-Winema National Forests. With the mitigations mentioned above and in Chapter 2, it is expected that many of plants within the Managed habitat sites would be protected during treatment activities, and the percent of Managed habitat impacted would be even less.

Even though Silver Lake Ranger District is on the northern edge of *Iliamna bakeri* range, there is a minute possibility this species may show up within the Toolbox Fire portion. The project area would be monitored for appearance of this species and sites would be protected if they are discovered. If *Iliamna bakeri* shows up in the burned areas, it is likely to appear 5 to 10 years post burn. The sites on the Fremont portion of the Fremont-Winema National Forests have been discovered 6 to 8 years post burn. This would mean *Iliamna bakeri* might appear in 2007, but probably more like 2008 and beyond. Timber harvest should be completed in 2004 and 2005. For Alternative E, site preparation and planting are the only activities proposed to occur in 2007 and beyond (Chapter 2). For the sites found on the Fremont portion of the Fremont-Winema National Forests on the Bly and Lakeview Ranger Districts, *Iliamna bakeri* appeared after harvest activities were completed. Therefore, it is apparent harvest activities would not eliminate habitat for *Iliamna bakeri*.

Eriogonum umbellatum var *glaberrimum* is a candidate for addition to the Region 6 Sensitive Species Plant List. One of the two sightings on the Silver Lake Ranger District occurs within the Toolbox Fire portion. This site is not located within a proposed harvest unit. Therefore, Alternative E would have No Impact on this species. However, additional field surveys may reveal new sights within the Toolbox Fire boundary. While it cannot be determined at this time what the impact of treatment activities would be on additional sites for this species, it is expected to be low. *Eriogonum umbellatum* var *glaberrimum* seems to prefer habitat having an open canopy, and is unlikely to be discovered in areas where harvest activities are proposed.

Noxious weed invasion has the potential create an adverse environment for sensitive plants and other native species. Currently, occupied *Castilleja chlorotica* habitat and the surrounding areas do not have noxious weeds present. The risk of noxious weed invasion in the project area is discussed in the Noxious Weed section of Chapter 3.

Cumulative Effects

Common to All Alternatives

Within Appendix A, the past, present, and reasonably foreseeable future activities are provided in a table format. All the activities listed in Appendix A tables were considered when compiling this report. However, only some of the activities mentioned in Appendix A have the potential to produce a cumulative effect on native and sensitive plant species. These activities will be disclosed and discussed below. Emphasis will be placed on activities within Benny Creek, East Duncan Creek, and Upper Duncan Creek subwatersheds, where *Castilleja chlorotica* habitat is present. Activities in the Silver Fire portion are not considered here, because the Silver Fire lies outside of these subwatersheds and does not contain *Castilleja chlorotica* habitat.

Past Activities Leading to Existing Conditions:

The National Forest System lands within the Toolbox Fire portion have experienced many changes during the 1900s. Exact figures on timber harvest acres are not available, but it can be presumed that essentially all of National Forest System lands have had some level of harvest during the past 100 years (Appendix A, Table A-2). Timber harvest removed the larger diameter trees, providing sunlight and additional nutrients for the regrowth of smaller diameter trees. The smaller diameter trees grew, and as a result, created denser stands then what is presumed to be the historic condition for the stands. Fire suppression during the past 100 years has also played a major role in the current vegetative conditions. Without periodic, low intensity fires, trees were allowed to grow as dense as the conditions allowed. Between harvest activities and fire suppression, open, park-like stands are not as apparent as they once have been. One sensitive plant species, *Castilleja chlorotica*, is found within the Toolbox Fire portion on National Forest System lands. *Castilleja chlorotica* prefers areas with less than 40 percent canopy cover. It can be hypothesized that as smaller diameter trees grew, canopy openings were reduced, and therefore, occupied or suitable habitat for *Castilleja chlorotica* were probably reduced as well.

On industrial forestlands within the Toolbox Fire portion, extensive logging has occurred throughout the twentieth century (Appendix A, Table A-13). Logging operations began in the 1940s, and by 2000, almost all commercial forest stands were logged at least once. Minimal precommercial thinning operations were conducted during this period of time.

Fire suppression activities have been occurring since the mid-1910s. From 1948-2001, Table A-1 (Appendix A) shows acres burned by wildfire for the eight subwatersheds pertinent to the Toolbox Fire Recovery Project. For this fifty-year period, a relatively small amount of acres experienced a wildfire. Approximately 530 acres burned in the Benny Creek

subwatershed, 9 acres in the East Duncan Creek subwatershed, and 130 acres in the Upper Duncan Creek subwatershed. Due to past fire suppression on Winter Rim, mountain big sagebrush was allowed to dominate the grass plant community and reach a mature age. Some of the mature mountain big sagebrush on Winter Rim is estimated to be approximately 40 years old. It is believed these extensive older mountain big sagebrush stands may be key in facilitating the full development of the *Castilleja chlorotica*/mountain big sagebrush hemiparasitic relationship (Phillips and Wooley, 1994).

Even though past fire suppression has allowed mountain big sagebrush to reach maturity, it has also allowed ground fuels to accumulate. Table A-3 (Appendix A) displays past fuels reduction activities by subwatershed. Approximately 4,260 acres in the Benny Creek and 250 acres in the Upper Duncan Creek subwatersheds have been underburned. Additionally, 360 acres in the Been Creek subwatershed were mowed. East Duncan Creek has not had under burning projects conducted within it. Burning of landings and slash piles after harvest activities occurred in all three of the subwatersheds mentioned above. Under burning, mowing, and burning of landings and slash piles have reduced the ground fuel accumulation, leading to a reduction in the fire hazard in treated areas. Fuels reduction activities were not found to have occurred on BLM lands, industrial forestlands, or non-industrial forestlands (Appendix A, Table A-3).

Another activity that has influenced the current vegetative condition on Winter Rim is livestock grazing. Sheep were grazed between 1900-1960s, with the heaviest grazing believed to have occurred between 1900-1922 (Phillips and Wooley, 1994). The end of common grazing allotments occurred in the early 1960s when defined allotments and pastures were created through the construction of fences (Appendix A, Table A-8). Two of the allotments, Winter Rim and Foster Butte, contain *Castilleja chlorotica* habitat.

Accurate data on the grazing situation on Winter Rim Allotment began in the mid-1960s (Appendix A, Table A-8). From 1966-1980, 1,500-2,000 sheep grazed July through August/September, with no use occurring in 1978. In 1981, the Winter Rim Allotment was converted from sheep to cattle. At this time, 300 head were permitted to graze open season (July 1 through September 30). In 1990, the use was reduced to 282 head of cattle using the two-pasture rotation system. In 2001 and 2002, 660 cattle used the Winter Rim Allotment June 15 through July 25, early season.

Foster Butte Allotment was grazed primarily by sheep until converted to cattle in the late 1940s. From 1966-1979, 1,602 head of cattle grazed from May 21 through September 20. During this period, a rest rotation grazing system was in place. In 1980, a 6-pasture rotation system with rest, deferment, and early season use was introduced. Between 1980 and 1993, 6,807 AUMs (Animal Unit Months) were permitted. In 1993, an early season grazing system began and continues today between late May through late July/early August. In 1993 through 2002, 6,297 AUMs were permitted in the Foster Butte Allotment. The two pastures within the Foster Butte Allotment of importance to *Castilleja chlorotica* habitat are Sycan and Foster.

During the time when the Toolbox Complex Fires were burning, a third fire, the Winter fire, was burning just southeast of the Toolbox Fire. The Winter fire burned approximately 34,000 acres (USDA Forest Service, 2003, Chapter 1). This fire burned on the east side of Winter Rim near *Castilleja chlorotica* habitat. The threat of particular concern is the spread of noxious weeds due to the amount of bulldozer lines and the influx of equipment, personnel, and vehicles during the fire suppression effort. The disturbance created by the construction of fire line during the suppression process created prime habitat for noxious weeds. Due to the proximity of Castilleja plants to the Winter fire, the activities occurring on the Winter fire could have an adverse cumulative effect on the *Castilleja chlorotica* habitat.

Suppression activities used during the Toolbox Fire complex include some of the most noticeable past effects in the project area. Within the Toolbox portion, retardant, and firing/burnout operations, in conjunction with bulldozer line, were used (Appendix A, Table A-1). The retardant drops and the firing/burnout operations occurred in the Lower Duncan subwatershed. This subwatershed is far enough away from the *Castilleja chlorotica* habitat that these activities are unlikely to have affected the plants. Approximately 236 miles of bulldozer line were constructed for suppression reasons (140 miles constructed in the Toolbox Fire portion and 96 miles in the Silver Fire portion). Some of the bulldozer lines are located outside the Toolbox project boundaries; however, all the bulldozer lines will be included within the cumulative effects analysis. The bulldozer line constructed within Benny Creek (31 miles), East Duncan Creek (9 miles), and Upper Duncan Creek (29 miles) subwatersheds have the potential to produce cumulative effects on *Castilleja chlorotica* habitat (Appendix A, Table A-1). Approximately 2 acres (1.4 miles) of bulldozer line were constructed through Protected *Castilleja chlorotica* habitat, and 1.9 acres (1.3 miles) through Managed habitat. All of the bulldozer line constructed within Protected *Castilleja chlorotica* habitat occurred within the Toolbox Fire portion perimeter. For the Managed *Castilleja chlorotica* habitat, approximately 0.6 acres (0.4 miles) of bulldozer line were constructed within the Toolbox Fire portion perimeter, while 1.3 acres (0.9 miles) were constructed outside.

Overall, bulldozer lines affected 0.2 percent of Protected habitat within the Silver Lake Ranger District and 0.15 percent within the Fremont portion of the Fremont-Winema National Forests. The bulldozer lines affected 0.2 percent of Managed habitat within the Silver Lake Ranger District and 0.04 percent within the Fremont portion of the Fremont-Winema National Forests. These figures are approximate, because the location of the constructed bulldozer lines in the GIS layers may not be completely accurate.

The bulldozer line also created prime habitat for noxious weeds. With the magnitude of the Toolbox Complex Fire, additional resources were brought in from places that are outside Lake County and from other states. This influx of equipment, personnel, and vehicles may have brought noxious weed seeds with them. There is a probability that the amount of noxious weed sites will increase, especially in the rehabilitated bulldozer lines. There is also a possibility that different noxious weed species will appear due to the broad geographical range the equipment, personnel, and vehicles came from. The increased risk of noxious weeds establishing on bulldozer lines increases the risk of noxious weeds invading *Castilleja chlorotica* habitat. In an attempt to keep noxious weeds out of the bulldozer lines in and adjacent to *Castilleja chlorotica* habitat, the bulldozer lines will be monitored minimally once a year for three to five years.

The treatment of noxious weeds has been occurring on the National Forest System lands as well as BLM lands in past years. In 2002, the Forest Service and BLM began separate three-year contracts for the treatment of noxious weeds with a private entity. Past treatment of noxious weeds has not only reduced the number of existing sites, but, within the noxious weed sites still remaining, the density of plants has been reduced considerably for both National Forest System and BLM lands (Appendix A, Table A-4). Noxious weed control in the project area is ongoing for National Forest System lands, as described in the 1998 Environmental Assessment for the Management of Noxious Weeds for the Fremont National Forest. Currently, occupied *Castilleja chlorotica* habitat and the surrounding areas do not have noxious weeds present. For further information on the noxious weed condition for the Silver Lake Ranger District, see the Noxious Weed section in this chapter.

Present and Future Foreseeable Activities:

Noxious weed invasion has the potential to create an adverse environment for sensitive plants and other native species. Currently, occupied *Castilleja chlorotica* habitat and the surrounding areas do not have noxious weeds present. Activities on adjacent lands will affect the potential for weed invasion on National Forest System lands within the Toolbox portion of the project area.

The Winter Fire Salvage and Restoration Environmental Assessment (USDA Forest Service, 2003) proposes activities on National Forest System lands in the adjacent Winter Fire. Approximately 69 acres within the Winter project area are currently infested with noxious weeds (USDA Forest Service, 2003, Chapter 3, p. 56). With the proposed harvest activities, there is a potential for spreading noxious weeds into uninfested areas. However, the Winter Environmental Assessment proposes to conduct the majority of harvest operations using helicopters instead of ground based tractors and equipment, which will help reduce the amount of ground disturbance and noxious weed habitat created. With the mitigations stated in the Winter Environmental Assessment and the current Forest Service contract for the treatment of noxious weeds in effect, the number of new infestations within the Winter fire boundary should be greatly reduced.

As a response to the Toolbox Complex Fire, the Bureau of Land Management (BLM) wrote a Burned Area Emergency Stabilization and Rehabilitation (ESR) Plan Environmental Assessment. A summary of the activities proposed by the BLM can be found in Appendix A, Table A-15. The BLM lands have noxious weeds and nonnative species present. The BLM plans to seed and plant tree seedlings in an attempt to provide competition for the noxious weeds and nonnative species in the Lower Duncan Creek subwatershed (USDI Bureau of Land Management, 2003). The distance between the Lower Duncan Creek subwatershed and the *Castilleja chlorotica* habitat is far enough that the possibility of noxious weeds spreading from BLM lands into *Castilleja chlorotica* is minimal. For additional information on the measures the BLM is taking to reduce noxious weed and nonnative species spread and establishment, see the Noxious Weed section of this chapter.

Industrial forestlands within the Toolbox Fire portion are owned by U.S. Timberlands Co., L. P. (UST). UST owns industrial forestlands within the Silver Fire portion as well. UST plans to plant tree seedlings after salvage logging, which will provide competition against noxious weeds and nonnative species. It is unknown if noxious weeds are present on UST lands and if other weed management actions will be taken. For additional information, see the Noxious Weed section of this chapter.

For the non-industrial forestlands within the Toolbox Fire portion, some owners are planning to harvest both dead and green timber to make the harvest activities profitable. They also plan to plant the lands that do not reach State density

requirements. It is unknown if noxious weed sites exist and, if they do, by what means non-industrial forestland owners plan to treat noxious weeds. However, non-industrial forestlands owners are aware of problems noxious weeds create and are trying to eliminate noxious weeds on their lands.

Two Forest Service restoration projects previously approved through NEPA decisions have treatment units located within the Benny Creek, East Duncan Creek, and Upper Duncan Creek subwatersheds (see Elston, R., 2003, "Toolbox Fire Recovery Project – Future Activity Already Covered with NEPA Decisions" in the Toolbox Fire Recovery Project analysis file. A summary of this report can be found in Table A-16 of Appendix A). Activities pertaining to these restoration projects may be ongoing or are scheduled to occur.

The Windmill Restoration Project is located on the northern end of the Toolbox Fire portion within the Upper and East Duncan Creek subwatershed. The activities occurring within the Windmill Restoration Project will not affect *Castilleja chlorotica* habitat due to the distance between the two areas. Part of the Triad Restoration Project is within the Toolbox Fire portion and lies within *Castilleja chlorotica* habitat in the Benny Creek subwatershed. The selected alternative for Triad will commercially and precommercially thin the dense pine stands where canopy closure has shaded out sites such that the mountain big sagebrush communities have been eliminated from the understory. In the long-term, these activities are likely to create open areas that will allow mountain big sagebrush to become established once again, and improve habitat for *Castilleja chlorotica*. Within the Triad project boundary located within the Benny Creek subwatershed, there is approximately 145 acres of Managed *Castilleja chlorotica* habitat. Approximately 4.5 of the 145 acres (3 percent) of Managed habitat will be affected by the activities proposed within the Toolbox Fire portion. The Biological Evaluation for the Triad project concluded the proposed activities were likely to affect individuals or habitat, but would not result in a trend toward federal listing or reduced viability for *Castilleja chlorotica* (USDA Forest Service, 2001). With the proposed activities within the Toolbox Fire portion impacting only 4.5 acres of Managed habitat within the Triad Restoration Project, the determination already issued for Triad will remain unchanged. Since the Triad restoration project will improve *Castilleja chlorotica* habitat in the long-term and will affect only 145 acres of Managed habitat, it is highly unlikely that the combined activities of Triad and Toolbox would adversely affect *Castilleja chlorotica*.

Cattle grazing will continue in the Benny Creek, East Duncan Creek, and Upper Duncan Creek subwatersheds and adjacent areas (Table A-8, Appendix A). In 2003, the grazing system on the Winter Rim Allotment will be reduced to 282 head, down from 660 head grazed in 2001 and 2002, and a two-pasture rotation system will be implemented instead of early season use. The land within the Winter Rim Allotment contains a large portion of the Winter Rim's *Castilleja chlorotica* habitat. The Winter Rim Allotment consists of two pastures, Bagley and Fremont. Within the Bagley pasture, approximately 400 acres of *Castilleja chlorotica* habitat exists (300 acres of Managed and 100 acres of Protected). Within the Toolbox Fire portion boundary, approximately 4 acres of Protected and 15 acres of Managed *Castilleja chlorotica* habitat exist inside the Bagley pasture. In the Fremont pasture, approximately 1,335 acres of *Castilleja chlorotica* habitat are present (525 acres of Managed and 810 acres of Protected). Within the Toolbox Fire portion boundary, approximately 44 acres of Protected *Castilleja chlorotica* habitat exist within the Fremont pasture.

In the Foster Butte Allotment, the Hager, Foster, and Dead Indian pastures will also have reduced numbers/AUMs and a shorter season in 2003 than in previous years (Table A-17, Appendix A). The remaining pastures will not experience changes to the number of cattle or grazing system. Within the Foster Butte Allotment, Sycan and Foster pastures contain Managed *Castilleja chlorotica* habitat. The Sycan pasture has approximately 170 acres Managed *Castilleja chlorotica* habitat, of which 3 acres are within the Toolbox Fire portion. The Foster pasture contains 13 acres of Managed *Castilleja chlorotica* habitat, all of which are within the Toolbox Fire portion.

In the Winter Rim and Foster Butte Allotments, *Castilleja chlorotica* will be monitored to ensure the cattle are not overgrazing the plants. Past monitoring within the *Castilleja chlorotica* habitat has shown grazing to occur on some plants. Prior to 2001, browsing or trampling was not noted within the monitoring plot in the Winter Rim Allotment. However, in 2001, cattle were turned out into the Winter Rim Allotment earlier then in past years. In addition, more cattle were turned out then in the previous five years. During the 2001 grazing season, it was noted that *Castilleja chorotica* plants outside the monitoring site had been grazed. In 2001, there was an extreme drought in the area. Therefore, it is unknown what factors lead to browsing of the *Castilleja chlorotica* plants in 2001 (Wooley, 2001). Additional monitoring will need to be conducted before any determination can be made on the impacts cattle have on *Castilleja chlorotica*. For 2003 grazing season in the Winter Rim Allotment, AUMs will be reduced in most pastures during 2003, compared to previous years. Grazing management post 2003 in the Winter Rim and Foster Butte Allotments will be based the 2003 monitoring information and completion of the Range Analysis for the area (Keil, 2003).

Salvage activities on BLM and private lands, as well as proposed salvage activities in the Winter Fire, would reduce future ground fuel accumulation and the potential for future high severity fires in the project area. This would reduce the risk of loss of *Castilleja chlorotica* habitat to wildfire over time. If salvage activities do not occur within the Winter fire boundary, then there would be a large ground fuel accumulation in that area within the next 15 to 20 years. This would increase the potential for a future high severity fire. Due to the location and topography, a high severity fire inside the Winter fire boundary would jeopardize *Castilleja chlorotica* habitat on Winter Rim.

Alternative A

As described above under Direct and Indirect Effects, Alternative A would not contribute to cumulative direct effects on *Castilleja chlorotica* habitat, or potential *Iliamna bakeri*, and *Eriogonum umbellatum* var *glaberrimum* habitat.

Alternative A would not contribute to cumulative fuel reduction in or near the Toolbox Fire portion, and therefore would result in a higher risk of future loss of *Castilleja chlorotica* habitat to wildfire than the action alternatives.

Alternative A would not contribute to cumulative ground disturbing activities in the Toolbox Fire portion, and, therefore, would not contribute to increased noxious weed habitat or increased risk of weed introductions which could potentially impact *Castilleja chlorotica* and other native species in the area.

Alternatives C, G, and H

As described under Direct and Indirect Effects, Alternatives C, G, and H would contribute to direct effects on 25 acres of Managed *Castilleja chlorotica* habitat. Cumulatively, effects from fire suppression, on-going projects, and proposed treatments would occur on 2 acres of Protected habitat (0.2 percent of Protected habitat on the District/ 0.15 percent of Protected habitat on the Forest) and 167.4 acres of Managed habitat (16.5 percent of Managed habitat on the District/ 3.5 percent of Managed habitat on the Forest). Most of the cumulative effects result from the Triad restoration project, which may impact individual plants, but is expected to improve habitat for the species over the long term. Although cattle grazing is on-going, it is not expected to contribute to direct effects on *Castilleja chlorotica*, based on the results of past monitoring and reduced numbers for 2003.

As described under Direct and Indirect Effects, Alternatives C, G, and H may contribute to cumulative ground disturbing effects on *Iliamna bakeri*, if the species does occur in the area post fire, but is unlikely to impact *Eriogonum umbellatum* var *glaberrimum.* Mitigation measures to address this potential impact may be found in the Mitigation and Resource Protection Measures section of Chapter 2.

As described under Direct and Indirect Effects, Alternatives C, G, and H would contribute to cumulative fuel reduction activities in or near the Toolbox Fire portion, and would result in a lower risk of future loss of *Castilleja chlorotica* habitat to wildfire than Alternatives A and D.

Alternatives C, G, and H would contribute to cumulative ground disturbing activities in the Toolbox Fire portion. Cumulative ground disturbing activities, such as salvage logging, fuels treatments, and associated activities, on all land ownerships in and near the Toolbox Fire portion would result in a substantial increase in suitable weed habitat and risk of noxious weed introduction in the area. This would increase the potential for noxious weed invasion to impact *Castilleja chlorotica* and other native species in the area. Mitigation measures to address this potential impact may be found in the Mitigation and Resource Protection Measures section of Chapter 2.

Alternative D

As described under Direct and Indirect Effects, Alternative D would not contribute to cumulative direct effects on *Castilleja chlorotica* habitat.

As described under Direct and Indirect Effects, Alternative D may contribute to cumulative ground disturbing effects on *Iliamna bakeri*, if the species does occur in the area post fire, but is unlikely to impact *Eriogonum umbellatum* var *glaberrimum.*

As described under Direct and Indirect Effects, Alternative D would contribute to cumulative fuel reduction activities in or near the Toolbox Fire portion, and would result in a lower risk of future loss of *Castilleja chlorotica* habitat to wildfire than Alternative A, but a higher risk than Alternatives C, E, G, and H.

Alternative D would contribute to cumulative ground disturbing activities in the Toolbox Fire portion. Cumulative ground disturbing activities, such as salvage logging, fuels treatments, and associated activities, on all land ownerships in and near the Toolbox Fire portion would result in a substantial increase in suitable weed habitat and risk of noxious weed

introduction in the area. This would increase the potential for noxious weed invasion to impact *Castilleja chlorotica* and other native species in the area. Mitigation measures to address this potential impact may be found in the Mitigation and Resource Protection Measures section of Chapter 2.

Alternative E

As described under Direct and Indirect Effects, Alternative E would contribute to direct effects on 18 acres of Managed *Castilleja chlorotica* habitat. Cumulatively, effects from fire suppression, on-going projects, and proposed treatments would occur on 2 acres of Protected habitat (0.2 percent of Protected habitat on the District/ 0.15 percent of Protected habitat on the Forest) and 160.4 acres of Managed habitat (15.8 percent of Managed habitat on the District/ 3.3 percent of Managed habitat on the Forest). Most of the cumulative effects result from the Triad restoration project, which may impact individual plants, but is expected to improve habitat for the species over the long term. Although cattle grazing is on-going, it is not expected to contribute to direct effects on *Castilleja chlorotica*, based on the results of past monitoring and reduced numbers for 2003.

As described under Direct and Indirect Effects, Alternative E may contribute to cumulative ground disturbing effects on *Iliamna bakeri*, if the species does occur in the area post fire, but is unlikely to impact *Eriogonum umbellatum* var *glaberrimum.*

As described under Direct and Indirect Effects, Alternative E would contribute to cumulative fuel reduction activities in or near the Toolbox Fire portion, and would result in a lower risk of future loss of *Castilleja chlorotica* habitat to wildfire than Alternatives A and D.

Alternative E would contribute to cumulative ground disturbing activities in the Toolbox Fire portion. Cumulative ground disturbing activities, such as salvage logging, fuels treatments, and associated activities, on all land ownerships in and near the Toolbox Fire portion would result in a substantial increase in suitable weed habitat and risk of noxious weed introduction in the area. This would increase the potential for noxious weed invasion to impact *Castilleja chlorotica* and other native species in the area. Mitigation measures to address this potential impact may be found in the Mitigation and Resource Protection Measures section of Chapter 2.

Determination of Effects - Toolbox Fire Portion

Fremont National Forest Sensitive plant species that are not discussed in the sections below are listed in Table 4. These species have a "NO IMPACT" determination of effects since they are not located within the Toolbox fire portion and therefore their habitat will not be impacted by any of the alternatives.

Castilleja chlorotica

The only sensitive plant species known to occur within the Toolbox fire portion is *Castilleja chlorotica*. The Conservation Strategy for this species identified Protected and Managed habitat necessary for the long-term viability of this species.

Alternatives A and D would not result in additional ground disturbing activities in *Castilleja chlorotica* habitat and would have No Impact on the species. Alternatives C, E, G, and H would result in ground disturbing activities in *Castilleja chlorotica* habitat.

All Protected *Castilleja chlorotica* habitat would be excluded from treatment units; a small amount of Protected habitat (2 acres, 0.04 percent) was impacted during fire suppression activities. Proposed activities in Alternatives C, G, and H would affect 25 acres of Managed habitat. Proposed activities in Alternative E would affect 18 acres of Managed habitat. Cumulatively, 167.4 acres of Managed habitat (16.5 percent of Managed habitat on the District/ 3.5 percent of Managed habitat on the Forest) would be effected if Alternative C, G, or H is implemented, and 160.4 acres of Managed habitat (15.8 percent of Managed habitat on the District/ 3.3 percent of Managed habitat on the Forest) would be effected if Alternative E is implemented. The majority of the cumulative effects result from the Triad restoration project, which is expected to improve habitat for the species over the long term.

Alternatives C, E, G, and H, will maintain the viability of *Castilleja chlorotica* on the Silver Lake District, and Forest as a whole, for the following reasons: the Winter Rim population is large, (approximately 500,000 individuals); Protected habitat will remain intact; only a small amount of Managed habitat will be effected by the Alternatives; and mitigations listed in Chapter 2 will be used to avoid impacts to plants in Managed habitat during project implementation. Therefore, for Alternatives C, E, G, and H, the proposed activities may impact individuals or habitat, but will not likely result in a trend toward federal listing or reduced viability for the population or species. Mitigation measures to address this potential impact may be found in the Mitigation and Resource Protection Measures section of Chapter 2.

Iliamna bakeri

Potential habitat exists in the Toolbox fire portion for *Iliamna bakeri*. This species is not known to occur in the area, but could appear in response to the fire.

Alternative A would not implement additional ground disturbing activities in the project area and would have No Impact on the species.

If *Iliamna bakeri* appears within the burned areas, the cumulative effects of the proposed ground disturbing activities in Alternatives C, D, E, G, and H may impact individuals or habitat, but will not likely result in a trend toward federal listing or reduced viability for the population or species. This determination is based on the fact that the species was first noted in other fires after salvage operations had already been completed, and therefore was not eliminated by salvage activities, and the fact that the project area will be monitored for the species and sites protected if they are found.

Eriogonum umbellatum var glaberrimum

This species may be added to the R6 Sensitive Plant List in 2004. All of the Alternatives will have No Impact on this species. Known sites are located outside of treatment units. If new sites are discovered, they are most likely to occur in open canopy habitats outside of treatment units.

Fremont Portion of the Fremont-Winema National Forests Sensitive Plant Species Biological Evaluation

Table 3.188 Summary of Conclusion of Effects for Toolbox Fire Portion of Toolbox Fire Recovery Project

SPECIES	ALT A	ALT C	ALT D	ALT E	ALT G	ALT H
pumice grape fern *Botrychium pumicola*	NI	NI	NI	NI	NI	NI
long-bearded mariposa lily *Calochortus longebarbatus* var *longebarbatus*	NI	NI	NI	NI	NI	NI
green-tinged paintbrush *Castilleja chlorotica*	NI	MIIH	NI	MIIH	MIIH	MIIH
prostrate buckwheat *Eriogonum prociduum*	NI	NI	NI	NI	NI	NI
Warner Mountain bedstraw *Galium serpenticum* var *warnerense*	NI	NI	NI	NI	NI	NI
Baker's globe mallow *Iliamna bakeri*	NI	MIIH	MIIH	MIIH	MIIH	MIIH
Shockley's ivesia *Ivesia shockleyi*	NI	NI	NI	NI	NI	NI
ephemeral or disappearing monkeyflower *Mimulus evenescens*	NI	NI	NI	NI	NI	NI
tricolored monkeyflower *Mimulus tricolor*	NI	NI	NI	NI	NI	NI
Blue-leaved penstemon *Penstemon glaucinus*	NI	NI	NI	NI	NI	NI
least phacelia *Phacelia minutissima*	NI	NI	NI	NI	NI	NI
Oregon semaphore grass *Pleuropogon oregonus*	NI	NI	NI	NI	NI	NI
Columbia crest *Rorippa columbiae*	NI	NI	NI	NI	NI	NI
short fruited thelypody *Thelypodium brachycarpum*	NI	NI	NI	NI	NI	NI

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Reviewed by: /s/ Sarah Malaby Date: May 22, 2003
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NI = No Impact
MIIH = May Impact Individuals or Habitat, but Will Not Likely Result in a Trend Toward Federal Listing or Reduced Viability for the Population or Species
LIFV* = Likely to Impact Individuals or Habitat with a Consequence that the Action may Contribute Towards Federal Listing or Result in Reduced Viability for the Population or Species
BI = Beneficial Impact
* Trigger for a Significant Action

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Silver Fire Portion

The Silver Fire portion lies within the Middle, Upper, and West Fork Silver Creek, and the Thompson Reservoir subwatersheds. Within the Silver Fire portion, the Forest Service manages the National Forest System lands and the Bureau of Land Management (BLM) manages the remainder of the federal lands. Private industrial and non-industrial forestlands also occur.

Existing Conditions

After reviewing the GIS layer and past survey information, sensitive plant species were not found to occur within the Silver Fire portion.

Sensitive Plants

Historically, *Iliamna bakeri* has not been found in past wildfires or prescribed burns on the Silver Lake Ranger District. However, since *Iliamna bakeri* appears after fires, there is a minute possibility for this species to appear post-burn. (For additional information on *Iliamna bakeri*, please refer to the Toolbox Fire Portion).

During the pre-field review, it was determined occupied or suitable habitat for other sensitive plant species does not occur within the Silver Fire portion. Records for the West Fork Silver Creek Restoration Project, 517 East, and Triad Restoration Project were consulted to verify that sensitive plant species were not found within the Silver Fire portion.

Cultural and Medicinal Plants:

The cultural and medicinal plants mentioned in the Toolbox Fire portion may occur in the Silver Fire portion as well. The distribution and abundance of these species within the project area is unknown. These species tend to occur in riparian areas, wet to dry meadows, or open pine and sagebrush shrublands. Many of the species are adapted to periodic fire and will likely respond favorably to the Silver Fire.

Environmental Consequences

Common to All Alternatives

There is insufficient information on the location and abundance of cultural and medicinal plants within the Silver Fire portion to compare the effects of the action alternatives on these species. Cultural and medicinal species tend to occur in riparian, meadow, and shrubland habitats. These areas are likely to be minimally impacted by the Silver Fire and proposed activities. Salvage and fuels treatment activities would be concentrated in more heavily timbered areas outside of riparian zones. As a result, these plants are likely to persist after the project, regardless of which alternative is selected.

Direct and Indirect Effects

Alternative A

The no action alternative would leave the proposed activity areas in their post-fire condition. Additional fire recovery activities would not occur on National Forest System lands, other then completion of activities proposed by the Burned Area Emergency Recovery (BAER) plan (Appendix A, Table A-7).

Alternative A would have no impact on *Iliamna bakeri* since additional ground-disturbing activities would not occur.

Alternatives C, D, E, G, and H

Even though Silver Lake Ranger District is on the northern edge of *Iliamna bakeri* range, there is a minute possibility this species may show up within the Silver Fire portion. The project area would be monitored for appearance of this species and sites would be protected if they are discovered. If *Iliamna bakeri* shows up in the burned areas, it is likely to appear 5 to 10 years post burn. The sites on the Fremont portion of the Fremont-Winema National Forests have been discovered 6 to 8 years post burn. This would mean *Iliamna bakeri* might appear in 2007, but probably more like 2008 and beyond. Timber harvest should be completed in 2004 and 2005. For Alternative C, site preparation and planting are the only activities proposed to occur in 2007 and beyond (Chapter 2). In Alternatives G and H, site preparation, planting, and some fuels treatments are proposed activities to occur in 2007 and beyond (Chapter 2). For the sites found on the Fremont portion of the Fremont-Winema National Forests on Bly and Lakeview Ranger Districts, *Iliamna bakeri* appeared after harvest activities were completed. Therefore, it is apparent harvest activities would not eliminate habitat for *Iliamna bakeri*.

Cumulative Effects

Common to All Alternatives

No cumulative effects were identified, since no sensitive plant sites are present in the Silver Fire portion.

Determination of Effects - Silver Fire Portion

Fremont National Forest Sensitive plant species that are not discussed in the sections below are listed in Table 5. These species have a "NO IMPACT" determination of effects since they are not located within the Silver fire portion and therefore their habitat will not be impacted by any of the alternatives.

Iliamna bakeri

Potential habitat exists in the Silver fire portion for *Iliamna bakeri*. This species is not known to occur in the area, but could appear in response to the fire.

Alternative A would not implement additional ground disturbing activities in the project area and would have No Impact on the species.

If *Iliamna bakeri* appears within the burned areas, the cumulative effects of the proposed ground disturbing activities in Alternatives C, D, E, G, and H may impact individuals or habitat, but will not likely result in a trend toward federal listing or reduced viability for the population or species. This determination is based on the fact that the species was first noted in other fires after salvage operations had already been completed, and therefore was not eliminated by salvage activities, and the fact that the project area will be monitored for the species and sites protected if they are found.

Fremont Portion of the Fremont-Winema National Forests Sensitive Plant Species Biological Evaluation

Table 3.189 Summary of Effects for Silver Fire Portion of Toolbox Fire Recovery Project

SPECIES	ALT A	ALT C	ALT D	ALT E	ALT G	ALT H
pumice grape fern *Botrychium pumicola*	NI	NI	NI	NI	NI	NI
long-bearded mariposa lily *Calochortus longebarbatus* var *longebarbatus*	NI	NI	NI	NI	NI	NI
green-tinged paintbrush *Castilleja chlorotica*	NI	NI	NI	NI	NI	NI
prostrate buckwheat *Eriogonum prociduum*	NI	NI	NI	NI	NI	NI
Warner Mountain bedstraw *Galium serpenticum* var *warnerense*	NI	NI	NI	NI	NI	NI
Baker's globe mallow *Iliamna bakeri*	NI	MIIH	MIIH	MIIH	MIIH	MIIH
Shockley's ivesia *Ivesia shockleyi*	NI	NI	NI	NI	NI	NI
ephemeral or disappearing monkeyflower *Mimulus evenescens*	NI	NI	NI	NI	NI	NI
tricolored monkeyflower *Mimulus tricolor*	NI	NI	NI	NI	NI	NI
blue-leaved penstemon *Penstemon glaucinus*	NI	NI	NI	NI	NI	NI
least phacelia *Phacelia minutissima*	NI	NI	NI	NI	NI	NI
Oregon semaphore grass *Pleuropogon oregonus*	NI	NI	NI	NI	NI	NI
Columbia crest *Rorippa columbiae*	NI	NI	NI	NI	NI	NI
short fruited thelypody *Thelypodium brachycarpum*	NI	NI	NI	NI	NI	NI

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Consistency with Fremont National Forest Land and Resource Management Plan

The proposed activities would be consistent with the Fremont National Forest Land and Resource Management Plan standards for endangered, threatened, and sensitive species.

NOXIOUS WEEDS

- Introduction
- Regulatory Framework
- Analysis Method
- Area of Analysis
  - Toolbox Portion
  - Silver Portion
- Existing Condition
- Environmental Consequences
  - Direct and Indirect Effects
  - Cumulative Effects
- Consistency with Forest Plan and Other Regulatory Framework

Introduction

Since 1995, gathering of site location and size for all known noxious weed sites on the Silver Lake Ranger District has been underway. This information has been put into GIS and is updated on an annual basis. Currently, there are 48 noxious weed sites on the Silver Lake Ranger District totaling 420 acres.

As of 2002, there is a three-year contract in effect for the treatment of noxious weeds on the Fremont portion of the Fremont-Winema National Forests. With this contract in effect, noxious weed treatments in 2002 were successful. Since this contract will be in effect for two more years (2003 and 2004), it is believed that successful treatment of noxious weed sites will continue. Post-Toolbox Complex Fire funding has been made available for the treatment of approximately 185 additional acres over two years. This will aid in the control of previously unknown sites, new infestations that occur as a result of fire suppression activities, and infestations that are a result of weed establishment in burned and disturbed areas.

Regulatory Framework

The Federal Noxious Weed Act of 1974, as amended, requires cooperation with state, local, and other federal agencies in the application and enforcement of all laws and regulations relating to management and control of noxious weeds (USDA Forest Service, 1995a). The Forest Service Manual describes a noxious weed as a plant that is aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being native or new to, or not common to, the United States or parts thereof (USDA Forest Service, 1995c). The 1989 Fremont National Forest Land and Resource Management Plan (LRMP, also referred to as the Forest Plan) provides direction to maintain or improve vegetative conditions as one of the Forest Management Goals (USDA Forest Service, 1989, 49). In the Forest Service Manual (USDA Forest Service, 1995b), the objective states that an integrated weed management approach should be used to control and contain the spread of noxious weeds on and adjacent to National Forest System lands.

In 1998, the Environmental Assessment for the Management of Noxious Weeds (the 1998 EA) was completed for the Fremont National Forest in accordance with the Regional Environmental Impact Statement (EIS) for Managing Competing and Unwanted Vegetation and the Mediated Agreement (USDA Forest Service, 1998, 4). The Decision Notice from this Environmental Assessment selected an alternative that allows a variety of noxious weed treatments, including herbicides (USDA Forest Service, 1998, 4).–The 1998 EA includes noxious weed management over the entire Fremont portion of the Fremont National Forest. The 1998 EA emphasized prevention as the first and most important aspect of noxious weed

management (USDA Forest Service, 1998, 23). Implementing prevention strategies include analyzing the risk of noxious weed invasion during the project planning process and developing tactics to avoid introduction or spread of noxious weeds (USDA Forest Service, 1998, 23). The 1998 EA further quoted the Mediated Agreement, stating, "Although not considered a substitute for prevention, early treatment methods should seriously be considered where prevention alone is insufficient or infeasible" (USDA Forest Service, 1998, 2). A summary of the objectives found in the 1998 EA include to establish and increase awareness of noxious weeds, promote long-term health and productivity of forest and range land ecosystems, and implement treatments that move the Forest towards 100 percent control of invader species (USDA Forest Service, 1998, 2). The 1998 EA analyzed the effects of various treatment methods including manual, biological, cultural, mechanical, and chemical methods.

Analysis Area

Toolbox Fire Portion

The Toolbox Fire portion includes approximately 57,000 acres and lies within the Lower, East, and Upper Duncan Creek, Benny Creek, Middle Silver Creek, and a small portion of Thompson Reservoir and Upper Silver Creek subwatersheds. Within the Toolbox Fire portion, the Forest Service manages the National Forest System lands and the Bureau of Land Management (BLM) manages the remainder of the federal lands. All industrial forestland is owned by U.S. Timberlands, Co., L.P. (UST). There is a small portion of non-industrial forestland within the Toolbox Fire portion as well.

Silver Fire Portion

The Silver Fire portion includes approximately 28,000 acres and lies within the Middle, Upper, and West Fork Silver Creek, and the Thompson Reservoir subwatersheds. Within the Silver Fire portion, the Forest Service manages the National Forest System lands and the Bureau of Land Management (BLM) manages the remainder of the federal lands. Private ownership occurs for both industrial and non-industrial forestlands.

Existing Condition

Currently, weed infestation in the Toolbox project area is relatively low. However, the fires of 2002 created prime habitat for noxious weeds on approximately 85,000 acres on the Silver Lake Ranger District. Of the 85,000 acres, the Toolbox Fire Recovery Project covers 48,000 acres of National Forest System lands. The fires exposed ground surfaces, reduced shade (increased light), and created a flush of nutrients (Goodwin et al., 2002). Native plant species were also consumed. Without the native plant species present, there is little competition against the establishment and spread of noxious weeds.

After reviewing the GIS layer and past survey forms, it was determined there are nine noxious weed sites covering approximately 6.5 acres within the Toolbox Fire portion. Three of the nine sites are infested with Canada thistle, totaling 2.7 acres. One Canada thistle site is scattered over 2.5 acres, while the other two are 0.1 acres each. Musk thistle is present in the remaining six sites, totaling 3.8 acres. Three musk thistle sites are 0.1 acres each, while another site is 0.3 acres in size. The largest musk thistle site is 2.2 acres followed by a site 1.0 acre in size. All nine noxious weed sites within the Toolbox Fire portion are located along roads. There is only one existing noxious weed site that is located within a proposed harvest unit. In Harvest Unit #131, there is a Canada thistle site that is 2.5 acres in size and has plants scattered throughout the site. This is a proposed harvest unit in Alternatives C, E, G, and H. Several years of treatment and monitoring at this site, including summer of 2003 monitoring have apparently resulted in eradication of this site. Continued monitoring during project implementation will be used to insure that this is the case. Adjacent to the Toolbox Fire portion along Graham Creek, there are approximately 13 acres of musk thistle sites. These sites are scattered along a road, but are within one mile of the burn boundary. These sites could potentially increase the risk of noxious weeds spreading into the burned areas.

Inside the boundaries for the Silver Fire portion, there are eight noxious weed sites totaling 5.5 acres in size. Three sites are infested with spotted knapweed totaling 2.1 acres. Two spotted knapweed sites are 1 acre each. Both of these sites have noxious weeds scattered within the 1.0-acre site. The third spotted knapweed site is 0.1 acres in size. There is one St. John's wort site that is 0.1 acre in size. Finally, there are four musk thistle sites within the Silver Fire portion. The largest site is scattered among 3 acres. The other three musk thistle sites are 0.1 acre each. All eight noxious weed sites within the Silver Fire portion are located along roads. Currently, all noxious weed sites are located outside proposed harvest units. Adjacent to the Silver Fire portion, there is one site of medusahead rye that is within one mile of the burned areas. There are also two sites of Canada thistle totaling 3 acres within one mile of the Silver Fire boundary as well. These sites could potentially increase the risk of noxious weeds spreading into the burned area.

The following is a description of the weed species that are known to occur in or near lands within the Toolbox project boundaries. These are the species most likely to spread in the project area.

Canada Thistle

Canada thistle (*Cirsium arvense*) is a perennial species where the majority of the roots are found in the upper two feet of soil, but can have extensive creeping horizontal roots up to 16 feet long and 2 to 22 feet deep (Morishita, 1999). It primarily reproduces vegetatively from horizontal creeping roots, but can also reproduce from seed (Morishita, 1999). Canada thistle can be found in open areas with moderate to medium moisture conditions (Morishita, 1999). In Silver Lake, it is primarily found in drainages and places with above normal moisture for this area. It has also been found in disturbed areas such as roadsides, old landings and skid trails, and road maintenance sites. Canada thistle reacts positively to disturbance. After two to three weeks of being burned in 2002, the underground roots in the Canada thistle sites were already sending up adventitious shoots to replace the burned shoots. In areas where known sites of Canada thistle burned in 2002, it is expected these sites will be denser and larger than they had been in the pre-fire environment. There are known sites of Canada thistle on National Forest System lands, BLM lands, and non-industrial forestlands. Repeated chemical treatments have proven to be successful in reducing the density and eliminating Canada thistle sites on National Forest System lands.

Musk Thistle

Musk thistle (*Carduus nutans*) is a biennial that germinates and grows into a rosette the first season (Beck, 1999). The second season, the plant bolts, produces seeds, and then dies (Beck, 1999). Musk thistle reproduces solely through seeds, which are dispersed by wind, water, wildlife, livestock, and human activities (Beck, 1999). It prefers sites that have had recent disturbance leading to bare soil (Beck, 1999). On the Silver Lake Ranger District, musk thistle occurs frequently in old harvest units, post-burn environments, and along roadways. Musk thistle is known to occur on National Forest System lands. Mechanical and chemical treatment methods have proven to be effective in reducing and eliminating musk thistle sites.

Bull Thistle

Bull thistle (*Cirsium vulgare*) is a biennial with a fleshy taproot. It reproduces solely from seeds that are dispersed by water, animals, human activities, and to a lesser extent, wind. (Beck, 1999). Disturbed areas are prime habitat for bull thistle to invade (Beck, 1999). On the National Forest System lands, bull thistle has been sighted, but has not proven to be an aggressive noxious weed. When it occurs on a disturbed site, it seems to disappear when native vegetation regains its pre-disturbance level. Due to the combination of limited funds and noxious weed species of higher priority, bull thistle has not been actively treated on the National Forest System land within the Fremont portion of the Fremont-Winema National Forests. Bull thistle also occurs on BLM lands and non-industrial forestlands.

Spotted Knapweed

Spotted knapweed (*Centaurea maculosa*) is a deep taprooted perennial species. This species reproduces by seeds, which are dispersed by wind, passing animals, or humans. Spotted knapweed responds favorably to disturbance, but will also invade well-established rangelands (Sheley et al., 1999a). The spotted knapweed sites on the National Forest System lands have decreased in number and size due to manual treatments combined with chemical treatments.

St. John's Wort

St. John's wort (*Hypericum perforatum*) is a perennial species with a deep penetrating taproot (Piper, 1999). It is commonly referred to as goatweed or Klamath weed (Piper, 1999). This species can become established in degraded or pristine range or forestlands (Piper, 1999). Any soil disturbance will decrease competition for St. John's wort and will cause it to increase (Piper, 1999). On the National Forest System lands within the Silver Lake Ranger District, there are two sites of this species. Chemical treatments on both sites have reduced the number of plants present.

Medusahead

Medusahead rye (*Taeniatherum caput-medusae* subsp. *asperum*) is an annual grass that reproduces by seed. The seeds have small silica barbs, which enable the seed to cling to animals, human clothing, and machinery. The seeds are also transported by wind and water. The seeds can germinate in the fall, winter, or spring. If the seed germinates during the fall months, the primary root will grow downwards during the winter and in the spring the lateral roots develop. This gives medusahead rye a competitive advantage over other native plant species. This species likes to invade areas where native vegetation has been weakened by overgrazing, intense fires, or cultivation. Medusahead rye is also capable of maintaining itself in diverse native plant communities (Miller, et al., 1999). This species is present on National Forest System lands, BLM lands, and potentially non-industrial lands.

Mediterranean Sage

Mediterranean sage (*Salvia aethiopis*) is a biennial reproducing primarily by seeds. The seeds are dispersed in a tumbleweed fashion. This species prefers degraded habitats with dry soils, such as roadside cutbanks and other areas of disturbance (Roche and Wilson, 1999). Mediterranean sage is currently present within and adjacent to the Toolbox project boundaries on BLM lands. It is potentially located on non-industrial forestlands as well. Manual and chemical treatments have proven to be effective, but it does take repetitive treatments.

Cheatgrass

Cheatgrass (*Bromus tectorum*) is a nonnative annual grass. The seeds germinate in the fall and survive the winter as a seedling. This gives cheatgrass a distinct advantage over other native species. This species reproduces by seeds, which can be transported by wind, animals, and human contact. Cheatgrass can be found on disturbed sites as well as undisturbed sites. Once cheatgrass is present in a plant community, it has the ability to out compete other native vegetation (Mosley, et al., 1999). This species is known to occur on National Forest System lands, BLM lands, and on non-industrial lands.

There is also potential for new weed species to be introduced to the area. Of particular concern are:

Yellow Star Thistle

Yellow star thistle (*Centaurea solstitialis*) is a winter annual that depends upon seeds for reproduction. The seeds are primarily dispersed by birds; however, animals, whirlwinds, humans, and vehicles also disperse seeds. Yellow star thistle displaces native plant communities and reduces plant diversity. It had been noted to invade sites that have had recent disturbance. Yellow star thistle favors sites originally dominated by perennial grasses, but it does not seem to compete well with sagebrush, except in disturbed areas (Sheley et al., 1999b). Currently, National Forest System lands and BLM lands do not have known occurrences of this weed. However, with the disturbance created by the fire suppression activities and the amount of suppression equipment and personnel that were from outside the local area, the chance of this species appearing is greater than ever before.

Leafy Spurge

Leafy spurge (*Euphorbia esula*) is a long-lived perennial with deep taproots. It reproduces either by seeds or vegetatively. Leafy spurge can be found along roadsides, in abandoned croplands, and other areas that have been disturbed. This species is highly competitive and can displace native vegetation creating a monoculture (Lajeunesse et al., 1999). Leafy spurge has been found in several sites on the Fremont portion of the Fremont-Winema National Forests on the Bly Ranger District. This noxious weed species poses a threat to the burned areas. With all the fire suppression equipment and personnel from outside the local area, there is a potential for this weed species to appear within the Toolbox project boundaries.

Dalmatian Toadflax

Dalmatian toadflax (*Linaria dalmatica*) is a deep-rooted perennial species that reproduces by seeds and by vegetative buds on the roots. Reproduction by seed is more important for initiating new toadflax infestations, while vegetative buds on the roots is important for increasing the plant density of a site. Dalmatian toadflax can be found invading disturbed sites such as roadbanks, areas near dwellings, and gravel pits (Lajeunesse, 1999). As of 2002, there is one site on the National Forest System lands within the Silver Lake Ranger District. This site consisted of one plant that was manually removed. There will be future monitoring of this site and adjacent area for additional plants.

On federal lands, all noxious weed sites within and adjacent to the Toolbox project boundaries have been given top priority for treatment in 2003 and 2004. Gravel pits designated for use in road maintenance/construction for the Toolbox project have been surveyed and are currently weed free. The number of sites and locations of noxious weeds on industrial or non-industrial forestlands are unknown.

Environmental Consequences

Direct and Indirect Effects

Effects Common to All Alternatives

Noxious weed spread may occur in the project area, regardless of which alternative is chosen. The fire created suitable habitat for weeds, and weed seeds are readily dispersed by wind, vehicles, and animals. Additionally, as described in the cumulative effects section, fire suppression activities may have introduced noxious weeds to the area, and ground-disturbing activities on adjacent land ownerships may increase weed spread in the area.

The consequences of noxious weed infestation can include alteration of the structure, organization, or function of ecological systems (Olson, 1999). Noxious weeds can increase soil erosion, leading to a disproportionate loss of biologically active organic matter and nitrogen. Noxious weeds have the ability to deplete soil water and nutrients to levels lower than native plant species can tolerate, allowing noxious weeds to out-compete native vegetation. Many noxious weeds are early successional species, meaning they colonize areas that have been recently disturbed. Since noxious weeds have the ability to deplete available resources to lower levels than native vegetation, they can quickly dominate the disturbed site. When noxious weeds dominate over native plant communities, native plant species diversity is decreased. Noxious weeds can out compete native species because they produce abundant seed, have fast growth rates, have no natural enemies, and are often avoided by large herbivores. Some noxious weeds also produce secondary compounds, which can be toxic to other native plant species, or animals. Weed infestation can therefore lead to a decrease in native plant species, which can alter the ability of wildlife to find suitable, edible forage.

At the watersheds level, noxious weeds can alter the seasonal water flow. Noxious weeds create more erosion than native plant species because they have fewer shallow roots, which would soak up and hold water. Noxious weeds also have less canopy closure than native plants. This increases the amount of sunlight directly hitting the soil, increasing the amount of water evaporated at the soil surface. This creates a hard crust on the soil, which becomes difficult for additional moisture to penetrate. When moisture cannot penetrate into the soil, this leads to increased soil surface run-off. The moisture held by the soil helps maintain stream levels throughout the summer. When noxious weeds are present, there is an increase in erosion and surface run-off, leading to a deterioration in watershed conditions.

The Toolbox Fire Recovery Project (Toolbox project) area would be monitored for noxious weeds under all of the alternatives. With the 1998 Environmental Assessment for the Management of Noxious Weeds (the 1998 EA) and the Forest Service noxious weed treatment contract in effect, regardless of which alternative is chosen for the Toolbox project, noxious weed sites on National Forest System lands will be treated in accordance with funds available. In addition to the funding for the noxious weed treatment contract, post Toolbox Complex Fire funding has been made available for the treatment of approximately 185 additional acres over two years. This will aid in the control of previously unknown sites, new infestations that occur as a result of fire suppression activities, and infestations that are a result of weed establishment in burned and disturbed areas. The noxious weeds found inside and surrounding the Toolbox Fire portion on National Forest System lands have been given top priority for treatment in 2003 and 2004.

In the short term, the alternatives would affect the potential for noxious weed infestation in the project area in two main ways. First, ground disturbing treatment activities, such as harvest activities and temporary road construction, would increase the amount of open disturbed habitat available for infestation. Second, increased activity and traffic would heighten the chance for introduction of noxious weed seeds from vehicles and equipment. The potential for noxious weed infestation would therefore increase with the amount of ground disturbing activity in each alternative.

In the long term, the alternatives would affect the recovery of native vegetation and reduction of open, disturbed habitat over time. Reforestation and re-establishment of tree canopy would reduce the amount of open habitat suitable for noxious weed establishment. Likewise, road decommissioning and lowering road density would reduce disturbed habitat and corridors for weed infestation.

Long-term impacts also include the potential for future high intensity fires, which would create additional area at risk to weed infestation. This risk decreases as the amount of fuel reduction activities increase.

Timber sale contracts, road packages, stewardship pilot projects, and service contracts are now required to include provisions to minimize the introduction and spread of invasive plants, pursuant to Executive Order 13112 dated February 3, 1999 (Joyner, 2002) (see mitigations in Chapter 2). These provisions state that the Purchaser/Contractor shall certify in writing that off-road equipment is free of noxious weeds prior to the start-up of timber sale, road, or other activities requiring off-road equipment operations and for subsequent moves of equipment to Sale Area. Being free of noxious weeds means the equipment will not have soil, seeds, vegetative matter, or other debris that could contain or hold seeds. “Off-road equipment” includes all logging and road construction machinery, and service contract equipment, except for log trucks, chip vans, service vehicles, water trucks, pickup trucks, cars, and similar vehicles. Equipment such as skyline yarders, brush cutters, flailers, or other equipment, which operate from the road surface shall be considered off-road equipment. This direction applies to road construction and reconstruction, logging, building of temporary roads, service contracts, or any project with operations involving “Off-road equipment.” The purchaser must also clean off-road equipment prior to moving between cutting units that are known to be infested with noxious weeds and units that are free of noxious weeds (USDA Forest Service, Region 6, 2002). This requirement would reduce the potential for introduction of weed seeds during implementation of the action alternatives.

Alternative A

The no action Alternative would leave the proposed activity areas in their post-fire condition. Additional fire recovery activities would not occur on National Forest System lands, other than completion of activities proposed by the Burned Area Emergency Recovery (BAER) plan (Appendix A, Table A-7). Without additional ground disturbing activities occurring, noxious weed habitat and the potential for new introductions would not be increased above the existing condition. The existing 6.5 acres of noxious weeds in the Toolbox Fire portion and the 5.5 acres in the Silver Fire portion will be monitored and given priority for treatment in 2003 and 2004.

With additional activities not occurring within the Toolbox Fire portion for Alternative A, this means that predicted fuel accumulations would be the highest for Alternative A. Higher fuel accumulation would increase the probability for future high intensity fires, which would create additional noxious weed habitat.

In the no action Alternative, roads would be left in their current condition. Closing and revegetating roads as proposed in all other alternatives would assist in preventing noxious weed spread. Alternative A would not reforest severely burned areas. If reforestation activities do not occur, the length of time for a forested canopy to grow and assist in shading out noxious weeds would be greater than in the action alternatives.

Noxious weed spread many occur in the project area if Alternative A is chosen. However, because of the lack of additional ground disturbance, Alternative A has the lowest probability of spreading and introducing noxious weeds when compared to Alternatives C, D, E, G, or H (see the following table).

Table 3.190 Factors Affecting the Risk of Noxious Weed Infestation in the Toolbox Project.

	Factors Increasing Risk Short-term		**Factors Decreasing Risk Long-term**			**Comparative Risk**
Alternative	**Acres of Ground Disturbance***	**Miles Temp Road Constructed****	**Acres Reforested**	**Road Density *****	**Acres of Fuel Treatment ********	
A	0	0	0	3.7	0	low
C	18,013	37.4	20,906	1.7	10,244	high
D	8,817	5.7	20,743	1.7	5,680	medium
E	11,490	29.0	20,753	2.5	6,723	medium
G	23,587	37.4	20,728	2.5	11,354	high
H	15,481	34.6	20,721	1.7	9,070	high

* Ground Disturbance was compiled using proposed harvest acres and prescribed burning acres. For Alternative G, the additional fuels treatments outside harvest units were included here.

** The figures in this column show the miles of new temporary roads that would be constructed in addition to the miles of unclassified roads that would be re-opened. In Alternative D, only re-opening of unclassified roads would occur.

*** Road Density is measured in miles of road per square mile of land. The value in the column represents the density of roads that would remain open after proposed activities are completed for each alternative. In Alternative A, the roads would be left in their current condition.

**** These figures encompass the additional fuels treatments within harvest units that are predicted to have greater than 20 tons per acre (TPA) for Alternatives C, D, G, and H. For Alternative E, these acres are predicted to have greater than 30 TPA.

Alternative C, E, G, and H

Alternatives C, E, G, and H are being grouped together due to their similar levels of proposed activities. Alternatives C, E, G, and H propose a range of approximately 11,500-14,500 acres of commercial salvage for the Toolbox project. The potential for weed invasion and spread would vary slightly among these alternatives based on the amount of activities proposed, which are shown in Table 1.

The Canada thistle site in Harvest Unit #131 and any new sites discovered in or near units during monitoring and unit layout would receive priority for treatment in 2003 and 2004 in an attempt to eradicate the sites before harvest and other ground disturbing activities occur. If existing or newly discovered noxious weed sites are not eradicated before harvest

activities occur, construction of landings and skid trails would not be permitted on these noxious weed sites (see mitigations in Chapter 2).

Alternatives C, G, and H are proposing to conduct activities fuels treatment in harvest units that are predicted to have greater than 20 tons per acre (TPA) of ground fuel accumulation in 15 years. Reducing the ground fuel accumulation would reduce the potential for future high intensity fires, thus decreasing the possibility of creating additional noxious weed habitat. Alternative E is proposing to conduct activities fuels treatments in harvest units that are predicted to have greater than 30 TPA of ground fuel accumulation in 15 years. This would help reduce the potential for future high intensity fires as well. For Alternative E, fewer acres of activities fuels treatments would occur than in Alternatives C, G, and H. Therefore, Alternative E would not reduce the threat of future high intensity fires as efficiently as Alternatives C, G, or H. In the short-term, activities fuel treatment would create ground disturbance, increasing the habitat for noxious weeds. In the long-term, reducing the probability of future high intensity fires would decrease the probability of creating noxious weed habitat.

In addition to the activities fuels treatments that are proposed to occur in harvest units in Alternative C, E, G, and H, Alternative G is proposing additional fuels treatments on National Forest System lands that are within a quarter mile of private lands. This would mean fuels treatments outside harvest units and additional activities fuels treatments within harvest units. The additional activities fuels treatments would reduce the probability of fire spreading between private and National Forest System lands. In terms of proposed activities fuels treatments, Alternative G would have the most, thus decreasing the potential for future high intensity fires more efficiently than Alternatives C, E, and H. In the short-term, activities fuel treatment would create additional ground disturbance, increasing the habitat for noxious weeds. In the long-term, reducing the probability of future high intensity fires would decrease the probability of creating noxious weed habitat.

Alternatives C, G, and H propose a range of 2,400 to 3,500 acres of prescribed burning within the Toolbox Fire portion. Two noxious weed sites are adjacent to the proposed burn area. One noxious weed site is infested with Canada thistle that is 0.1 acre in size. The second site is musk thistle that is 0.1 acre in size. These sites would be a priority for weed treatment in 2003 and 2004 to number of plants in the sites, if not eliminate all the plants from the site. Prescribed burning would create additional ground disturbance, possibly increasing the habitat for noxious weeds. Prescribed burning outside of activities fuels treatments is not a proposed activity in Alternative E. There is also no proposed prescribed burning for the Silver Fire portion.

Alternatives C, E, G, and H would reforest approximately 20,700-20,900 acres each of severely burned areas, speeding the establishment of a forest canopy, which would assist in shading out weeds (see the preceding table).

Within the Toolbox project, Alternatives C, E, G, and H propose to construct new temporary roads or re-open existing unclassified roads. Alternatives C and G propose to construct or re-open 37.4 miles of roads, while Alternative H proposes 34.6 miles and Alternative E proposes 29.0 miles. When activities behind the newly constructed or re-opened roads are completed, these roads would be closed or decommissioned. In the short-term, construction of new temporary roads and re-opening of existing unclassified roads would create additional noxious weed habitat. When these roads are eventually closed or decommissioned noxious weed habitat and corridors would be eliminated.

Watershed improvement projects, such as decommissioning existing roads, would assist in preventing noxious weed spread by closing off corridors. Alternatives C and H propose reducing road density to 1.7 miles of road per one square mile of land. Alternatives E and G proposed reducing road density to 2.5 miles of road per one square mile of land. These activities would help eliminate noxious weed habitat and corridors for seed dispersal.

Overall, Alternatives C, E, G, and H have a relatively high potential for introducing and spreading noxious weeds due to the amount of ground disturbing activities when compared to Alternatives A and D (see the preceding table). Mitigation measures to address this potential impact may be found in the Mitigation and Resource Protection Measures section of Chapter 2.

Alternative D

In Alternative D, approximately 6,400 acres is proposed for commercial salvage. All the known noxious weed sites exist outside of proposed harvest units. Therefore, harvest activities would not disturb known noxious weed sites. Any new sites discovered in or near units during monitoring and unit layout would receive priority for treatment in 2003 and 2004, in an attempt to eradicate the sites before harvest and other ground disturbing activities occur.

In Alternative D, prescribed burning is not a proposed activity outside of activities fuels treatments. This would not create additional ground disturbance, therefore noxious weed habitat would not be increased.

Alternative D would reforest 20,700-20,900 acres of severely burned areas, speeding the establishment of a forest canopy, which would assist in shading out weed (see the preceding table).

Within the Toolbox Fire portion, Alternative D does not propose to construct new temporary roads, but proposes to re-open 5.7 miles of existing unclassified roads. This would not increase noxious weed habitat in the short or long-term.

Watershed improvement projects, such as decommissioning existing roads, would assist in preventing noxious weed spread by closing off corridors. Alternative D proposes reducing road density to 1.7 miles of road per one square mile of land. This activity would help eliminate noxious weed habitat and corridors for seed dispersal.

Alternative D proposes a lower amount of harvest activities and activities fuels treatments when compared to Alternatives C, E, G, or H (see the preceding table). In the short-term, there would be less ground disturbing activities occurring in Alternative D than the other action alternatives, which means less noxious weed habitat would be created than for Alternatives C, E, G, or H. Alternative D is less effective at treating fuels than the other action alternatives, which would increase the potential for future high intensity fires in the long term (see the preceding table). Alternative D would create more short-term noxious weed habitat due to the proposed ground disturbing activities than Alternative A. In the long-term, Alternative D would be more effective in reducing ground fuel accumulation than Alternative A, which would increase the potential for future high intensity fires in the long term (see preceding table).

Cumulative Effects

Common to All Alternatives

Within Appendix A, the past, present, and reasonably foreseeable future activities are provided in a table format. All the activities listed in Appendix A tables were considered when compiling this report. However, only some of the activities mentioned in Appendix A have the potential to produce cumulative effects on noxious weed spread and establishment. These activities will be disclosed and discussed below.

Past Activities:

Suppression activities within the Toolbox Fire portion, including retardant, and firing/burnout operations, in conjunction with dozer line, were used (Appendix A, Table A-1). There were approximately 236 miles of dozer line constructed for suppression reasons (140 miles constructed in the Toolbox Fire portion and 96 miles in the Silver Fire portion) (Appendix A, Table A-1). Some of the dozer lines are located outside the Toolbox project boundaries; however, all the dozer lines will be included within the cumulative effects analysis. The dozer line created prime habitat for noxious weeds. With the magnitude of the Toolbox Complex Fire, additional resources were brought in from places that are outside Lake County. This influx of equipment, personnel, and vehicles may have introduced noxious weed seeds. There is a possibility that the amount of noxious weed sites would increase, especially in the rehabilitated dozer lines. There is also a possibility that different noxious weed species would appear due to the broad geographical range the equipment, personnel, and vehicles came from.

During the time when the Toolbox Complex Fires were burning, a third fire, the Winter Fire, was burning just southeast of the Toolbox fire. The Winter fire burned approximately 34,000 acres (USDA Forest Service,2003, Chapter 1). This fire burned on the east side of Winter Rim from the Toolbox Fire portion side. Suppression activities may have introduced weeds in this fire as well. Due to the proximity of the Toolbox Fire portion to the Winter Fire, it is possible that the activities occurring on the Winter Fire could have a cumulative effect on noxious weed spread and establishment within the Toolbox Fire portion. Because the Winter Fire is several miles away from the Silver Fire, the Winter Fire is unlikely to affect noxious weed spread in the Silver Fire .

The treatment of noxious weeds has been occurring on the National Forest System lands as well as BLM lands in past years. Accurate documentation of noxious weed sites began occurring around 1995 for National Forest System lands. After the 1998 Environmental Assessment for Management of Noxious Weeds for the Fremont National Forest (1998 EA) was approved, chemical treatment was permitted for use on National Forest System lands. In 2002, the Forest Service and BLM began separate three-year contracts for the treatment of noxious weeds. Past treatment of noxious weeds has not only reduced the number of existing sites, but within the noxious weed sites still remaining, the density of plants has been reduced considerably on both National Forest System and BLM lands (Appendix A, Table A-4).

Present and Future Foreseeable Activities:

Present and future ongoing treatment of noxious weeds on all ownerships is listed in Appendix A, Table A-14.

As a response to the Toolbox Complex Fire, the Bureau of Land Management (BLM) wrote a Burned Area Emergency Stabilization and Rehabilitation (ESR) Plan Environmental Assessment. A summary of the activities proposed by the BLM can be found in Appendix A, Table A-15. For the Toolbox Fire portion, ground-disturbing activities include salvage harvest on 71 acres and juniper thinning on 1,650 acres. These activities will reduce future fuel accumulation. Revegetation activities include seeding on 1,650 acres, and planting ponderosa pine and bitterbrush seedlings on 600 acres within the Lower Duncan Creek subwatershed (Appendix A, Table A-15). For the Silver Fire portion, the BLM proposes to juniper thin on 3,000 acres within the Middle, Upper, and West Fork Silver Creek subwatershed, seed on 290 acres within the Middle and Upper Silver Creek subwatershed, and plant ponderosa pine and bitterbrush seedlings on 250 acres within the Upper Silver Creek subwatershed (Appendix A, Table A-15).

Seeding and planting seedlings will provide competition against noxious weeds and nonnative species in the newly disturbed areas. Prior to the fires of 2002, the BLM had known noxious weeds (Canada thistle, medusahead rye, and Mediterranean sage) and nonnative species (cheatgrass) on their lands within the Toolbox Fire portion (USDI Bureau of Land Management, 2003). The potential for medusahead rye to invade National Forest System lands is high due to its presence along most roads in the Dead Indian Rim and Duncan Creek areas (USDI Bureau of Land Management, 2003). The BLM has a contract with a private entity for the treatment of noxious weed sites. This will help reduce the spread and establishment of noxious weeds and nonnative species. The BLM has placed all the noxious weeds and nonnative species within and surrounding the Toolbox Fire portion as a top priority for treatment in 2003. The proposed seeding and seedling plantings, in conjunction with weed treatments on BLM lands, reduces the threat of noxious weeds and nonnative species spreading onto National Forest System lands.

The industrial forestlands within the Toolbox Fire portion are owned by U.S. Timberlands Co., L. P. (UST). UST also owns industrial forestlands within the Silver Fire portion as well. The activities and the numbers presented below are for all UST lands within the Toolbox project boundaries. It is unknown exactly where the following will occur. However, industrial forestlands are far more prominent on the Toolbox Fire portion than the Silver Fire portion. Approximately 23,200 acres of UST lands burned within the Middle Silver Creek, Benny Creek, Lower, East, and Upper Duncan Creek subwatershed. Ground disturbing activities include harvest of both dead and green timber on approximately 16,000 of the 23,200 acres. These activities will reduce future fuel accumulation in the area. The majority of the salvage logging operations was conducted in the fall of 2002, and the remainder will be completed in 2003. In 2003, UST is planning on conducting approximately 5,000 acres of site preparation by ripping. Additional site preparation may be conducted if areas are found to require ripping prior to planting. Revegetation activities include replanting approximately 18,000 acres (10,000 acres from salvage, 6,000 acres from logging prior to the fires, and 2,000 acres from burned plantations) (Appendix A, Table A-13). In 2003, approximately 8,400 acres will be planted and the remaining acres in 2004 (Appendix A, Table A-13).

Since UST conducted the harvest operations during the fall and winter, native plant recovery will be greater than if harvest activities had occurred during the spring and summer. Harvest operations conducted in the fall and winter also reduced the probability of spreading noxious weed seeds to non-infested areas during harvest activities. Noxious weed and nonnative species occur on UST lands, but the location and size of the sites are unknown. Planting tree seedlings will help provide competition against noxious weeds and nonnative species in the long-term. Currently, treatment of noxious weed and nonnative species discovered on lands owned by UST is not scheduled to occur. Overall, with the volume of salvage logging and disturbance occurring on UST lands, there is potential for noxious weeds to become established there, and spread onto National Forest System lands.

Another industrial forestlands owner is Wasser and Winters Company. Their land is located within the Silver Fire portion; however, they chose not to conduct salvage harvest on this land because there was not enough commercial volume remaining after the fires. Wasser and Winters Company is also tentatively relying on natural regeneration by lodgepole pine. Therefore, additional activities are not planned to occur on their lands.

For the non-industrial forestlands within the Toolbox Fire portion, some owners are planning to harvest both dead and green timber to make the harvest activities profitable. They also plan to plant the lands that do not reach State of Oregon density requirements. It is unknown where noxious weed sites occur or by what means non-industrial forestlands owners plan to treat noxious weeds. However, non-industrial forestland owners are aware of the problems noxious weeds create and are trying to eliminate noxious weeds on their lands.

On-going Forest Service projects in the Toolbox Fire portion include part of the Triad Restoration project and part of the Windmill Restoration project (see Elston, R., 2003, “Toolbox Fire Recovery Project – Future Activity Already Covered with NEPA Decisions” in the Toolbox Fire Recovery Project analysis file). A summary of this report can be found in Table

A-16 of Appendix A. The Silver Fire portion has ongoing Forest Service projects as well, including part of the Triad Restoration project and a portion of the West Fork Silver Creek Restoration Project. In the areas of overlap between these restoration projects and the Toolbox project boundary, noxious weeds are not present. For these restoration projects, minimal project implementation will occur in the future for the area of overlap within the Toolbox project boundary.

The Winter Fire Salvage and Restoration Environmental Assessment (USDA Forest Service, 2003) proposes activities on National Forest System lands in the adjacent Winter Fire. Ground disturbing activities include salvage logging. These treatments would reduce future fuel accumulation in the area. Reforestation would occur in harvested units.

Approximately 69 acres within the Winter project area are currently infested with noxious weeds (USDA Forest Service, 2003, Chapter 3, p. 56). With the proposed harvest activities, there is a potential for spreading noxious weeds into uninfested areas. However, the Winter Environmental Assessment proposes to conduct the majority of harvest operations using helicopters instead of ground-based equipment, which will help reduce the amount of ground disturbance and noxious weed habitat created. Treatment of weeds in the Winter project area is on going and will be a priority in 2003 and 2004, reducing the potential for spread into the Toolbox Fire portion.

The Toolbox project overlaps four existing cattle grazing allotments (Foster Butte, Yamsay Mountain, Buck Creek, and Winter Rim). Grazing will continue in the project area in 2003, with reduced numbers in the Winter Allotment, Yamsay Allotment, and three out of the six pastures in the Foster Butte Allotment. Monitoring will take place during the 2003 season to determine if standards are being met. The affect of livestock grazing on noxious weed spread is not well studied and appears to vary under different circumstances. Grazing can potentially contribute to noxious weed spread by creating ground disturbance, removing competing native vegetation, and dispersing weed seeds. Grazing is also used in some systems as a control method to reduce noxious weed seed production. Grazing has occurred on National Forest System lands in the Toolbox project area for decades at higher numbers than will occur in 2003, with apparently little effect on weed infestation. Currently, only .03 percent of National Forest System land in the Toolbox project area is infested. It is therefore expected that grazing will have a minor impact on noxious weed spread compared to proposed and on-going ground disturbing activities such as salvage logging.

When cattle are brought onto National Forest System lands, they are unloaded in designated areas. District range personnel monitor these unloading sites for noxious weeds regularly. Currently, new noxious weed infestations have not been observed at the designated unloading sites.

Alternative A

Alternative A would not contribute to cumulative ground disturbing activities in the Toolbox project, and, therefore, would not contribute to increased noxious weed habitat or increased risk of weed introductions. Ground disturbing activity on adjacent lands will increase the potential for weed infestation on National Forest System lands in the Toolbox project. The BLM is planning harvest activities on 71 acres, all within the Toolbox Fire portion. Overall, 8,000 acres of BLM lands burned in the Toolbox Complex Fire. Therefore, the BLM is harvesting less than 1 percent of their burned lands. UST has or will have harvested approximately 16,000 acres of the 23,200 acres within the Toolbox project boundary, or 68 percent, with the majority of the harvest activities occurring within the Toolbox Fire portion. Cumulative ground disturbing activities, such as salvage logging and prescribed fire, on all land ownerships would occur on approximately 16,071 acres out of 85,000 acres, or an estimated 19 percent of the Toolbox project area with this alternative.

Alternative A would not contribute to cumulative fuel reduction in or near the Toolbox project, and therefore would result in a higher risk of future severe fires which could create additional noxious weed habitat, compared to the action alternatives.

Alternative A would not contribute to cumulative restoration of native vegetation in the area. On National Forest System lands, the time for a forested canopy to grow and assist in shading out noxious weeds would be longer for this alternative than for the action alternatives.

Alternatives C, E, G, and H

Alternative C proposes ground disturbing activities over approximately 18,000 acres and proposes 37.4 miles of roads be constructed or re-opened (see preceding table). The acres of harvest for BLM and UST would be the same as mentioned above in Alternative A. Therefore, cumulative ground disturbing activities, such as salvage logging and prescribed fire, on all land ownerships would occur on approximately 34,071 acres, or an estimated 40 percent of the Toolbox project area.

Alternative E proposes 11,490 acres of ground disturbing activities and 29.0 miles of roads to be constructed or re-opened. Therefore, cumulative ground disturbing activities for all land ownerships would occur on approximately 27,560 acres, or an estimated 32 percent of the Toolbox project area.

Alternative G proposes 23,590 acres of ground disturbing activities and 37.4 miles of roads to be constructed or re-opened. Therefore, cumulative ground disturbing activities for all land ownerships would occur on approximately 38,660 acres, or an estimated 47 percent of the Toolbox project area.

Alternative H proposes 15,480 acres of ground disturbing activities and 34.6 miles of roads to be constructed or re-opened. Therefore, cumulative ground disturbing activities for all land ownerships would occur on approximately 31,550 acres, or an estimated 37 percent of the Toolbox project area.

Overall, Alternative G would have the most cumulative ground disturbing activities, followed by Alternative C, Alternative H, and Alternative E.

These alternatives would result in a substantial increase (32 to 47 percent) in suitable weed habitat and risk of noxious weed introduction in the area as a whole. Mitigations described in Chapter 2, along with early detection and treatment would be used to help reduce the risk of weed spread on National Forest System lands.

As described under Direct and Indirect Effects, Alternatives C, E, G, and H would contribute to cumulative fuel reduction activities in or near the Toolbox Fire portion, and would result in a lower risk of future high intensity wildfire than Alternatives A and D. Future high intensity fires could create additional weed habitat.

Alternatives C, E, G, and H would contribute to cumulative restoration of native vegetation in the area, decreasing the length of time for a forested canopy to grow and assist in shading out noxious weeds than would occur under Alternatives A and D.

Alternative D

Alternative D proposes ground disturbing activities over approximately 8,870 acres and proposes 5.7 miles of roads be constructed or re-opened (preceding table). The acres of harvest for BLM and UST would be the same as mentioned above in Alternative A. Therefore, cumulative ground disturbing activities, such as salvage logging and prescribed burning, on all land ownerships would occur on approximately 24,940 acres, or an estimated 29 percent of the Toolbox project area.

Alternative D would result in the least amount of cumulative ground disturbance of the action alternatives. Mitigations described in Chapter 2, along with early detection and treatment would be used to help reduce the risk of weed spread on National Forest System lands.

As described under Direct and Indirect Effects, Alternative D would contribute to cumulative fuel reduction activities in or near the Toolbox Fire portion, and would result in a lower risk of future high intensity wildfire than Alternatives A, but a higher risk than the other action alternatives. Future high intensity fires could create additional weed habitat.

Alternative D would contribute to cumulative restoration of native vegetation in the area, decreasing the length of time for a forested canopy to grow and assist in shading out noxious weeds than would occur under Alternative A.

Consistency with Fremont National Forest Land and Resource Management Plan

All alternatives would be consistent with Forest Plan goals to maintain or improve vegetative conditions. Mitigation measures listed in Chapter 2 have been designed to prevent the spread and infestation of noxious weeds.

RANGE

- Introduction
- Analysis Area
- Regulatory Framework
- Permitted Livestock and Grazing Management
- Existing Condition
- Environmental Consequences,
    - Direct and Indirect Effects
    - Cumulative Effects
- Non-Forested Plant Communities
- Existing Condition
- Environmental Consequences
    - Direct and Indirect Effects
    - Cumulative Effects
- Consistency with Forest Plan and Other Regulatory Framework

Introduction

This range section includes analysis for two components of range management. The first component, *Permitted Livestock and Grazing Management*, discusses effects, if any, on the portions of four permitted livestock allotments on the Fremont/Winema National Forests (NF) that are within the Toolbox Fire Recovery Project analysis area. The decision to allow grazing in 2003 on all of the allotments within the project area was made with interdisciplinary input and included modifications to permitted use, specific mitigations where necessary, or both. Modifications to permitted livestock grazing are outside the scope of this analysis. Any modifications to the Term Grazing and Term Private Land Permits within the analysis area were made in response to a change in resource condition and are in compliance with Part 1.3 of the permits issued, 36 CFR 222.4, and within the direction of the Forest Wide Standards for Range Management in the Fremont National Forest Land and Resource Management Plan (1989).

The second component, *Non-Forested Plant Communities*, details the expected effects the alternatives will have on six non-forested plant communities within the project area, as well as the vegetative condition cumulative effects.

Analysis Area

Analysis of the effects alternatives would have on permitted livestock grazing includes the four allotments that have portions within the project area. Those allotments are Buck Creek, Foster Butte, Winter Rim, and Yamsay Mountain. Analysis of effects on non-forested plant communities includes the entire Toolbox project area.

Regulatory Framework

The statutory authorities to protect, manage, and administer the National Forest System lands and other lands under the Forest Service administration for range management purposes, as well as the regulatory authorities and administrative

orders pertaining to range resources and permitted livestock grazing, are summarized in Forest Service Manual 2200 and are found at 36 CFR 222.1. The Fremont National Forest Land and Resource Management Plan (1989) includes Forest-wide Standards for range management, including general Standards and Guidelines for managing the resource for healthy range with satisfactory conditions. The LRMP also includes Standards and Guidelines for range/livestock management intensities, range administration, allotment management planning, and noxious weed control.

Permitted Livestock and Grazing Management

Existing Conditions

Definitions

- Early Season –Livestock grazing occurs in the spring of the year following green up and continues to mid-summer - May 1 through July 15.
- Deferred - A delay of livestock grazing on an area for an adequate period of time to provide for plant reproduction, establishment of new plants, or restoration of vigor - July 15 through October 15
- Rotation - A grazing scheme where animals are moved from one grazing unit in the same group of grazing units to another without regard to specific graze rest periods or levels of plant defoliation - no specific dates
- Deferred Rotation - A grazing system that provides for a systematic rotation of the deferment among pastures - July 15 through October 15
- Transitory Range - Land which produces forage or has inherent forage producing capabilities and can become available on a temporary basis as a result of partial or complete removal of the vegetation through fire, logging, or other events.
- Forest Range Environmental Study (FRES) Management Level - A level assigned to an allotment that reflects the management practices currently in place. These management levels are used to set allowable use of forage within an allotment and/or a pasture.
- Level C - Livestock are managed to achieve full utilization of allocated forage. Management systems are designed to obtain distribution and maintain plant vigor. Riding, herding, salting, fencing, and water developments are part of the management on these allotments.

Permitted Use

The following table displays the permitted use on Buck Creek, Foster Butte, Winter Rim, and Yamsay Mountain allotments. The Foster Butte and Winter Rim allotments are included in the Upper Sycan Range Analysis for permit re-issuance, scheduled for the next two years. Range analysis for permit re-issuance for the Buck Creek and Yamsay Mountain allotments is scheduled for 2007.

Table 3.191 Range – Permitted Use on Allotments Within the Toolbox Fire Recovery Project Area

Allotment	Size (Acres)	Permitted Use							System	FRES Mgt. Level
		Dates	Head Months (HMs)			Animal Unit Months (AUMs)				
			USFS	Private	Total	USFS	Private	Total		
Buck Creek	37,237	6/1-9/30	1,003	1,005	**2,008**	1,331	1,336	**2,667**	Early Season / Deferred Rotation	C
Foster Butte	138,247	6/1-9/30	4,280	1,931	**6,211**	5,681	2,551	**8,232**	Early Season	C
Winter Rim	12,191	6/25-9/24	853	0	**853**	1,129	0	**1,129**	Deferred Rotation	C
Yamsay Mtn.	11,719	7/16-9/31	309	0	**309**	405	0	**405**	Deferred	C

FRES=Forest Range Experimental Study

Current Management

All of the allotments were used during the 2003-grazing season. One allotment was used as permitted. Modifications were made to use permitted on three allotments. In addition, specific mitigation measures were in place on one allotment. Modifications and specific mitigations to permitted head months, season of use and grazing systems are detailed in the following table. Modifications to the Term Grazing and Term Private Land Permits within the analysis area were made in response to a change in resource condition and are in compliance with Part 1.3 of the permits issued, 36 CFR 222.4, and within the direction of the Forest Wide Standards for Range Management in the Fremont National Forest Land and Resource Management Plan.

Table 3.192 Range – 2003 Authorized Use for Allotments Within the Toolbox Fire Recovery Project Area

Allotment	2003		Mitigations 2003
	Head Months	AUMs	
Buck Creek	1,078*	1,423*	HM/AUM reduction
Foster Butte	4,368*	5,766*	HM/AUM reduction Site Specific - Use herding to decrease utilization
Winter Rim	853	1,129	
Yamsay Mt	155*	205*	HM/AUM reduction

*Modification in response to change in resource condition

Grazing Permit Analysis

The purpose of this project, as described in the Purpose and Need statement in Chapter 1, does not include analysis or decisions related to permitted livestock grazing. Modifications necessary as a result of change in resource condition have been made as described in the Current Management section. Analysis, which results in the development of allotment management plans, is scheduled prior to 2010 for all of the allotments within the project area.

Burned Acres

Approximately 1,557 acres in the Winter Rim Allotment, 380 acres in the Buck Creek Allotment, and 428 acres in the Yamsay Mountain Allotments are outside the project area but within the boundaries of the 2002 fires. These acreages are not part of direct effect analysis in the *Permitted Livestock* section, as they are outside the project area being analyzed and no activities related to this project would be occurring there. However, data on these acres was made available for cumulative effects analysis, as well as for decisions made outside this analysis on grazing for the 2003 season.

Acreages within each allotment that are within the boundary of the 2002 fires and in the project area are listed in the following table. Although included within a fire boundary, not all of the acres burned. Fire severity determination was completed as part of the Burned Area Emergency Rehabilitation (BAER) efforts in the project area. The terms severity and intensity have often been used in different ways in different arenas. They are even sometimes used interchangeably and are often confused. For example, the Toolbox Complex BAER report (for the entire Toolbox Complex) indicated that 74,673 acres burned with low severity, 11,311 acres with moderate severity, and 810 acres with high severity. However the maps that accompanied that report instead displayed "burn intensity." There were three severities defined: low, moderate, and high. Areas defined as low severity sites included understory burn and un-burned areas (BAER report, 2002). The BAER report shows that 86 percent of the Toolbox Complex area was defined at low severity. BAER fire severity does not reflect conifer mortality as represented in the September 2002 mortality mapping completed for this project.

Table 3.193 Range – Allotment Acres Within the Toolbox Fire Recovery Project Area

Allotment	Total Allotment Acres	Acres within the Project Area
Buck Creek	37,237	613
Foster Butte	138,247	60,297
Winter Rim	12,191	1,783
Yamsay Mt	11,719	8,688

Environmental Consequences

Direct and Indirect Effects

Common to All Alternatives

None of the proposed alternatives would affect permitted use for the allotments within the project area. Modifications to permits in response to a change in resource condition could still be made in accordance with Part 1.3 of the Term Grazing and Term Private Land Permits, if necessary. Permanent changes to the Term Grazing and Term Private Land Permits could be made during the scheduled grazing permit analyses.

Alternative A

It is expected this alternative would make the least amount of transitory range available. This would be mainly due to the limited distribution caused by the accumulation of dead down trees associated with no commercial salvage or fuels treatment and reduction. An increase in effort on the part of the permittees may be required to manage the allotments with the accumulation of down dead trees. This would be minimal and is not expected to impact the proper range management of the allotments. The increased production expected in non-forested plant communities could be diminished if dead down trees are allowed to accumulate.

Alternatives C, D, E, G, and H

An increase in transitory range could result in increased livestock distribution through natural movement of the animals, especially when used early season. It should be noted that the total amount of transitory range resulting from any of the alternatives would be limited in its availability to livestock, depending on other factors such as slope and distance to water. A more open structure in forested vegetation communities could also increase distribution. With increased commercial salvage, the natural movement of livestock could increase. Increased distribution into forested plant communities also has the potential to relieve livestock grazing pressure from historic pre-fire use areas, mainly non-forested plant communities. Commercial salvage restrictions in RHCAs could impede movement with the accumulation of down, dead material. Large accumulations of down dead material have led to decreased natural distribution in other allotments on the forest.

Cumulative Effects

Common to All Alternatives

Appendix A, *Past, Present, and Reasonably Foreseeable Future Activities Within the Cumulative Effects Analysis Area,* provides information regarding cumulative resource effects. Regardless of the alternative chosen, an increase in transitory range is expected as a result of a decrease in canopy cover and early seral conditions in forested plant communities post-fire. This availability would be a combination of existing graminoid plants becoming more palatable post-fire and new plants become established. There could be an increase in available forage for livestock; however, no increase in capacity has been granted. The temporary increase in forage is expected to decline in approximately 10-20 years, as young trees become established and shade out the ground vegetation (FSM 2200). A slight increase in production in non-forested plant communities may occur post-fire and could relieve grazing pressure on non-forested plant communities in the future. This increase could be due to an opening in canopy cover where tree mortality has occurred on encroaching conifers or where shrub cover and decadent plant material has been removed.

Non-Forested Plant Communities

Existing Conditions

The six non-forested plant communities discussed in this section are as follows:

- 101 - CJ S1 12 Juniper/Low Sage/*Festuca idahoensis*
- 104 – CJ S3 11 Juniper/Bitterbrush/Bunchgrass
- 200 – SD 19 13 Low Sage/*Festuca idahoensis-Sitanion*
- 202 – SD 29 12 Big Sage/*Festuca idahoensis – Sitanion*
- 203 – SD 19 12 Low Sage/*Festuca idahoensis*
- 225 – MX Meadow

Complete non-forested plant community descriptions can be found in the *Range – Non-Forested Plant Communities* report in the Toolbox Fire Recovery Project analysis file.

Burned Acres - Non-Forested Plant Communities

Fire severity acres are based on the BAER report completed post-fire for the Toolbox, Silver, and Winter Fires. The BAER analysis of fire severity better represents conditions and expected response for the non-forested plant communities. These acres do not represent conifer mortality classes and should not be interpreted as such.

Three levels of fire severity were defined for the BAER effort: low, moderate and high. Areas defined as low severity contained a mosaic of understory burn conditions and unburned sites. In the non-forested plant community types presented, 8 acres were defined as high severity, 561 as moderate, and 7,514 at low (see the following table). All acres are approximate.

101 - CJ S1 12 Juniper/Low sage/*Festuca idahoensis*

Approximately 1,475 acres of this plant community are within the project area. Approximately 7 acres were defined as high severity, 338 as moderate severity, and 1,130 as low severity.

104 - CJ S3 11 Juniper/Bitterbrush/ Bunchgrass

Of the 2,247 acres within the project area, the majority, 2,146 were low in severity and the remaining 101 were moderate in severity. No acres were defined as high severity.

200 - SD 19 13 Low Sage/*Festuca idahoensis - Sitanion hystrix*

Approximately 2,714 acres of this plant community type are within the project area. Burn severity was primarily in the low category (2,631 acres), with 83 acres were in the moderate category. No acres were defined as high severity.

202 - SD 29 12 Big Sage/*Festuca idahoensis – Sitanion hystrix*

93 acres within the project area were defined as low severity and 1 acre was defined as high severity.

203 - SD 19 12 Low Sage/*Festuca idahoensis*

Approximately 602 acres are within the project area. There were no areas of high severity for this plant community, however, 577 acres were defined as low severity and 25 acres were defined as moderate severity.

225 - MX Meadow/Riparian

A specific count of the acreages for each of the meadow sub-types is not available at this time. Maps delineating the meadow sub-types are currently being created. What is known is that these plant communities can generally be found in the project area as part of transition from streams and other water sources to uplands. Within the project area, the total acres, severity of burn, expected fire response, and alternative effects make the current delineation adequate. Within the project area there is a total of 382 acres of the meadow plant community type. The meadow areas mapped includes a mix of the three meadow subtypes, and may contain small areas of season-long water-dependent sedge sites. Of the acres within the project area, 368 acres were defined as low severity and 14 acres were defined at moderate severity. There were no high severity sites.

Table 3.194 Burn Severities for Non-Forested Plant Communities Within the Toolbox Project Area, Based on BAER

Ecoclass	Severity			
	High	Moderate	Low (burned / unburned mosaic)	Totals
101- CJ S1 12 Juniper/Low Sage/*Festuca idahoensis*	7	338	1,130	**1,475**
104 - CJ S3 11 Juniper/Bitterbrush/Bunchgrass	0	101	2,146	**2,247**
200 - SD 19 13 Low Sage/ *Festuca idahoensis-Sitanion* hystrix	0	83	2,631	**2,714**
202 - SD 29 12 Big Sage/*Festuca idahoensis - Sitanion* hystrix	1	0	93	**94**
203 - SD 19 12 Low Sage/*Festuca idahoensis*	0	25	577	**602**
225 - MX Meadow	0	14	368	**382**
Totals	**8**	**561**	**6,945**	**7,514**

Environmental Consequences

Direct and Indirect Effects

Alternative A

The post-fire response expected in these communities, based on the BAER burn severities, would still occur. However, no harvest in the non-forested plant community areas could increase the recovery time. This is mainly due to accumulation of dead down trees and the processes necessary to decompose the plant material. Tree invasion could be expected without the introduction of more frequent fire (through prescribed methods).

Alternatives C, D, E, G, and H

Salvage Harvest

Post-fire response to non-forested plant communities could be increased by the removal of dead trees through commercial salvage operations. Levels of salvage vary by alternative, depending on resource needs outside the non-forested plant communities, and would probably not vary significantly within these communities. Fuel accumulations and subsequent hazards would be reduced, with the exception of the amount of harvest in RHCAs

RHCA Salvage

Although some degree of salvage in RHCAs is planned for all action alternatives, the acres vary. Accumulation of dead down trees in non-forested-RHCA plant communities may exceed levels present with more historic fire intervals. As the acres being salvaged decrease, this possibility increases. This could increase the fire intensity at ground level if not treated. Increased plant community function and, consequently, increases in herbaceous species would be somewhat impacted in all alternatives due to the restrictions placed on salvage in RHCAs. Levels of RHCA salvage are discussed in more detail below.

Alternative C

RHCA Salvage

Direct Effects – Approximately 632 RHCA acres are proposed for salvage. This alternative would allow for the least amount of accumulation of dead down trees and lower the likelihood of exceeding levels present with more historic fire intervals.

For RHCA areas (buffers) where salvage harvest would not occur, indirect effects of this alternative would be decreased plant community function and decreased herbaceous species, increased recovery time in non-forested plant communities in buffers, increased fuels accumulation that could lead to increased fire intensity during a wildfire, and decreased opportunity for prescribed fire, resulting in increased fuel loads for future higher intensity fires.

Reforestation

Indirectly, under this alternative, reforestation in Category 3 and 4 RHCAs could influence the recovery of non-forested sites. Outside of RHCAs, mitigations are in place on other non-forested sites to keep restocking at appropriate levels.

Prescribed Fire

The use of prescribed fire as habitat improvement for shrub dependent wildlife species may be beneficial to the maintenance of function of shrub dominated non-forested plant communities with a return of historic fire intervals. Prescribed fire under this alternative may increase herbaceous productivity.

Soil and Riparian Projects

Under Alternative C, successful deciduous planting could decrease the time of recovery for specific species in the riparian zones.

Alternative D

RHCA Salvage

Under this alternative, approximately 216 RHCA acres are proposed for salvage harvest. Accumulation of dead down trees may exceed levels present with more historic fire intervals where salvage does not occur. This alternative has the highest likelihood of exceeding down dead accumulation that would be seen with more historic fire intervals.

In RHCA areas where harvest would not occur, this alternative (along with Alternative H) would have the highest likelihood of decreased plant community function and decreased herbaceous species, increased recovery time in RHCA non-forested plant communities, increased fuels accumulation that could lead to increased fire intensity during a wildfire, and decreased opportunity for prescribed fire, resulting in increased fuel loads for future higher intensity fires.

Reforestation

Reforestation in Category 3 and 4 RHCAs could influence the recovery of non-forested sites. Outside of RHCAs, mitigations are in place on other non-forested sites to keep restocking at appropriate levels.

Prescribed Fire

Use of prescribed fire as habitat improvement for shrub dependent wildlife species could be beneficial to the maintenance of function of non-forested plant communities with the return of historic fire intervals and may result in increases in herbaceous productivity.

Soil and Riparian Projects

Successful deciduous planting could decrease the time of recovery for specific species in the riparian zones.

Alternative E

RHCA Salvage

Under this alternative, approximately 532 RHCA acres are proposed for salvage harvest. Accumulation of dead down trees may exceed levels present with more historic fire intervals where salvage does not occur.

For RHCA areas (buffers) where salvage harvest would not occur, indirect effects of this alternative would be decreased plant community function and decreased herbaceous species, increased recovery time in non-forested plant communities in buffers, increased fuels accumulation that could lead to increased fire intensity during a wildfire, and decreased opportunity for prescribed fire, resulting in increased fuel loads for future higher intensity fires.

Reforestation

Reforestation in Category 3 and 4 RHCAs could influence the recovery of non-forested sites. Outside of RHCAs, mitigations are in place on other non-forested sites to keep restocking at appropriate levels.

Prescribed Fire

The opportunity to introduce historic fire intervals into non-forested plant communities, which benefit, in function and structure, from the occurrence of low intensity prescribed fire, would be eliminated and herbaceous productivity would decrease.

Soil and Riparian Projects

Successful deciduous planting could decrease the time of recovery for specific species in the riparian zones.

Alternative G

RHCA Salvage

In this alternative, approximately 610 RHCA acres are proposed for salvage harvest. Accumulation of dead down trees may exceed levels present with more historic fire intervals where salvage does not occur.

For RHCA areas (buffers) where salvage harvest would not occur, indirect effects of this alternative would be decreased plant community function and decreased herbaceous species, increased recovery time in non-forested plant communities in buffers, increased fuels accumulation that could lead to increased fire intensity during a wildfire, and decreased opportunity for prescribed fire, resulting in increased fuel loads for future higher intensity fires.

Reforestation

Reforestation in Category 3 and 4 RHCAs could influence the recovery and function of non-forested sites. Outside of RHCAs, mitigations are in place on other non-forested sites to keep restocking at appropriate levels.

Prescribed Fire

The use of prescribed fire as habitat improvement for shrub dependent wildlife species may be beneficial to the maintenance of function of shrub dominated non-forested plant communities with a return of historic fire intervals. Prescribed fire under this alternative may increase herbaceous productivity.

Soil and Riparian Projects

Successful deciduous planting could decrease the time of recovery for specific species in the riparian zones.

Alternative H

RHCA Salvage

Under this alternative, approximately 216 RHCA acres are proposed for salvage harvest. Accumulation of dead down trees may exceed levels present with more historic fire intervals where salvage does not occur. This alternative has the highest likelihood of exceeding down dead accumulation that would be seen with more historic fire intervals.

Indirectly, this alternative (along with Alternative D) has the highest likelihood of decreased plant community function and herbaceous species, increased recovery time in RHCA non-forested plant communities, increased fuels accumulation that could lead to increased fire intensity during a wildfire, and decreased opportunity for prescribed fire, resulting in increased fuel loads for future higher intensity fires.

Reforestation

Reforestation in Category 3 and 4 RHCAs could influence the recovery and function of non-forested sites. Outside of RHCAs, mitigations are in place on other non-forested sites to keep restocking appropriate levels.

Prescribed Fire

Use of prescribed fire as habitat improvement for shrub dependent wildlife species could be beneficial to the maintenance of function of non-forested plant communities by the return of historic fire intervals and may result in increases in herbaceous productivity.

Soil and Riparian Projects

Successful deciduous planting could decrease the time of recovery for specific species in the riparian zones.

Cumulative Effects

Common to All Alternatives

Condition and Trend

The condition and trend of the non-forested plant communities within the project area are based on data collected for the Grazing Permit Analysis process, tree mortality mapping done for this project, Appendix A, *Past, Present, and Reasonably Foreseeable Future Activities within the Cumulative Effects Analysis Area,* and professional judgment based on known past activities and field visits. References to tree mortality are made in an effort to describe the pre- and post-fire degrees of tree invasion into the non-forested plant communities. In a general, for non-forested plant communities, tree mortalities greater than 51 percent are an indication that tree invasion was high, 26-50 percent tree mortality indicated tree densities that show a moderate level of tree invasion, and 0-26 percent tree mortality represent normal tree densities.

The current conditions of the non-forested plant communities are influenced by current and past management practices. These include livestock use, a decreased fire frequency, and other land management practices on both private and public land. The most notable management practice in recent years has been the suppression of fire (USDA RMRS-GTR-42, 2000). Recently, the use of proactive fuels management has begun to address the changes caused by lack of regular fire intervals in both forested and non-forested plant communities. However, the frequency of fire and level of reintroduction of the fire intervals necessary to keep non-forested plant communities functioning has not been adequate.

Fire suppression has lead to the invasion of trees into meadows and other non-forested vegetation types (Hopkins 1979, Kovalchick 1987, USDA RMRS-GTR-42, 2000). Photographs included in long-term trend data collection records for sites within the project area show significant conifer invasion. The conifer invasion and subsequent change in water dynamics, as well as the nutrient sequestering resulting from lack of fire, has affected both production and plant diversity (USDA RMRS-GTR-42, 2000), and, in turn, the function of the non-forested plant communities as a whole. Overall, 2,234 acres of the non-forested plant communities had 0-25 percent tree mortality, 1,949 acres had 26-50 percent tree mortality, and 3,329 acres had greater than 51 percent tree mortality (see the following table).

101 – CJ S1 12 Juniper/Low sage/*Festuca idahoensis*

104 – CJ S3 11 Juniper/Bitterbrush/ Bunchgrass

No long-term trend data was available for these plant community types. Tree mortality for 774 acres of the Juniper/Low Sage/*Festuca idahoensis* community was defined as greater that 51 percent. In the Juniper/Bitterbrush/Bunchgrass plant community type, 808 acres were defined as 51-100 percent tree mortality. This suggests substantial conifer invasion into both plant communities. As junipers are a component of this ecosystem, the 1,008 acres defined as mortalities of 0 –25 percent for these plant communities could indicate expected degrees of juniper occurrence, as 2-4 acres of juniper trees are expected with periodic fire. Exclusion of periodic fire could increase juniper expansion (Hopkins 1979). Areas defined as 25-50 percent (1191 acres) are experiencing moderate tree invasion.

Table 3.195 Tree Mortality in Non-forested Plant Communities Within the Toolbox Project Area (Hall 2003)

Ecoclass	Severity		
	0-25%	26-50%	51-100%
101- CJ S1 12 Juniper/Low Sage/*Festuca idahoensis*	333	478	774
104 - CJ S3 11 Juniper/Bitterbrush/Bunchgrass	675	713	808
200 - SD 19 13 Low Sage/ *Festuca idahoensis-Sitanion hystrix*	1046	398	1273
202 - SD 29 12 Big Sage/*Festuca idahoensis - Sitanion hystrix*	8	50	37
203 - SD 19 12 Low Sage/*Festuca idahoensis*	0	96	264
225 - MX Meadow	172	47	173
Totals	**2234**	**1949**	**3329**

200 - SD 19 13 Low Sage/*Festuca idahoensis - Sitanion hystrix*

No condition and trend data is available for this plant community type. Tree mortality was defined as 51-100 percent for 1,273 acres, indicating high invasion and, to some degree, loss of function. Tree mortality was defined as 0-25 percent for 1,046 acres, and the remaining 398 were shown to have 26-50 percent tree mortality. Based on plant community descriptions (Hopkins 1979), the density of conifer species suggested by the 26-50 percent tree mortality is also probably beyond the historic condition.

202 - SD 29 12 Big Sage/*Festuca idahoensis – Sitanion hystrix*

No condition and trend data is available for this plant community type. Poor condition sites show an increase in juniper cover (Hopkins 1979). Tree mortality of 51-100 percent was defined for 37acres, indicating high tree invasion and, to some degree, loss of function. The 26-50 percent tree mortality mapped on 50 acres also showed a decline in condition. Tree mortality for 8 acres was 0-25 percent.

203 - SD 19 12 Low Sage/*Festuca idahoensis*

No condition and trend data is available for this plant community type. Tree mortality for 264 acres were mapped at 51-100 percent, showing the most severe cases of tree invasion. Moderate tree invasion occurred on 96 acres that were mapped at 26-50 percent mortality, and 263 acres were shown to have 0-25 percent tree mortality.

205 - MX Meadow/Riparian

Condition and trend data available for these plant community types show an overall increase in plants and decrease in bare ground. Tree mortality data shows 173 acres of the meadow plant community type within the fire boundary had significant amounts of tree invasion with mortalities of 51-100 percent. This invasion has had an effect on riparian species abundance. Based on plant community descriptions (Hopkins 1979 and Kovalchik 1987), the density of conifer species suggested by the 26-50 percent tree mortality (47 acres) is also beyond the historic condition.

Post-Fire Response of Plant Communities

Both BAER data and conifer mortality data will be referenced in this section. Mortality data is interpreted as an indication of the level of conifer invasion into a system.

Proper management of a non-forested plant community requires considerations of the community as a whole and not the management for any one particular plant species. However, some discussion on the effects of fire on individual species is appropriate and included in this report.

The occurrence of high burn severities was minimal, in only 8 acres out of the 7,514 acres of non-forested plant community types addressed. The remaining acreage was in the moderate severity category (561 acres), and low severity (6,945 acres) (Table NFPC –1). The low severity areas contain a mosaic of unburned sites and sites that experienced an under burn (Burned Area Emergency Recovery report), which is typical for wildfire in these communities (USDA RMRS-GTR-42, 2000). In general, an increase in herbaceous species is expected post-fire for the non-forested plant communities. Low intensity fire is similar to the fire intensity mimicked when prescribed fire treatments are implemented. Prescribed fire has been shown to result in an increase in productivity in sedge and meadow communities (FEIS), as well as in other non-forested sites (Hopkins 1979, West and Hassan 1985, Kovalchik 1987, and Tracy and McNaughton 1996). Hall (2003) predicts shrub sprouting in riparian communities and an increase in herbaceous cover on the shrub and juniper communities. Succession in sagebrush communities is generally grass/forb-dominated communities with sagebrush recovery in 30 or more years (USDA RMRS-GTR-42, 2000).

Individual plant mortality can be expected in areas that received high and, depending on the species, moderate severity burns. This mortality should be mitigated through the secondary succession resulting from adjacent sites with intact or enhanced species (USDA RMRS-GTR-42, 2000), existing soil seed banks, or both.

101 – CJ S1 12 Juniper/Low sage/*Festuca idahoensis*

104 – CJ S3 11 Juniper/Bitterbrush/ Bunchgrass

Fire intervals of 5-40 years maintained bunchgrass communities (USDA RMRS-GTR-42, 2000), indicating fire has played a role in the maintenance and function of these communities. *Festuca idahoensis* has been shown to be more susceptible to fire, both a reduction in basal diameter and mortality. *Agropyron spicatum* may be more tolerant of fire, with plants experiencing a reduction in basal diameter (Conrad and Poulton 1966). These responses were seen at ridge tops in what was probably a high intensity fire. Bitterbrush is highly susceptible to fire (Fire Effects Information System). However,

fuel loading in the juniper/bitterbrush communities tends to be low in all but decadent stands. Old and young plants do not have a tendency to re-sprout (Blaisdell and Muegger 1956). Considering the amount of acres in these communities that burned at high severity, 7 in the Juniper/Low sage/*Festuca idahoensis* and 0 in the Juniper/Bitterbrush/ Bunchgrass community, and the adjacent plants that remained unburned, re-colonization of bunchgrasses is expected. The tree mortality in these plant communities indicated a 50 percent or greater loss of tree species on 52 percent of the Juniper/Bitterbrush/Bunchgrass type. Where fire has killed junipers in this plant community, bitterbrush has appeared more vigorous (Fire Effects Information System EM).

205-MX Meadow/Riparian

Sedge-Wet Meadow sites and stream channel green-lines were looked at post-fire, August through September 2002. Some species expected on these sites are *Carex aquatilis*, *Carex nebraskensis* and *Carex utriculata*. These *carex* species are rhizhomatus and the rhizomes are generally protected from all but the most severe fires (Fire Effects Information System). Post-fire, *carex* spp within the project area along the stream channels showed recovery. Post-fire recovery for these species can be rapid with low to moderate severity fires that top-kill the vegetation. This rapid recovery within the project area indicated the rhizomes necessary for vegetative re-growth were not killed and the individual plants responded as expected for a low intensity fire (DeBenedetti and Parsons 1984, Racine et al. 1987). Periodic burning is suggested as a management tool to remove and breakup the litter layer (Hopkins 1979) and increase productivity. In areas devoid of vegetation post-fire, vegetative re-colonization of *carex* spp. is expected.

200-SD 19 13 Low Sage/*Festuca idahoensis - Sitanion hystrix*

202- SD 29 12 Big Sage/*Festuca idahoensis – Sitanion hystrix*

203 – SD 19 12 Low Sage/*Festuca idahoensis*

Variations in plant species response to fire in sagebrush communities are high. Elevation, pre-fire vegetation condition, and variations within and between species are some of the factors that effect response of the plant communities and individual plants. Limited research on low sage fire response has been completed. It appears to receive damage by fire. Basin big sage is considered intermediate in flammability. Reinvasion by big sage could be expected to occur through seed sources in adjacent, unburned areas (Fire Effects Information System). Brush control through use of fire can lead to dominance by *Chrystnothamnus* spp. (rabbitbrush) but can also increase productivity of the herbaceous layer. Invasion by cheatgrass is a concern post-fire (Fire Effects Information System, Hopkins 1979), especially below 5000 feet elevation. Considering less than 1 acre of this type burned high and the remaining 93 acres either burned at low severity or did not burn, it is expected that the burned acres will responds with an increase in the herbaceous layer. Any occurrence of cheatgrass should not affect the function of the community, as it is most likely in the high burn severity acre. Any areas with low severity should not provide an increased opportunity for large amounts of cheatgrass. Although tree mortalities indicated a significant amount of tree invasion into these communities, post-fire mortality should result in an open canopy and increase in water availability. This combination will also improve the likelihood of increased productivity of the herbaceous layer.

Cumulative Effects

Alternatives C, D, E, G and H

Salvage harvest operations have the potential to spread noxious weeds into non-forested plant communities. Combined with suppression activities in non-forested plant communities, the chance for establishment of noxious weeds increases. The acres of non-forested plant communities that experience high fire intensities, as well as areas in these communities where suppression activities occurred, are more susceptible to weed invasions. Introduction of previously undocumented noxious weeds through suppression activities may have occurred. Any introduction or increase of noxious weeds into these systems could decease the function of these communities, but the acres where this is likely are few. Mitigations and BAER treatments will minimize the chances of this occurring. Mitigation measures to address this potential impact may be found in the Noxious Weeds mitigations in the Mitigation and Resource Protection Measures section of Chapter 2.

Mitigation

Mitigation measures for the action alternatives are in response to deciduous plantings and reforestation. These mitigations would not affect permitted grazing, but could increase management necessary in the allotments. The increase in management in not expected to be extreme and, in both cases, would be temporary. A complete list of mitigations is included in Chapter 2.

Monitoring

Compliance Checks and Monitoring

To ensure management direction as outlined in the Annual Operating Instructions (AOI) is followed, range management staff conducts use supervision throughout the grazing season. This supervision allows for verification that the instructions are being adhered to. Allotment resource condition monitoring takes place throughout the grazing season. This day-to-day monitoring allows for adjustments to the instructions, if necessary, as a response to a change in resource conditions. End-of-season monitoring is completed on allotments as a measure of compliance with the allowable forage use standards set and is also an indicator of successful management. Use supervision, resource condition, and end-of-season monitoring will be conducted on the allotments/pastures included in the analysis area at the end of the 2003 grazing season. Monitoring plans for all activities that may affect range management can be found in Appendix D.

Consistency with Fremont National Forest Land and Resource Management Plan

The proposed activities would be consistent with the Forest-wide Standards for range management, including general Standards and Guidelines for managing the resource for healthy range with satisfactory conditions, range/livestock management intensities, range administration, allotment management planning, and noxious weed control.

INVENTORIED ROADLESS AREAS and OTHER UNROADED AREAS

Inventoried Roadless Areas

- Introduction
- Regulatory Framework
- Existing Condition
- Direct and Indirect Effects
- Cumulative Effects
- Consistency with Forest Plan and Other Laws

Other Unroaded Areas

- Introduction
- Regulatory Framework
- Analysis Area
- Analysis Methods
- Direct and Indirect Effects
- Cumulative Effects
- Consistency with Forest Plan and Other Laws

INVENTORIED ROADLESS AREAS

Introduction

In 1972, the Forest Service began identifying roadless areas for wilderness consideration through Roadless Area Review and Evaluation (RARE I). In 1979, the agency completed RARE II, a more extensive national inventory of roadless areas. The Fremont National Forest incorporated RARE II data to develop inventories of roadless areas into the Forest Plan.

Regulatory Framework

On January 12, 2001, the Department of Agriculture issued the Roadless Area Conservation Final Rule, accompanied by a Final Environmental Impact Statement (FEIS) and Record of Decision, published as part of the final rule, 36 CFR 294, Special Areas, Roadless Area Conservation (NARA, 2001). The rule established prohibitions on road construction, road reconstruction, and timber harvesting in inventoried roadless areas on National Forest System lands. The intent of the rule was to provide lasting protection for inventoried roadless areas within the National Forest System in the context of multiple-use management. On May 10, 2001, the Idaho District Court enjoined the Forest Service from implementing all aspects of the Roadless Area Conservation Rule, as well as a section in the Forest Planning Rule that addresses the inventory and evaluation of roadless areas during Forest Plan revision (USDC, 2001). On December 14, 2001, Forest Service Manual (FSM) Interim Directive No. 1920-2001-1 was issued (USDA, 2001). This created a new Manual section on Management of Inventoried Roadless Areas and revised decision authorities for timber harvest and road construction and reconstruction projects in Inventoried Roadless Areas (IRAs).

The Ninth Circuit Court of Appeals reversed the May 10, 2001 ruling by the U.S. District Court for the District of Idaho, on December 12, 2002. On July 11, 2003 Wyoming U.S. District Court Judge Clarence Brimmer issued a decision that again stopped the rule from being implemented, for what appears to be the entire nation.

Existing Condition

There are no inventoried roadless areas (IRA) within the Toolbox Fire Recovery project area. The nearest IRA is the Antler Roadless Area, which, at it nearest point, is approximately three miles west of the project area boundary (and the fire perimeter). The Antler IRA is 5,413 acres.

Environmental Consequences

Direct and Indirect Effects

Alternatives A (No Action), C, D, E, G and H

There are no inventoried roadless areas (IRA) within the Toolbox Fire Recovery project area and none of the alternatives include proposed activity within an IRA. It is unlikely that either sound from Toolbox Fire Recovery Project activities or smoke associated with activity fuels reduction would impact the Antler IRA. The IRA is, at a minimum, three miles to the west of the project area. Prevailing winds are from the west and southwest. It is very unusual for winds to blow from east to west in the area. The Antler IRA is both upslope and upstream from the project area. Because of these factors, none of the alternatives would affect the natural integrity, solitude, apparent naturalness, special features, manageability or boundaries of the Antler IRA, or any IRA. There would be no direct or indirect effect as a result of implementation of either the no action alternative, or any action alternative.

Cumulative Effects

Cumulative effects to be considered in the context of this analysis include the impact on the environment which results from the incremental impact of the Toolbox Fire Recovery Project, when added to other past, present, and reasonably foreseeable future actions. Cumulative effects are the total effect of direct and indirect effects of the action, plus past, present, and reasonably foreseeable future actions on a given resource. The Antler Roadless Area occupies portions of both the West Fork Silver Creek subwatershed and the Thompson Reservoir subwatershed, both of which are within the Toolbox Fire Recovery Project cumulative effects analysis area.

Common to All Alternatives

All past present and reasonably foreseeable future activities within the cumulative effects analysis area are listed in Appendix A. An examination of the analysis that is documented in Appendix C of the FEIS for the Fremont National Forest LRMP and Appendix A for this analysis (Tables A-2 – Composite of Vegetative Treatments, Table A-5 – Recreation Facility Development and Table A-8 – Livestock Grazing and Allotments), reveals that, “Human influences have had a minor impact on the natural integrity and long-term ecological process of the area. Overall the impacts (of livestock grazing and timber harvesting) are not severe and the area appears natural to most visitors, with the possible exception of encountering cattle” (USDA Forest Service, 1989, FEIS Appendix C, 21). In 1992, three years after the LRMP was issued, livestock grazing within the Antler IRA ceased. Current and reasonably foreseeable future allotment management plans do no include any livestock grazing within the Antler IRA. Prior to 1989, timber harvesting within the Antler IRA was limited to salvage logging in localized spots along the periphery of the area (USDA Forest Service, 1989, FEIS Appendix C, 21). No timber harvest activities have occurred within the Antler IRA since the LRMP was issued. No livestock grazing, timber harvest, prescribed fire, or other activities are planned for the future within the Antler IRA.

Future fire suppression could have a long-term negative effect on natural integrity by altering the successional pathways of habitats and a short-term negative effect on solitude through noise and activities associated with fire suppression.

The area is allocated to semi primitive non-motorized recreation with light levels of use. Prior to the early 1990s when the area was traversed by the Fremont National Recreation Trail, the area received approximately 250 recreation visitor days (RVDs) annually. Presently, with the existence of the trail, that use has increased, but is still within the 800 RVDs that the Fremont National Forest LRMP FEIS indicated the area was capable of accommodating, while still providing outstanding opportunities for solitude (USDA Forest Service, 1989, FEIS Appendix C, 21). Recreational hunting and fishing would

have very minor and short-term effects on solitude. Indirect effects associated with recreational use include noxious weed spread, soil compaction and erosion, litter, evidence of fire rings, etc. These effects are minor but long-term.

In conclusion, all alternatives, which themselves would have no direct or indirect effects, together with reasonably foreseeable and ongoing activities, would likely result in minor reductions in solitude within the Antler IRA.

Consistency with Forest Plan and Other Laws and Regulations

All alternatives are consistent with Forest Plan direction regarding IRAs and the Interim Directives associated with the Roadless Area Conservation Final Rule.

OTHER UNROADED AREAS

Introduction

Unroaded areas are defined in the FEIS for the Roadless Area Conservation Final Rule as "any area, without the presence of a classified road, of a size and configuration sufficient to protect the inherent characteristics associated with its roadless condition. Unroaded areas do not overlap with inventoried roadless areas." (USDA, 2000, FEIS Glossary, G-12) Unroaded areas have typically not been inventoried and are, therefore, separate from inventoried roadless area. For the sake of clarity, the term "unroaded area" will be used in this section to differentiate these areas from IRAs. Unroaded areas do not overlap with Inventoried Roadless Areas (IRA), which are considered in the previous section.

Regulatory Framework

There are no Forest-wide or Management Area standards specific to unroaded areas, although many of the resources that unroaded areas typically contain (i.e. wildlife, riparian resources, trails and non-motorized recreation) are specifically covered by LRMP standards and guidelines or goals.

Approximately 80 percent of the area within the units listed in "Table 3.197 Activities Within the Unroaded Areas on ONRC Submitted Map" is allocated to Management Area 5 (MA 5) in the Fremont National Forest Land and Resource Management Plan (LRMP). MA 5 is allocated for commercial production of sawtimber within Forest-Wide Standards and Guidelines for all resources including soil, water, and wildlife habitat. The LRMP establishes an objective in MA 5 of creating a healthy forest condition characterized by a variety of age classes, through control of stocking levels, species mix, and protection from insects, disease, and other damage. Approximately 10 percent of the area within the proposed salvage units is allocated to Management Area 1 (MA 1) Mule Deer Winter Range Habitat. The remaining area within salvage units is within MA 2 Bald Eagle (BEMA) and MA 15 (Fish and Wildlife Habitat/Water Quality). Information provided elsewhere in Chapter 3 in the following sections: Watersheds; Air Quality; Wildlife; and Threatened, Endangered and Sensitive Species sections, is also applicable to unroaded areas.

If road management activities are planned, either in previously roaded areas or in unroaded areas outside of IRAs, Forest Service Handbook 7712.1 requires decisions that include road management activities be informed by an interdisciplinary science-based roads analysis, if those activities would result in new road construction, changes in access, such as changes in current use, traffic patterns, and road standards, or where there may be adverse effects on soil and water resources, ecological processes, or biological communities (road construction, reconstruction, and decommissioning) (USDA, 2001, FS Manual 7700, 17).

Analysis Area

The Oregon Natural Resources Council (ONRC) submitted a map of five unroaded areas in and adjacent to the project area to the Toolbox Fire Recovery Project Interdisciplinary Team (IDT) Leader. The ONRC map was a follow-up to a response from ONRC during initial project scoping that requested that the project, "…avoid timber harvest, roads, mining, development and motorized recreation in roadless areas greater than or equal to 1000 acres." The ONRC response also requested that the EIS should clearly state whether the project is in any portion of a roadless area inventoried during the RARE II process, or in a non-inventoried roadless area greater than or equal to 1000 acres. The five unroaded areas will be referred to in this analysis by the letters "A" through "E"; corresponding to the following legal descriptions that reference a central location within each ONRC mapped unroaded area:

- A: Unroaded T29S, R14E, Section 17
- B: Unroaded T29S, R15E, Section 35

- C: Unroaded T 29S, R16E, Section 32
- D: Unroaded T30S, R16E, Section 22
- E: Unroaded T 31S, R14E, Section 11

Two of the areas identified on the ONRC map of unroaded areas (C and E above) are characterized by land areas that are between open roads, deeply incised by classified open roads or include areas that stick out like a peninsula. These areas may contain characteristics of unroaded areas, such as high quality soil, water, and air, or diversity of plant and animal communities, but would be less likely to provide the solitude that is often provide by unroaded areas. The analysis area for the direct and indirect effects on unroaded areas consists of the area within the ONRC mapped unroaded areas, within the Toolbox Fire Recovery Project area boundary. The analysis area for cumulative effects is the extent of these unroaded areas, both inside of and outside the project area boundary.

Table 3.196 Unroaded Areas

Unroaded Area Legal Description (representative location)	Approximate size of area w/in Toolbox Project Boundary (Acres)	Geographic or other Descriptive Features	Description/Comments
A: Unroaded T29S, R14E, Section 17	900	In the area of Chase Spring, Silver Creek, and West Fork Silver Creek	Approximately 48 percent National Forest; 52 percent Bureau of Land Management lands for a total approximate size of 4200 acres. About 45 percent of National Forest portion is w/in project boundary
B: Unroaded T29S, R15E, Section 35	200	Centered on Hager Mountain	Traversed by the Fremont National Recreation Trail (NRT). Total area approx. 3600 acres. Approx. 6 percent of area is within project area
C: Unroaded T 29S, R16E, Section 32	3400	East-west trending area, centered on "Indian Rim"	Traversed by the NRT. Incised by Classified Roads 2914021 and 3036012. Bounded on the east by Road 2901.
D: Unroaded T30S, R16E, Section 22	900	North-south trending area, primarily below Winter Ridge, with "fingers" above the rim.	Intermittently traversed by the NRT. Only those portions of the area that lie above Winter Ridge are within the Toolbox project boundary (a narrow strip never greater than ½ mile wide). Area is almost entirely below the rim within the Winter Fire. Approximately 5,000 acres total shown on submitted map, but total area not determined (the area extended beyond the coverage of the submitted map). Bounded on the north by Road 2901.
E: Unroaded T 31S, R14E, Section 11	1800 (north) 0 (south)	In the Graham Creek area	Contains 2 separate parts, divided by Classified Road 2800066. Total area approx. 2700 acres (north) and 2000 acres (south). Northern portion incised by Classified Road 2800505. Approx. 65 percent of northern area is within project area. None of southern portion is within project area.

Analysis Methods

The areas included on the ONRC submitted map are identified in this analysis by legal description that is approximately centered within the unroaded area in order to provide a representative location (see following table). The areas are un-named on map submitted by ONRC. Specific acreage figures were not provided for the areas, but estimates on their size were made using a "dot-grid" method. All were initially presumed to be greater than 1000 acres. None of the ONRC submitted unroaded areas were identified during the Roadless Area Review and Evaluation (RARE I), RARE II, or the EIS for the Roadless Area Conservation Final Rule as eligible areas of 5,000 or more acres in size.

The analysis of effects on unroaded areas requires a description of the activities that are proposed within them, weighed against the values unroaded areas can provide or contribute to. Those values include:

- Natural appearing landscapes for dispersed unroaded recreation opportunities such as hiking, camping, wildlife viewing, hunting and cross-country skiing, and the solitude they can provide.
- Protection of cultural and heritage resources.
- High quality or undisturbed soil, water, and air.
- Habitat for abundant and healthy fish and wildlife populations.
- Diversity of plant and animal communities, including areas that are relatively at less risk from noxious weeds.
- Habitat for threatened, endangered, and sensitive species

Effects of proposed actions were determined using a qualitative discussion based on amount and type of proposed activities. Those activities that are included in all action alternatives that have the potential to have an effect on unroaded areas include: commercial salvage, fuels treatments, temporary road construction, prescribed fire, and road management. These activities are proposed in varying amounts in the alternatives, as shown in the tables below. Other activities included in the action alternatives such as aspen enhancement; deciduous plantings, large woody debris placement, reforestation, and plantation thinning would have minimal effect and are not considered further in this section, though information provided in Soils and Geology; Watershed; Air Quality; Wildlife; Forested Plant Communities; Recreation; Noxious Weeds and Threatened, Endangered and Sensitive Species sections within the Wildlife, Fisheries, Sensitive Plants, and Noxious Weeds sections is also applicable to unroaded areas.

Environmental Consequences

Direct and Indirect Effects

The analysis area for the direct and indirect effects on unroaded areas consists of the area within the ONRC mapped unroaded areas, within the Toolbox Fire Recovery Project area boundary, as displayed in the preceding table. The following table summarizes those potentially significant activities (other than road management), by proposed salvage unit number, that are proposed for the Toolbox Fire Recovery Project within the unroaded areas:

Table 3.197 Action Alternatives - Activities Within the Unroaded Areas on ONRC Submitted Map

Unroaded Area (Central Legal Descript.)	**Unit No.**	**Commercial Salvage**					**Temporary Road**										**Prescribed Fire**
		Approximate **Acres** of Salvage within unroaded area shown on ONRC Map					Temporary Re-open Existing Unclassified Road (**Miles**)					New Temporary Construction (**Miles**)					
		Alternative					**Alternative**					**Alternative**					
		C	**D**	**E**	**G**	**H**	**C**	**D**	**E**	**G**	**H**	**C**	**D**	**E**	**G**	**H**	
A: T29S, R14E, Sec 17 (Chase Spring, etc.)	177*H	20			14												None with any Alt.
	178	3		3	3	3						0.2		0.2	0.2	0.2	
	201	3	3	3	3	3											
	203*	8	1	8	8	7	0.5		0.5	0.5	0.5	0.1		0.1	0.1	0.1	
B: T29S, R15E, Sec 35 (Hager Mountain)	192	18	18		18	18	0.5	0.5		0.5	0.5						None with any Alt.
	193	47	47	47	47	30	0.4	0.4	0.7	0.4	0.4						
C: T 29S, R16E, Sec 32 (Indian Rim)	19*	53	50	53	53	23											None with Alts. D & E;
	20*	11		11	11	10											
	21	108	108	108	108												
	22*H	116	112	116	116												10 Acres with Alts. C & G
	23*H	53	49	53	53												
	24H	87	86	87	87												
	25	31			31	31						0.3			0.3	0.3	
	26	99	2	99	99	94						0.4		0.4	0.4	0.4	

Table 3.197 Action Alternatives - Activities Within the Unroaded Areas on ONRC Submitted Map (continued)

Unroaded Area (Central Legal Descript.)	**Unit No.**	**Commercial Salvage**					**Temporary Road**										**Prescribed Fire**
		Approximate **Acres** of Salvage within unroaded area shown on ONRC Map					Temporary Re-open Existing Unclassified Road (**Miles**)					New Temporary Construction (**Miles**)					
		Alternative					**Alternative**					**Alternative**					
		C	**D**	**E**	**G**	**H**	**C**	**D**	**E**	**G**	**H**	**C**	**D**	**E**	**G**	**H**	
D: T30S, R16E, Sec 22 (Beneath Winter)	140*	20			20	20											20 Acres with Alts. D & E;
	149*	55	6	55	55	55											
	165	10		10	10	10						0.1		0.1	0.1	0.1	
	169*	48	46	48	48	47											35 Acres with Alts. C & G
	170*	14			14	14											
	171*	32		32	32												
	172	29			29	29						0.1			0.1	0.1	
	173*	18		18	18	18						0.1		0.1	0.1	0.1	
E: T 31S, R14E, Sec 11 (Graham Cr.)	86	11			11	9	0.3			0.3	0.3						None with any Alt.
	94	14	12	14	14	12	0.3	0.3	0.3	0.3	0.3						
	95	14		14	14		0.6		0.6	0.6							
	96	12		12	12	12						0.1		0.1	0.1	0.1	
	97*	38			38	38						0.2			0.2	0.2	

* Only a portion of the unit is within the area shown as unroaded on the ONRC map
H - Units 22, 23, 24 and 177 are helicopter units and would require no temporary roads
Units 19, 20, 21, 140, 149, 169, 170, 171 and 201 are accessible from existing classified roads and would not require any temporary road

The following table summarizes road management activity on classified roads, by alternative, that are proposed for the Toolbox Fire Recovery Project within or immediately adjacent to the unroaded areas

Table 3.198 Action Alternatives - Road Management of Classified Roads in or near the Unroaded Areas on ONRC Submitted Map

Area	"Relationship" of Classified Road to Unroaded Area	Road Management Action									
		Decommission (Miles)					Close (Miles)				
		Alternative					Alternative				
		C	D	E	G	H	C	D	E	G	H
A: Unroaded T29S, R14E, Section 17	Edge of Area	0	0	0	0	0	0	0	0	0	0
	Incised into Area	0.3	0.3	0.3	0.3	0.3	0	0	0	0	0
	Actually within Area	0	0	0	0	0	0	0	0	0	0
B: Unroaded T29S, R15E, Section 35	Edge of Area	0.2	0.2	0	0.2	0.2	0	0	0.2	0	0
	Incised into Area	0	0	0	0	0	0	0	0	0	0
	Actually within Area	0	0	0	0	0	0	0	0	0	0
C: Unroaded T 29S, R16E, Section 32	Edge of Area	1.9	1.9	0	1.6	1.9	0.8	0.8	1.6	0	0.8
	Incised into Area	1.2	1.2	0.4	1.2	1.2	2.3	2.3	0.8	0	2.3
	Actually within Area	0	0	0	0	0	0	0	0	0	0
D: Unroaded T30S, R16E, Section 22	Edge of Area	0	0	0	0	0	0	0	0	0	0
	Incised into Area	1.0	1.0	0	0.6	1.0	0.5	0.5	0.6	0	0.5
	Actually within Area	0.2	0.2	0	0.2	0.2	0.1	0.1	0.2	0	0.1
E: Unroaded T 31S, R14E, Section 11	Edge of Area	0	0	0	0	0	1.5	1.5	1.5	1.5	1.5
	Incised into Area	0	0	0	0	0	0	0	0	0	0
	Actually within Area	0	0	0	0	0	0	0	0	0	0

Alternative A

The no action alternative would not include any salvage activity, temporary road use or prescribed fire in any of the unroaded areas. There would be no direct effect on the natural appearance, opportunities for solitude, cultural resources, soil water or air, wildlife habitat, noxious weed presence or habitat for threatened, endangered or sensitive species. The degree of natural appearance would remain as is in both the short term and the long term, though it would evolve over an approximate 15 year period from one characterized by primarily by a mosaic of standing dead trees, to one of dead and downed trees. A potential indirect effect may occur because none of the road management activities that are included to varying extent in the action alternatives would be implemented. No action to decommission or close roads that are either along the edge, incised into, or actually within the unroaded areas on the ONRC submitted map would occur. There would be no change in the roadless character of any of the areas.

Road decommissioning or closure can benefit opportunities for dispersed unroaded recreation, for solitude, and can be an important tool in increasing the protection of cultural resources. With Alternative A, all existing access to areas containing heritage material would remain open. The potential for illegal gathering activity would be unchanged and the long-term benefit of increased protection would not be realized with Alternative A.

Under Alternative A, existing road densities and miles of open roads within Category 1 and 4 RHCAs would remain unchanged, as no road closures or decommissions would occur. As discussed in the Fisheries section in Chapter 3, roads account for most of the sediment problems in a watershed because they are a link between sediment source areas (skid trails, landings, and cutslopes, etc.) and stream channels. With Alternative A, road conditions on the landscape would continue to exert stress on drainages within the project and their native trout populations by delivering fine sediment to instream habitats.

Alternatives C and G

For the five unroaded areas, Alternatives C and G differ only in regard to 6 acres of commercial salvage in a single helicopter unit in area A (29S, R14E, Sec 17 - Chase Spring) that has activity within unroaded area in Alternative C, but not in Alternative G; therefore, they are grouped together. There is a difference between the two alternatives in regard to road management, salvage harvest within Riparian Habitat Conservation Areas and non-commercial fuels treatment that will be noted below.

As shown in Table 3.197, with Alternatives C and G, each of the unroaded areas would have some commercial salvage activity. This ranges from approximately 34 acres within unroaded area A (29S, R14E, Sec 17 - Chase Spring B) to 558 acres within unroaded area C (T 29S, R16E, Sec 32 - Indian Rim). All salvage activity in four of the five unroaded areas for all areas would occur along the outer margins of the areas. For these four areas the direct and indirect effect would generally be limited to these border areas. Area C (T 29S, R16E, Sec 32 - Indian Rim) would have salvage activity within 3 helicopter units, totaling 256 acres that are more interior to the unroaded area.

All areas except B (T29S, R15E, Sec 35 - Hager Mountain) would have some new temporary road construction. This ranges from an estimated 0.3 miles in area A (29S, R14E, Sec 17 - Chase Spring), D (T30S, R16E, Sec 22 - Beneath Winter) and E (T 31S, R14E, Sec 11 - Graham Cr.) to 0.7 miles is area C (T 29S, R16E, Sec 32 - Indian Rim). Temporary roads would be built under Best Management Practices (see Appendix C). Re-opening of existing unclassified roads, in the amounts for each of the areas shown in the preceding table, would also occur under Best Management Practices for temporary road use during timber sale activity. In order to prevent low-level casual use, all temporary roads would be obliterated following use.

As shown in Table 3.197, prescribed fire activity is minimal in all areas, with the most (35 acres) in area D (T30S, R16E, Sec 22 - Beneath Winter).

Alternative G includes fuels treatment beyond areas proposed in any other alternative. These would be non-commercial treatments, both within and outside proposed harvest units, in areas that are within ¼ mile of the boundary between National Forest and private land. Treatments in this ¼ mile buffer zone would include ladder fuel reduction treatments, prescribed burning, and a variety of other fuels treatments that would allow more control of both prescribed fire and of wildfire. Approximately 275 acres, within unroaded areas, inside of proposed harvest units would receive this additional fuels treatment. Approximately 355 acres, within the unroaded areas outside of proposed harvest units would receive this additional fuels treatment. The activity would result in a temporary reduction in opportunity for solitude. On the other hand it would improve the sustainability of the forested stands that are being treated and contribute to the development of late and old forest conditions. Due to the small amount of area affected (spread over four of the five unroaded areas) the effect of this activity would be minimal in relation to any unroaded characteristics.

In addition to the closure of the unclassified temporary roads, road management actions to decommission or close roads, as shown on the preceding table, would occur with Alternative C and G for each of the five unroaded areas. These roads are broken out in the tables by the descriptive terms: “edge,” “incised,” or “actually within.”

Natural Appearance and Solitude; Unroaded Recreation Opportunity

Apparent naturalness would be decreased by harvesting timber on a total of approximately 970 acres within the five unroaded areas. Stumps would be visible in the foreground. Helicopter logging units (approximately 275 acres of the total acres) would not be expected to be noticeable from a distance. The amount of area that would be impacted this way is detailed in Table 3.197. Since most fire-killed trees generally fall down within 15-20 years, removing some of these trees through timber harvest would have the same visual effect from a distance in the long term. There would be a short-term interruption of solitude due to equipment involved with timber harvest within the vicinity of unroaded areas. The re-opening of existing unclassified roads is greatest with Alternatives C and G, in comparison with the other action alternatives. In total, an estimated 2.6 miles of unclassified road would be temporarily re-opened within the five unroaded areas. Most of this would be within unroaded area B (T29S, R15E, Sec 35 - Hager Mountain) and E (T 31S, R14E, Sec 11 - Graham Cr.). An unclassified road is one that is not constructed, maintained, or intended for long-term use, such as a

remnant of short-term-use roads associated with fire suppression and timber harvest, as well as travel-ways resulting from off-road vehicle use. Re-opening existing unclassified roads would have the effect of "reversing" (in the short term) the return to natural appearance that typically occurs with closed unclassified roads. In the long term, due to their temporary use and subsequent obliteration, their return to natural appearance would be expected to proceed. The development of temporary roads is greatest with Alternatives C and G, in comparison with the other action alternatives. The effects of these roads on solitude and apparent naturalness would be the same as attributed to the re-opening of unclassified roads.

Unroaded recreation opportunities would be somewhat diminished in the short term. The primary unroaded recreation opportunity that is present is the Fremont National Recreation Trail (NRT). It occurs within three of the five unroaded areas. While salvage activities are occurring, a short-term interruption in solitude associated with the operation of either ground-based or helicopter yarding systems would occur. In the long term, because mitigation measures designed to protect the NRT are included for all of the action alternatives (see Chapter 2), the effect on the recreation opportunity associated with the trail would be minimal.

In the long term, due to the decommissioning and closure of classified roads associated with each of the five-unroaded areas, the degree of “roadless character” may increase on a local level. The total amount of decommissioning is similar between Alternatives C and G, but the overall level of road management activity is less with Alternative G, because substantially less road would be closed with Alternative G. For the project area as a whole, about half of the currently open road would be either decommissioned or closed with Alternative C and approximately one-third of the currently open road would be either decommissioned or closed with Alternative G. Due to this difference, the localized long-term increase of roadless character would be greater with Alternative C than with Alternative G. Road management actions would have the effect of increasing the roadless character of these areas, particularly Area C (centered on T 29S, R16E, Sec 32 in the Indian Rim area) where the largest amount of road management would occur.

Cultural Resources

Mitigation measures designed to protect all known or discovered cultural resources are included for all of the action alternatives (see Chapter 2). Therefore, there should be no short term or direct effects on any of the cultural resource sites that may occur within any of the five unroaded areas. Another important aspect of cultural resource protection, to which unroaded areas generally contribute disproportionately (in comparison to roaded areas) is protection from illegal gathering. There have been recent cases of illegal gathering on the Silver Lake Ranger District that have resulted in arrest and prosecution. Long-term access to the areas where potential illegal gathering could occur would be more effectively controlled with Alternative C than G, as more miles of road are closed or decommissioned with Alternative C than G.

Noxious Weeds

Effects of the alternatives on the potential for spread of noxious weeds are discussed elsewhere in Chapter 3. There are no specific effects relating to noxious weeds within unroaded areas that differ from those described under the general Noxious Weed section.

Soil, Air and Water; Wildlife Habitat; Habitat for Threatened, Endangered or Sensitive Species

Effects of the alternatives on the potential for effects on these resources are discussed elsewhere in Chapter 3. Only those effects that differ or are specific to a particular unroaded area will be discussed here.

Area A (29S, R14E, Sec 17 - Chase Spring) is the only one of the five unroaded areas that contains a perennial stream. Both West Fork Silver Creek and Silver Creek occur within this unroaded area. Alternative C and G have the most salvage harvest within area A of any of the alternatives. This includes unit 177, which is a helicopter unit in the vicinity of Silver Creek. No temporary roads, either re-opening of existing unclassified roads or new construction, would be used for unit 177. In Alternative C, approximately 6 acres of this unit are within the outer 100 feet of a Category 1 RHCA. In Alternative G, none of the unit is within the RHCA. For the entire Toolbox Fire Recovery Project, salvage harvest would occur only in the outer 100 feet of the RHCA in units that are within the Riparian Habitat Conservation Areas (RHCA) of a perennial stream (Category 1 RHCA). RHCAs for such streams are typically 300 feet wide (or wider) in slope distance beyond the edge of the active stream channel, on each side of the stream. No salvage would occur other than in the outer 100 feet of RHCA. No mechanized ground-based equipment would be allowed within the entire width of the RHCA. In addition, for all units, Timber Best Management Practices, Road Best Management Practices, and Soil Productivity Guidelines (see Appendix C) would be in effect. With these protective design measures in place, any detrimental effects on the soil, water, and fisheries resources within area A should be minimal and short term in nature. For Alternative C, salvage in Category 1 RHCAs would be via helicopter to minimize soil disturbance and compaction. If any project-generated sediment were to reach fish bearing streams, it is expected that it would be short-term in nature, and at an

immeasurable, negligible level. No significant increases in water yield or sedimentation are predicted. See the Fisheries, Watershed, and Soils sections of Chapter 3 for additional detail.

The following table displays summarized information (for all alternatives) from the Wildlife, Fisheries, and Botany biological evaluations pertaining to Threatened, Endangered or Sensitive Species that have a presence (or habitat presence) within unroaded area, and the effects on these species and habitats. Additional detail is available in the appropriate sections elsewhere in Chapter 3.

Table 3.199 Summary of Threatened, Endangered, or Sensitive Species With a Presence (or Habitat Presence) within Unroaded Area

Species Name	Status	Species or Habitat Present in Which Unroaded Area	Effects (on Species)						Effects (on Habitat)					
			Alternative						Alternative					
			A	C	D	E	G	H	A	C	D	E	G	H
Green-tinged paintbrush *(Castilleja chlorotica)*	Sensitive	D	NI	MI IH	NI	MI IH	MI IH	MI IH	NI	MI IH	NI	MI IH	MI IH	MI IH
Redband trout (*Oncorhynchus mykiss spp*.)	Sensitive	A	MI IH	MI IH	MI IH	MI IH	MI IH	MI IH	MI IH	MI IH	MI IH	MI IH	MI IH	MI IH
Bald eagle *(Haliaeetus leucocephalus)*	Threatened	A, C	NE	NE					NE	NE				
Oregon spotted frog *(Rana pretiosa)*	Candidate; Sensitive	A	NI	MIIH					NI	MIIH				
Peregrine falcon *(Falco peregrinus)*	Sensitive	D (outside project area)	NI	NI					NI	NI				
Western sage grouse *(Centrocercus urophasianus*	Sensitive	A, C	NI	MIIH					NI	NI				
Gray flycatcher *(Empidonax wrightii)*	Sensitive	A, B, C, D, E	NI	MIIH					NI	MIIH				
California wolverine *(Gulo gulo)*	Sensitive	D	NI	MIIH					NI	MIIH				
Pacific fisher *(Martes pennanti)*	Sensitive	A, B, C, D, E	NI	MIIH					NI	MIIH				
Northern Leopard Frog *(Rana boylii)*	Sensitive	A, D (for D: outside project area)	NI	MIIH					NI	MIIH				
Columbia Spotted Frog *(Rana luteiventris)*	Sensitive	A	NI	MIIH					NI	MIIH				
Oregon spotted frog *(Rana pretiosa)*	Sensitive	A	NI	MIIH					NI	MIIH				
Northwestern Pond Turtle *(Clemmys marmorata marmorata)*	Sensitive	A	NI	MIIH					NI	MIIH				

NE = No Effect from the project on the species or critical habitat.
NI = No Impact
MIIH = May impact individuals or habitat, but will not likely contribute to a trend toward federal listing or loss of viability to the population or species.

Alternative D

As shown in the Table 3.197, with Alternative D each of the unroaded areas would have some commercial salvage activity. This ranges from approximately 4 acres within unroaded area A (29S, R14E, Sec 17 - Chase Spring) to 407 acres within unroaded area C (T 29S, R16E, Sec 32 - Indian Rim). All salvage activity in four of the five unroaded areas for all areas would occur along the outer margins of the areas. For these four areas, the direct and indirect effect would generally be limited to these border areas. Area C (T 29S, R16E, Sec 32 - Indian Rim) would have salvage activity within three helicopter units, totaling 247 acres that are more interior to the unroaded area.

No areas would have any new temporary road construction. This is the least of any action alternative. Re-opening of 1.2 miles (total) of existing unclassified roads, in the amounts for each of the areas as shown in Table 3.197, would occur under Best Management Practices for temporary road use during timber sale activity (see Appendix C). In order to prevent low-level casual use, all temporary roads would be obliterated following use.

As shown in Table 3.197, prescribed fire activity is limited to 20 acres in area D (T30S, R16E, Sec 22 - Beneath Winter).

In addition to the closure of the unclassified temporary roads, road management actions to decommission or close roads, as shown on Table 3.198, would occur with Alternative D for each of the five-unroaded areas. These roads are broken out in the tables by the descriptive terms: “edge,” “incised,” or “actually within.”

Natural Appearance and Solitude; Unroaded Recreation Opportunity

Apparent naturalness would be decreased by harvesting timber on a total of approximately 540 acres within the five unroaded areas. Stumps would be visible in the foreground. Helicopter logging units would not be expected to be noticeable from a distance. The amount of area that would be impacted this way is detailed in Table 3.197. Since most fire-killed trees generally fall down within 15-20 years, removing some of these trees through timber harvest would have the same visual effect from a distance in the long term. There would be a short-term interruption of solitude due to equipment involved with timber harvest within the vicinity of unroaded areas. The re-opening of existing unclassified roads is least with Alternative D, in comparison with the other action alternatives. In total, an estimated 1.2 miles of unclassified road would be temporarily re-opened within the five unroaded areas. Most of this (0.9 miles) would be within unroaded area B (T29S, R15E, Sec 35 - Hager Mountain). Re-opening existing unclassified roads would have the effect of "reversing" (in the short term) the return to natural appearance that typically occurs with closed unclassified roads. In the long term, due to their temporary use and subsequent obliteration, their return to natural appearance would be expected to proceed. There is no development of new temporary roads with Alternative D.

Because of the small amount of activity proposed for unroaded areas, unroaded recreation opportunities would be only minimally decreased in the short term. The primary unroaded recreation opportunity that is present is the Fremont National Recreation Trail (NRT). The trail traverses or partially traverses three of the five unroaded areas. While salvage activities are occurring, a short-term interruption in solitude, associated with the operation of either ground-based or helicopter yarding systems, would occur. In the long term, because mitigation measures designed to protect the NRT are included for all of the action alternatives (see Chapter 2), the effect on the recreation opportunity associated with the trail would be minimal.

In the long term, due to the road decommissioning and closure associated with each of the five-unroaded areas, the degree of “roadless character” may increase on a local level. The amount of decommissioning and closure within the five unroaded areas is the same with Alternative D as with Alternatives C and H. Road management actions would have the effect of increasing the roadless character of these areas, particularly Area C (centered on T 29S, R16E, Sec 32 in the Indian Rim area) where the largest amount of road management would occur. For the project area as a whole, the amount of decommissioning is slightly greater with Alternative D than the other action alternatives. For the project area as a whole, more than half of the currently open road would be either decommissioned or closed with Alternative D.

Cultural Resources

Mitigation measures designed to protect all known or discovered cultural resources are included for all of the action alternatives (see Chapter 2). Therefore, there should be no short term or direct effects on any of the cultural resource sites that may occur within any of the five unroaded areas. Another important aspect of cultural resource protection, to which unroaded areas generally contribute disproportionately (in comparison to roaded areas) is protection from illegal gathering. There have been recent cases of illegal gathering on the Silver Lake Ranger District that have resulted in arrest and prosecution. Long-term access to the areas where potential illegal gathering could occur would be more effectively

controlled with Alternative D than any other alternative, as more miles of road are closed or decommissioned with Alternative D.

Noxious Weeds

Effects of the alternatives on the potential for spread of noxious weeds are discussed elsewhere in Chapter 3. There are no specific effects relating to noxious weeds within unroaded areas, that differ from those described under the general Noxious Weed section.

Soil, Air and Water; Wildlife Habitat; Habitat for Threatened, Endangered or Sensitive Species

Effects of the alternatives on the potential for effects on these resources are discussed elsewhere in Chapter 3. Only those effects that differ or are specific to a particular unroaded area will be discussed here.

Area A (29S, R14E, Sec 17 - Chase Spring) is the only one of the five unroaded areas that contains a perennial stream. Both West Fork Silver Creek and Silver Creek occur within this unroaded area. Alternative D has the least salvage harvest within area A of any of the action alternatives. Alternative D does not include unit 177, which was previously discussed under Alternatives C and G, nor does it contain any units in the project as a whole, other than those in roadside hazard corridors, that are within any Riparian Habitat Conservation Areas (RHCA) of either a perennial stream or an intermittent stream. For all units in the project area, Alternative D would have in effect Timber Best Management Practices, Road Best Management Practices, and Soil Productivity Guidelines (see Appendix C). With these protective design measures in place, any detrimental effects on the soil, water and fisheries resources within area A should be minimal and short term in nature. If any project-generated sediment were to reach fish bearing streams, it is expected that it would be short-term in nature, and at an immeasurable, negligible level. No significant increases in water yield or sedimentation are predicted. See the Fisheries, Watershed and Soils sections of Chapter 3 for additional detail.

Effects on threatened, endangered or sensitive species within the unroaded areas are displayed above, for all alternatives in Table 3.198, in the Alternative C and G section.

Alternative E

As shown in the Table 3.197, with Alternative E each of the unroaded areas would have some commercial salvage activity. This ranges from approximately 14 acres within unroaded area A (29S, R14E, Sec 17 - Chase Spring B) to 527 acres within unroaded area C (T 29S, R16E, Sec 32 - Indian Rim). All salvage activity in four of the five unroaded areas for all areas would occur along the outer margins of the areas. For these four areas, the direct and indirect effect would generally be limited to these border areas. Area C (T 29S, R16E, Sec 32 - Indian Rim) would have salvage activity within three helicopter units, totaling 256 acres, which are more interior to the unroaded area.

All areas except B (T29S, R15E, Sec 35 - Hager Mountain) would have some new temporary road construction. This ranges from an estimated 0.2 miles in area D (T30S, R16E, Sec 22 - Beneath Winter) and E (T 31S, R14E, Sec 11 - Graham Cr.) to 0.7 miles is area C (T 29S, R16E, Sec 32 - Indian Rim). Temporary roads would be built under Best Management Practices (see Appendix C). Re-opening of existing unclassified roads, in the amounts for each of the areas shown in the preceding table, would also occur under Best Management Practices for temporary road use during timber sale activity. In order to prevent low-level casual use, all temporary roads would be obliterated following use.

As shown in Table 3.197, no prescribed fire activity is proposed in any unroaded area.

Natural Appearance and Solitude; Unroaded Recreation Opportunity

Apparent naturalness would be decreased by harvesting timber on a total of approximately 791 acres within the five unroaded areas. Stumps would be visible in the foreground. Helicopter logging units would not be expected to be noticeable from a distance. The amount of area that would be impacted this way is detailed in Table 3.197. Since most fire-killed trees generally fall down within 15-20 years, removing some of these trees through timber harvest would have the same visual effect from a distance in the long term. There would be a short-term interruption of solitude due to equipment involved with timber harvest within the vicinity of unroaded areas. The re-opening of existing unclassified roads is less with Alternative E than with Alternatives C and G. In total, an estimated 2.1 miles of unclassified road would be temporarily re-opened within the five unroaded areas. Re-opening existing unclassified roads would have the effect of "reversing" (in the short term) the return to natural appearance that typically occurs with closed unclassified roads. In the long term, due to their temporary use and subsequent obliteration, their return to natural appearance would be expected to proceed. The development of new temporary roads is less with Alternative E than with Alternatives C and G. The effects of these roads on solitude and apparent naturalness would be the same as attributed to the re-opening of unclassified roads.

Unroaded recreation opportunities would be somewhat diminished in the short term. The primary unroaded recreation opportunity that is present is the Fremont National Recreation Trail (NRT). It occurs within three of the five unroaded areas. While salvage activities are occurring, a short-term interruption in solitude associated with the operation of either ground-based or helicopter yarding systems, would occur. In the long term, because mitigation measures designed to protect the NRT are included for all of the action alternatives (see Chapter 2), the effect on the recreation opportunity associated with the trail would be minimal.

In the long term, due to the road decommissioning and closure associated with each of the five unroaded areas, the degree of "roadless character" may increase on a local level. The amount of decommissioning, both within the unroaded areas and for the project area as a whole, is the least with Alternative E than any action alternative, but, due the amount of road closure, the overall level of road management activity is comparable to Alternative G. Road management in Area C (centered on T 29S, R16E, Sec 32 in the Indian Rim area) differ between Alternative E and the rest of the action alternatives in that only about 15 percent of the decommissioning that would occur with Alternatives C, D, G or H would occur with Alternative E. Instead of decommissioning, Alternative E relies more heavily on road closure. The effect on use patterns by vehicles should be similar to the other action alternatives; however, the presence of the roadbed itself would be more apparent. For the project area as a whole, approximately one-third of the currently open road would be either decommissioned or closed with Alternative E.

Cultural Resources

Mitigation measures designed to protect all known or discovered cultural resources are included for all of the action alternatives (see Chapter 2). Therefore, there should be no short term or direct effects on any of the cultural resource sites that may occur within any of the five unroaded areas. Another important aspect of cultural resource protection, to which unroaded areas generally contribute disproportionately (in comparison to roaded area) is protection from illegal gathering. There have been recent cases of illegal gathering on the Silver Lake Ranger District that have resulted in arrest and prosecution. Long term access to the areas where potential illegal gathering could occur would be less effectively controlled with Alternative E than the other action alternatives, as less miles of road are closed or decommissioned with Alternative E than most other alternatives (same amount as with Alternative G). Only Alternative A (no action) would be less effective in limiting long-term access to the areas where potential illegal gathering could occur.

Noxious Weeds

Effects of the alternatives on the potential for spread of noxious weeds are discussed elsewhere in Chapter 3. There are no specific effects relating to noxious weeds within unroaded areas that differ from those described under the general Noxious Weed section.

Soil, Air and Water; Wildlife Habitat; Habitat for Threatened, Endangered or Sensitive Species

Effects of the alternatives on the potential for effects on these resources are discussed elsewhere in Chapter 3. Only those effects that differ or are specific to a particular unroaded area will be discussed here.

Area A (29S, R14E, Sec 17 - Chase Spring) is the only one of the five unroaded areas that contains a perennial stream. Both West Fork Silver Creek and Silver Creek occur within this unroaded area. Alternative E does not include unit 177, which is a helicopter unit (in Alternatives C and G) in the vicinity of Silver Creek. For the entire Toolbox Fire Recovery Project, salvage harvest would occur only in the outer 100 feet of the RHCA in units that are within the Riparian Habitat Conservation Areas (RHCA) of a perennial stream (Category 1 RHCA). RHCAs for such streams are typically 300 feet wide (or wider) in slope distance beyond the edge of the active stream channel, on each side of the stream. No salvage would occur other than in the outer 100 feet of RHCA. No mechanized ground-based equipment would be allowed within the entire width of the RHCA. In addition, for all units, Timber Best Management Practices, Road Best Management Practices, and Soil Productivity Guidelines (see Appendix C) would be in effect. With these protective design measures in place, any detrimental effects on the soil, water, and fisheries resources within area A should be minimal and short term in nature. For Alternative E, salvage in Category 1 RHCAs would be via helicopter to minimize soil disturbance and compaction. If any project-generated sediment were to reach fish bearing streams, it is expected that it would be short-term in nature, and at an immeasurable, negligible level. No significant increases in water yield or sedimentation are predicted. See the Fisheries, Watershed, and Soils sections of Chapter 3 for additional detail.

Effects on threatened, endangered or sensitive species within the unroaded areas would be the same with Alternative E as discussed above under Alternatives C and G.

Alternative H

As shown in the Table 3.197, with Alternative H each of the unroaded areas would have some commercial salvage activity. This ranges from approximately 13 acres within unroaded area A (29S, R14E, Sec 17 - Chase Spring) to 193 acres within unroaded area D (T30S, R16E, Sec 22 - Beneath Winter). Alternative H has the least total amount of proposed salvage harvest within unroaded area (483 total acres) of any of the action alternatives. All salvage activity for all areas would occur along the margins of the areas. Therefore, the direct and indirect effect would generally be limited to these border areas. The three helicopter units that are included in the other action alternatives within the interior of Area C are not included in Alternative H.

All areas except B (T29S, R15E, Sec 35 - Hager Mountain) would have some new temporary road construction. The amount and effect would be the same as described for Alternatives C and G. Re-opening of existing unclassified roads, in the amounts for each of the areas shown in Table 3.197, would also occur under Best Management Practices for temporary road use during timber sale activity. In order to prevent low-level casual use, all temporary roads would be obliterated following use.

As shown in Table 3.197, prescribed fire activity is limited to 20 acres in area D (T30S, R16E, Sec 22 - Beneath Winter).

Natural Appearance and Solitude; Unroaded Recreation Opportunity

Apparent naturalness would be decreased by harvesting timber on a total of approximately 483 acres within the five unroaded areas. This is the least of any action alternative. Stumps would be visible in the foreground. Since most fire-killed trees generally fall down within 15-20 years, removing some of these trees through timber harvest would have the same visual effect from a distance in the long term. There would be a short-term interruption of solitude due to equipment involved with timber harvest within the vicinity of unroaded areas. The re-opening of existing unclassified roads is less with Alternative H than with Alternatives C and G. In total, an estimated 2.0 miles of unclassified road would be temporarily re-opened within the five unroaded areas. Re-opening existing unclassified roads would have the effect of "reversing" (in the short term) the return to natural appearance that typically occurs with closed unclassified roads. In the long term, due to their temporary use and subsequent obliteration, their return to natural appearance would be expected to proceed. The development of new temporary roads is less with Alternative H than with Alternatives C and G. The effects of these roads on solitude and apparent naturalness would be the same as attributed to the re-opening of unclassified roads.

Unroaded recreation opportunities would be somewhat diminished in the short term. The primary unroaded recreation opportunity that is present is the Fremont National Recreation Trail (NRT). It occurs within three of the five unroaded areas. While salvage activities are occurring, a short-term interruption in solitude associated with the operation of ground-based yarding systems would occur. There are no helicopter operations proposed with Alternative H, therefore this would not be a contributing factor to short term interruption of solitude. In the long term, because mitigation measures designed to protect the NRT are included for all of the action alternatives (see Chapter 2), the effect on the recreation opportunity associated with the trail would be minimal.

In the long term, due to the road decommissioning and closure associated with each of the five unroaded areas, the degree of “roadless character” may increase on a local level. The amount of decommissioning and closure within the five unroaded areas is the same with Alternative H as with Alternatives C and D. Road management actions would have the effect of increasing the roadless character of these areas, particularly Area C (centered on T 29S, R16E, Sec 32 in the Indian Rim area) where the largest amount of road management would occur. For the project area as a whole, about half of the currently open road would be either decommissioned or closed with Alternative H.

Cultural Resources

Mitigation measures designed to protect all known or discovered cultural resources are included for all of the action alternatives (see Chapter 2). Therefore, there should be no short term or direct effects on any of the cultural resource sites that may occur within any of the five unroaded areas. Another important aspect of cultural resource protection to which unroaded areas generally contribute disproportionately (in comparison to roaded area) is protection from illegal gathering. There have been recent cases of illegal gathering on the Silver Lake Ranger District that have resulted in arrest and prosecution. Long-term access to the areas where potential illegal gathering could occur would be reduced with Alternative H, as about half of the currently open roads would be either decommissioned or closed.

Noxious Weeds

Effects of the alternatives on the potential for spread of noxious weeds are discussed elsewhere in Chapter 3. There are no specific effects relating to noxious weeds within unroaded areas, that differ from those described under the general Noxious Weed section.

Soil, Air and Water; Wildlife Habitat; Habitat for Threatened, Endangered or Sensitive Species

Effects of the alternatives on the potential for effects on these resources are discussed elsewhere in Chapter 3. Only those effects that differ or are specific to a particular unroaded area will be discussed here.

Area A (29S, R14E, Sec 17 - Chase Spring) is the only one of the five unroaded areas that contains a perennial stream. Both West Fork Silver Creek and Silver Creek occur within this unroaded area. Alternative H does not include unit 177, which was previously discussed under Alternatives C and G, nor does it contain any units in the project as a whole, other than those in roadside hazard corridors, that are within any Riparian Habitat Conservation Areas (RHCA) of either a perennial stream or an intermittent stream. For all units in the project area, Alternative H would have in effect Timber Best Management Practices, Road Best Management Practices, and Soil Productivity Guidelines (see Appendix C). With these protective design measures in place, any detrimental effects on the soil, water and fisheries resources within area A should be minimal and short term in nature. If any project-generated sediment were to reach fish bearing streams, it is expected that it would be short-term in nature, and at an immeasurable, negligible level. No significant increases in water yield or sedimentation are predicted. See the Fisheries, Watershed, and Soils sections of Chapter 3 for additional detail.

Effects on threatened, endangered, or sensitive species within the unroaded areas would be the same with Alternative H as discussed above under Alternatives C and G.

Cumulative Effects

The analysis area for cumulative effects is the extent of the unroaded areas, both inside of and outside the project area boundary. Of the five unroaded areas on the map submitted by ONRC, only Area C (centered on T 29S, R16E, Sec 32 - Indian Rim) is fully on National Forest System lands and fully within the project area boundary. Table 3.196 “Unroaded Areas” displays the extent of the unroaded beyond project area boundaries (see Table 3.196 “Comments” column).

The analysis of cumulative effects on unroaded areas requires a consideration of past, present, and reasonably foreseeable future activities within the cumulative effects analysis area, regardless of ownership, weighed against the values unroaded areas can provide or contribute to.

Past Activities

On National Forest lands, timber harvest and road construction have occurred within all five unroaded areas, though to a lesser extent that on many other areas within the Fremont National Forest. This past activity is born out by the fact that re-opening existing unclassified roads, to be used as temporary roads, would provide access to nine of the 27 units that are displayed in Table 3.197. Other past activities relating to road construction have resulted in two of the unroaded areas being significantly incised with classified roads: area C (T 29S, R16E, Sec 32 - Indian Rim and area E (T 31S, R14E, Sec 11 - Graham Cr.). The portion of Area D (T30S, R16E, Sec 22 - Beneath Winter) that is within the project area, specifically that area on top of Winter Ridge, contains several short fingers of classified road 0.1 to 0.2 miles in length.

Other than timber harvest and road construction, the primary additional past activities that have occurred include livestock grazing within all areas for at least the past 100 years, fire suppression activity for approximately that same length of time, and dispersed recreation, including hunting and fishing, and since the early 1990s, hiking on the NRT that traverses three of the five unroaded areas. Area A includes about 2,200 acres that are on Bureau of Land Management lands. The primary past activity in this area has been livestock grazing for approximately 100 years.

The most significant past event that has occurred within at least portions of the five unroaded areas was the Toolbox Complex Fire of 2002 itself and the suppression activities in response to the fires.

Despite this past activity, and its effect on the unroaded characteristics of the areas, they continue to provide many of the values that are often best provided in an unroaded setting, including natural appearing landscapes, solitude, and habitat for abundant and healthy fish and wildlife populations.

Alternative A and Action Alternatives

Natural Appearance and Solitude; Unroaded Recreation Opportunity

In addition to the direct and indirect effects discussed in the previous section, several future or on-going activities have the potential to have an effect. This includes the neighboring Winter Fire Salvage timber sales (approximately 4 miles southeast of the Toolbox Fire Recovery project). This project activity, currently planned for implementation in 2003 and 2004, includes primarily helicopter yarding of fire salvage timber sale units. In examining the unroaded area map submitted by ONRC, it appears that some of this activity would be within or near the southern extension of unroaded area D (T30S, R16E, Sec 22 - Beneath Winter); however, the area extended beyond the coverage of the submitted map. There would be a short-term interruption of solitude due to this activity.

Other planned future activities that could have a cumulative effect include the expected re-building of the Fremont Point Cabin and the reconstruction of the Fremont National Recreation Trail (NRT). The Fremont Point Cabin is near unroaded area D (T30S, R16E, Sec 22 - Beneath Winter), while the NRT traverses portions of area B (T29S, R15E, Sec 35 - Hager Mountain), area C (T 29S, R16E, Sec 32 - Indian Rim) and unroaded area D (T30S, R16E, Sec 22 - Beneath Winter). This activity has the potential to cumulatively affect solitude because of the sounds associated with the activity (short term) and, indirectly, due to anticipated increases in recreation use (long term).

Of the other reasonably foreseeable future activities listed in Appendix A, the only one on National Forest System lands that would likely have an impact on any of the unroaded areas is listed in Appendix A, Table A-16 as a 2004 to 2007 project for commercial thinning, activity fuels treatment, and pre-commercial thing within the Upper Silver Creek subwatershed. Portions of nine commercial thinning units in the Triad Restoration Project occur within area B (T29S, R15E, Sec 35 - Hager Mountain). The effects of this are documented in the Triad Restoration Project analysis file (Silver Lake Ranger District). Approximately 150 acres with area B (T29S, R15E, Sec 35 - Hager Mountain) would be commercially and pre-commercially thinned during the next three years with this project. No classified road would be constructed; however, approximately 1.2 miles of temporary road would be constructed to access the nine units. These roads would be developed under Best Management Practices, and, in order to prevent low-level casual use, these roads would be obliterated following use. The Triad Decision Notice incorporates protective measures in regard to those resources which unroaded areas typically offer, including a measure to minimize impact on the National Recreation Trail and ensure its continued integrity that requirements pertaining to the locations of landings and skid trails in four units that are within the foreground viewing zone of the NRT. The Triad project contains thinning prescriptions that would limit activities to trees less than 21 inches dbh. The effect of the thinning prescriptions would be to open up the forest and allow increased sight distance and larger trees to develop. A short-term impact on solitude would occur during project implementation. In the short term, the increased numbers of stumps and the open nature of the forest stand would likely be the most apparent visual change resulting from implementation. The use of whole-tree yarding should minimize the effects pertaining to slash. In the long term the project would result in the development of historic “open park-like” conditions, characterized by large, orange-barked ponderosa pine trees

Reasonably foreseeable future activities outside National Forest lands that would likely have an impact within any of the unroaded areas are noted in Appendix A, Table A-15, as seedling planting and seeding within the Upper Silver Creek subwatershed during the period 2003 to 2005. This includes planting 250 acres of ponderosa pine and bitterbrush and seeding (primarily grasses, both aerial and ground application) 290 acres in the Upper and Middle Silver Creek subwatersheds. Portions of the activity would occur within Area A (29S, R14E, Sec 17 - Chase Spring). The effects of this activity would include a short-term reduction in solitude, particularly in relation to aerial seeding, and the long-term development of desirable vegetation. No new roads would be developed.

Additional reasonably foreseeable future activities outside National Forest lands that would impact solitude within any of the unroaded areas include the 71 acres of fire salvage on BLM lands listed in Appendix A, Table A-15, for 2003. While this activity would not occur within any of the ONRC mapped unroaded areas, it is adjacent to area C (T 29S, R16E, Sec 32 - Indian Rim).

Grazing on both National Forest System lands and BLM lands may have minor long-term impacts on apparent naturalness, although effects would not be greater than past impacts.

Future fire suppression on National Forest lands would be expected to produce a long-term negative effect on the development of sustainable ponderosa pine ecosystems. Fire suppression on both National Forest lands and BLM lands would have a short-term negative effect on solitude.

Indirect effects associated with recreational use, including noxious weed spread, erosion, litter, and evidence of fire rings, are expected to remain minor but could create localized long-term negative impacts on natural appearance.

Cultural Resources

All reasonably foreseeable future activities that could potentially affect cultural resources would include mitigation measures designed to protect all known or discovered cultural resources. Therefore, there should be direct cumulative effects on any of the cultural resource sites that within any of the five unroaded areas. However, the overall cumulative effect from the combination of Alternative A and other reasonably future activities could potentially be greatest for Alternative A because there would be no decrease in open road density associated with Alternative A. Long term access to the areas where potential illegal gathering could occur would be more effectively controlled with the action alternatives, than with Alternative A.

Noxious Weeds

Cumulative effects of the alternatives, when considered in the context of other past, present, and reasonably foreseeable future activities on the potential for spread of noxious weeds, are discussed elsewhere in Chapter 3. There are no specific cumulative effects relating to noxious weeds within unroaded areas, that differ from those described under the general Noxious Weed section.

Soil, Air and Water; Wildlife Habitat; Habitat for Threatened, Endangered or Sensitive Species

Effects of the alternatives on the potential for cumulative effects on these resources are discussed elsewhere in Chapter 3. There are no specific cumulative effects relating to these resources within unroaded areas, that differ from those described under the appropriate sections found elsewhere within Chapter 3.

Two sensitive species have a presence (or habitat presence) within unroaded area outside the project area boundary. This includes Peregrine falcon *(Falco peregrinus),* which is present in unroaded area D (T30S, R16E, Sec 22 - Beneath Winter) to the east of the project area and Northern Leopard Frog *(Rana boylii),* which has habitat present in unroaded area D (T30S, R16E, Sec 22 - Beneath Winter) to the east of the project area. The biological evaluation pertaining to these species, reported in the Wildlife section of Chapter 3, document the expected cumulative effects relating to theses species.

Common to All Action Alternatives

Natural Appearance and Solitude; Unroaded Recreation Opportunity

The reasonably foreseeable future activities as discussed above under “Alternative A and Action Alternatives” would occur and combine with the indirect and direct effects of the Toolbox action alternatives, as noted below.

Looking at the direct effects from the Toolbox Fire Recovery Project on natural appearance and solitude, on an area by area basis, reveals that Alternative H would result in the least amount of salvage activity within area B (T29S, R15E, Sec 35 - Hager Mountain) and substantially less activity within area C (T 29S, R16E, Sec 32 - Indian Rim) compared to other action alternatives. Alternative D would result in the least amount of salvage activity within area A (29S, R14E, Sec 17 - Chase Spring), area D (T30S, R16E, Sec 22 - Beneath Winter) and area E (T 31S, R14E, Section 11 – Graham Creek). Apparent naturalness would be decreased in the short term by salvage harvest. Stumps would be visible in the foreground. Helicopter logging units would not be expected to be noticeable from a distance. The amount of area that would be impacted this way is detailed in Table 3.197. Since most fire-killed trees generally fall down within 15-20 years, removing some of these trees through timber harvest would have the same visual effect from a distance in the long term. There would be a short-term interruption of solitude due to equipment involved with timber harvest within the vicinity of unroaded areas.

In summary, because Alternative H has the least total amount of proposed salvage harvest within all unroaded areas (483 total acres) of any of the action alternatives, and because all salvage activity with Alternative H for all areas would occur along the margins of the areas, it would have the least amount of negative short-term cumulative effects on natural appearance and solitude. In addition, Alternative H, along with Alternatives C and D, includes the most potential to have a long-term benefit on natural appearance and solitude because these alternatives include the greatest amount of road decommissioning and closure of any of the alternatives. Because Alternative G and Alternative C have the greatest total amount of proposed salvage harvest within all unroaded areas (972 acres, Alternative C and 966 acres, Alternative G), these alternatives have the greatest amount of negative short-term cumulative effects on natural appearance and solitude. Alternatives E and G include the least potential to have a long-term benefit on natural appearance and solitude because these alternatives include the least amount of road decommissioning and closure of any of the alternatives. However, the

overall long-term cumulative effect would still be positive for these less intensive road management alternatives as approximately one-third of the currently open road would be either decommissioned or closed for the area as a whole.

In conclusion, all alternatives, together with reasonably foreseeable and ongoing activities, would produce a short-term reduction in solitude within the ONRC mapped unroaded areas. Solitude is likely to be reduced in Alternative A as well, although not to the degree of the action alternatives in the short-term (2-5 years). Natural appearance would also be reduced in the short term regardless of the alternative selected. The additional effect on natural appearance and solitude attributable to other on-going or reasonably foreseeable future activities is the same for all action alternatives. The action alternatives have the potential to increase the acres of unroaded lands in the long-term due to decommissioning of roads. Eventually, these roadbeds would disappear or would be hidden with vegetation, and motorized use should decrease. Natural appearance and solitude would be increased in the long-term, most likely to the extent that it counteracts the other ongoing and reasonably foreseeable activities within the areas. Cumulatively, the effect would be an increase in the value of the roadless characteristics and an increase in acres classified as unroaded, although the effects are not likely to be apparent for 20 to 30 years.

Noxious Weeds

Cumulative effects of the alternatives, when considered in the context of other past, present and reasonably foreseeable future activities on the potential for spread of noxious weeds are discussed elsewhere in Chapter 3. There are no specific cumulative effects relating to noxious weeds within unroaded areas, that differ from those described under the general Noxious Weed section.

Soil, Air and Water; Wildlife Habitat; Habitat for Threatened, Endangered or Sensitive Species

Effects of the alternatives on the potential for cumulative effects on these resources are discussed elsewhere in Chapter 3. There are no specific cumulative effects relating to these resources, within unroaded areas, that differ from those described under the appropriate sections found elsewhere within Chapter 3.

Two sensitive species have a presence (or habitat presence) within unroaded area outside the project area boundary. This includes Peregrine falcon *(Falco peregrinus),* which is present in unroaded area D (T30S, R16E, Sec 22 - Beneath Winter) to the east of the project area and Northern Leopard Frog *(Rana boylii)* which has habitat present in unroaded area D (T30S, R16E, Sec 22 - Beneath Winter) to the east of the project area. The biological evaluation pertaining to these species, reported in the Wildlife section of Chapter 3, document the expected cumulative effects relating to theses species.

Consistency with Forest Plan and Other Laws and Regulations

All alternatives are consistent with Forest Plan direction.

All proposals pertaining to road management were developed through a road analysis process that consisted of six steps: Setting up the analysis, describing the situation, identifying issues, assessing benefits, problems, and risks, describing opportunities, setting priorities, and reporting. The recommendations regarding road management were made with a full compliment of pertinent resource specialists, including: soils, hydrology, fisheries, wildlife, cultural, silviculture, recreation, engineering, timber and fire. Each road was reviewed in a systematic manner by the roads analysis team. The engineer shared pertinent information found during the field inventory and a discussion ensued regarding the necessity of each road as it pertained to each resource.

AIR QUALITY

- Introduction
- Air Quality Regulatory Framework
- Area of Analysis
- Analysis Methods
- Existing Condition
- Environmental Consequences
    - Direct and Indirect Effects
    - Cumulative Effects
- Consistency with Forest Plan and Other Regulatory Framework

Introduction

Smoke contains pollutants including tiny particles called particulate matter (PM). Particulate matter can cause significant health problems, especially for people suffering from respiratory illnesses. Smoke affects the clarity of the air (visibility). Based on recent research, the Environmental Protection Agency (EPA) revised the air quality standards to provide better health and visibility protection. With the new standards, land managers must consider using techniques that minimize prescribed fire emissions and impacts of smoke on public health and the environment. Planning and cooperation among land managers, air quality regulators, and local communities ensures that prescribed fire, clean air, and public health goals are met.

The main air quality concern associated with the Toolbox Fire Recovery Project is the amount and concentration of PM produced by proposed prescribed burning. Particulate matter is comprised of a mixture of solid particles and liquid droplets. Some particles are large or dark enough to be seen as dust or soot, but most are too small to be seen by the human eye. Particle size is measured in microns (one micron equals one millionth of a meter). Particles can be up to 50 microns or larger, and this size tends to settle out of the air quickly and is less likely to affect public health. Particles 10 microns and smaller (PM-10) may be inhaled deep into the lungs and pose a great threat to public health and visibility. Fine particles 2.5 microns and smaller (PM –2.5) are of the highest concern and are generally emitted from activities such as industrial and residential combustion, wildland fire, agricultural burning, and vehicle exhaust.

Air Quality Regulatory Framework

The Clean Air Act

The basic framework for controlling air pollutants in the United States is the 1970 Clean Air Act (CAA), as amended in 1990 and 1999 (42 U.S.C. § 7401 et seq.). The CAA was designed to protect and enhance the quality of the nation's air resources. The CAA encourages reasonable federal, state and local government actions for pollution prevention. State Implementation Plans (SIPs) are developed to implement the provisions of the Clean Air Act (The State of Oregon Clean Air Act Implementation Plan (OAR 340-200-0040))

National Ambient Air Quality Standards (NAAQS)

The EPA has established NAAQS for seven criteria pollutants that have been determined to be harmful to the public and environment. The following table lists the seven NAAQS. Oregon has adopted most of these standards to form the Oregon Ambient Air Quality Standards (DEQ Ambient Air).

Table 3.200 EPA National Air Quality Standards for Criteria Pollutants

Pollutant	Time Period Average	Federal	Oregon
Carbon Monoxide (CO)	One-hour 8-Hour	35 ppm 9 ppm	35 ppm 9 ppm
Lead (Pb)	Calendar Quarter (90 days)	1.5 µg/m3	1.5 µg/m3
Nitrogen Dioxide (NO2)	Annual Arithmetic Mean	0.053 ppm	0.053 ppm
Sulfur Dioxide (SO2)	Annual Arithmetic Mean 24-Hour 3-Hour	0.03 ppm 0.14 ppm ----------	**0.02 ppm **0.10 ppm **0.50 ppm
Ozone	8-Hour Hourly Average	0.08 ppm 0.12 ppm	---------- 0.12 ppm
PM10	Annual Arithmetic Mean 24-Hour Average	50 µg/m3 150 µg/m3	50 µg/m3 150 µg/m3
PM2.5	Annual Arithmetic Mean 24-Hour Average	15 µg/m3 65 µg/m3	15 µg/m3 65 µg/m3

* ppm = parts per million
µg/m3 = micrograms per cubic meter
** denotes more stringent standards than federal

The main air quality concern associated with this project is the amount and duration of PM produced by prescribed burning. Prescribed burning produces very little to none of the other regulated pollutants. Additionally, smoke from prescribed fire must meet the ambient air quality standards for PM-10 and PM-2.5.

Prevention of Significant Deterioration

The Prevention of Significant Deterioration (PSD) provisions of the Clean Air Act require measures, "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreation, scenic, or historic value." Stringent requirements are therefore established for areas designated as "Class I" areas (42 U.S.C. § 7475 (d)(2)(B)). Designation as a Class I area allows only very small increments of new pollution above already existing air pollution levels.

Class I areas are:

- International parks
- National wilderness areas greater than 5000 acres
- National memorial parks greater than 5000 acres
- National parks greater than 6000 acres that existed on August 7, 1977

The only Class I near the Toolbox Fire Recovery Project area is the Gearhart Wilderness (Pacific Northwest Air, 1). The Gearhart Wilderness is 22 miles South, South East of the analysis area.

A requirement of PSD is that new major stationary sources, or major modifications of existing stationary sources, must first receive a PSD permit from the appropriate air regulatory agency before implementing construction or modification. A stationary source is one that is well defined, such as the smoke stack of a coal-fired power plant or smelter. The Toolbox Fire Recovery area is not considered a major stationary source and therefore is not subject to the PSD permitting process.

Visibility Protection

The Clean Air Act establishes as a national goal, "the prevention of any future, and the remedying of any existing impairment of, visibility in mandatory Class I Federal areas which impairment results from manmade air pollution" (42 U.S.C. § 7491 et seq.).

Visibility impairment is a basic indicator of air pollution. The EPA has determined that regional variation in visibility needs to be addressed. As a result, the EPA promulgated Regional Haze Regulations for Protection of Visibility in National Parks and Wilderness Areas in 1997. These regulations are intended to improve visibility, or visual air quality, in more than 150 Class I Areas across the country. The Regional Haze regulations apply to all States, including those States that do not have any Class I areas. Pollution that occurs in those states may or may not contribute to impairment in other states or Class I areas, but must be accounted for.

Non-Attainment Areas

If a community does not meet or "attain" the NAAQS, the EPA designates it as a non-attainment area. The state must then demonstrate to the public and EPA how that area will meet the ambient air quality standards in the future based upon controlling emission sources, through a control plan that is part of the SIP. The emissions from prescribed fire may be considered as part of the demonstration. The nearest PM-10 non-attainment areas are Bend and Lakeview (DEQ Air Quality).

Conformity

The general conformity provisions of the CAA (Section 176(c)), prohibit federal agencies from taking any action within a non-attainment area that causes or contributes to a new violation of the standards, increases the frequency or severity of an existing violation, or delays the timely attainment of a standard as defined in the area plan. Federal agencies are required to ensure their actions conform to applicable State Implementation Plans. *The Toolbox Fire Recovery Project is not subject to the conformity process since it does not occur within a non-attainment area boundary*.

Policies and Programs

Interim Air Quality Policy on Wildland and Prescribed Fires

The "Interim Air Quality Policy on Wildland and Prescribed Fires" (EPA 1998) addresses public health and welfare impacts caused by wildland fires managed to meet resource objectives and prescribed fires. This policy complements the Natural Events Policy, which addresses public health impacts caused by wildland fires. The Interim Air Quality Policy urges states and tribal managers to collaborate with wildland owners and managers to mitigate the air quality impacts that could be caused by the increase of prescribed fires and wildland fires managed to meet resource objectives.

The Interim Policy "urges wildland owners/managers to: (1) notify air quality managers of plans to significantly increase their future use of fire for resource management, (2) consider the air quality impacts of fires and take appropriate steps to mitigate those impacts, (3) consider appropriate alternative treatments, (4) and participate in the development and implementation of State and Tribal Smoke Management Plans". ***The Toolbox Fire Recovery Project meets the intent of the Interim Policy through the NEPA analysis process and the air quality standards listed in the Fremont National Forest Land and Resource Management Plan.***

Smoke Management

Prescribed fire, often in combination with other management techniques, can be used to restore wildland forests to a more sustainable structure while simultaneously reducing the potential for catastrophic wildfires. Unfortunately, prescribed fire runs contrary to current federal and state environmental laws because any fire event has the potential to degrade ambient air quality, impact visual quality, and expose the public to unhealthy pollutants.

Air regulatory agencies and the public must come to understand the complex trade-offs between increased prescribed fire, wildfire, visual impairment, and public exposure to smoke before this issue can be resolved Land managers and researchers have cooperated to develop the Fire Emissions Trade-off Model (FTEM) that would determine the level of prescribed fire treatments that would minimize combined emissions from both prescribed fire and wildfire. The model evaluated forest fuel types and vegetation characteristics similar to that of the Toolbox project area and estimated total emissions from wildfire and prescribed fire is expected to increase continuously over the next 40 years with increasing levels of prescribed fire treatments. Between 40 - 80 years, emissions are expected to remain constant with increasing levels of prescribed fire treatment, and, beyond 80 years, total emissions will begin to drop. The FETM model also produced a dramatic reduction in the number of wildfire acres burned and associated wildfire smoke emissions only with increased levels of prescribed fire treatments.

Consumption of Fuel vs. Emission Production

Studies from the Columbia River Basin Analysis show that emissions from wildfires are 50 to 70 percent greater than that of prescribed burns. The potential particulate matter of 10 microns per million parts air (PM10) from a wildfire is twice the amount as from a prescribed fire of the same size. Smoke management studies show approximately 80 to 90 percent of the fuels are consumed in the flaming stage and 10 to 20 percent are consumed in the smoldering stage.

Smoke Management Programs

Managing smoke from prescribed burning across agency lands is tracked and monitored by the USDA Forest Service and USDI Bureau of Land Management, Regional Air and Smoke Program located in Portland Oregon. The Interagency

Monitoring of Protected Visual Environments program (IMPROVE) is one of the ways smoke is monitored across both Washington and Oregon through the use of fifteen receptor sites. The objectives of the program are to:

- Establish current visibility and aerosol conditions in mandatory Class I areas
- Identify chemical species and emission sources responsible for existing human-made visibility impairment
- Document long-term trends for assessing progress towards the national visibility goals
- Provide regional haze monitoring representing all visibility-protected federal Class I areas where practical

The Oregon Airshed Group operates under the guidelines of the State Implementation Plan (SIP). The intent of the SIP "is to minimize or prevent smoke impacts to communities while using fire to accomplish land and resource management objectives." The SIP identifies the responsibilities of air regulatory agencies, and federal, tribal, state, and private land managers. The SIP provides accurate and reliable guidance and direction to the individuals performing the burning operations. This program is designed to meet the state's regulatory needs as well as the Interim Policy mentioned above.

Members of the Oregon Airshed Group report planned burns to the smoke Monitoring Unit in Salem. Burns are reported by "airshed" (geographical areas identified by the Airshed Group with similar topography and weather patterns) and "impact zones" (communities identified by the Airshed Group susceptible to smoke intrusions). The smoke Monitoring Unit meteorologist/program coordinator evaluates proposed burns, existing air quality, and forecasted weather conditions including atmospheric stability and transport winds. This information is used to issue daily burn restrictions for members of the Airshed Group. Burn restrictions are issued primarily from spring through fall. Oregon Department of Environmental Quality (DEQ) monitors planned prescribed burns and issues advisories when air dispersion is poor.

Area of Analysis

North Lake County is the primary air quality analysis area for the Toolbox Fire Recovery Project. The only non-attainment area in Lake County is the town of Lakeview. Other non-attainment areas closest to the Toolbox Fire Recovery Project are Bend, 75 miles north; and Burns, 80 miles east. Class I areas within 100 miles of this analysis area include the Gearhart Wilderness, located 22 miles south-southeast. Smoke from the slash piles, underburning, and jackpot burning has been modeled for this analysis area.

Analysis Methods

Air quality is temporarily affected by several activities associated with forest management. Prescribed burning produces smoke. Harvesting activities can produce dust as well as vehicle emissions. Dust and vehicle emissions can temporarily reduce air quality in the immediate vicinity of machinery operations. All alternatives involving commercial removal would require the application of dust abatement to roads. Impacts from dust and vehicle emissions would be short-term and temporary in nature. The focus of this portion of the analysis is on prescribed burning smoke from Alternatives C, D, E, G and H. Alternative A (no action) has no prescribed burning and would produce no emissions.

The First Order Fire Effects Model (FOFEM) version 4.0 Regionalized fuels methodology was used to estimate smoke emissions from prescribed burning because site-specific fuel treatment data is available. BlueskyRAINS (Rapid Access Information System) is a modeling framework used to predict cumulative impacts of smoke from agriculture, forest, and range fires by linking together data and models of fuel consumption, emissions, meteorology and smoke dispersion. Information such as burn location, current and predicted weather and type of burn are entered into the model to produce a prescribed burn simulation map with predicted dispersion forecasts by request time parameters. Real time animations of surface smoke can be simulated using blueskyRAINS. The model shows potential smoke impacts using real time meteorology. The simulations can be updated continuously.

All prescribed burning should be done when atmospheric conditions favor good air quality, good plume rise, and dispersion as forecasted by the Smoke Monitoring Unit. Since good air quality and atmospheric conditions must coincide with certain vegetation and fuel conditions, it is not likely that all burn units would be accomplished in one season or year, as modeled. Thus, smoke emission and dispersion modeling for fall 2005 and spring 2006, show more smoke at one time than would likely occur with practicable burning over several seasons.

Existing Condition

Meteorology/Weather

The Silver Lake basin is bounded by the Connelly Mountains on the east and the foothills of the Cascades on the west. These mountain ranges are minor barriers to westerly flowing weather movement, and only trap air within the basin under strong high-pressure systems. Topography and weather patterns determine the extent to which airborne particulate matter accumulates within the Airshed. Air flows within valleys, upward with diurnal heating and downward with nocturnal cooling, much like water flows within stream channels.

Daily Patterns

Daily daytime temperature changes affect how PM and other pollutants are dispersed. The cooling of the earth's surface at night creates downslope winds that carry pollutants from higher terrain to low lying areas. Here pollutants may pool or exit the region along the river drainages. The heating of the earth's surface during the day causes pollutants to rise with the heated air where they are diluted and dispersed with the westerly flow. Temporary inversions can cause smoke to lie along drainages in night and early morning.

Seasonal Patterns

Temperature inversions may occur at any time of the year, but are more common during the winter months of December, January, and February. During this time period, emissions can be trapped in a layer of cold surface air. This happens when snow covers the ground and keeps the earth's surface from heating. It is particularly pronounced in mountain valleys that trap air. Atmospheric conditions of high pressure contribute to stable, slow moving stagnant air masses. Weather changes with frontal systems and low pressure helps move air and break down inversions. However, inversions may persist throughout the day in winter when heating is less than in summer.

Prevailing southwesterly winds above Fremont-Winema National Forests mountainous terrain usually moves smoke from the southwest toward the northeast in the direction of the Deschutes and Ochoco National Forests. Locally, topographic features and the heating and cooling of the earth's surface modify winds. Consequently, all major drainages are subject to local variations that can temporarily trap smoke, affecting its dilution and dispersal.

Air Quality

Sources of Particulate Matter

Private debris burning, agricultural burning, and wood burning stoves all contribute smoke. Many residents burn fencerows and irrigation ditches in the early spring. Farmers and ranchers around the vicinity sometimes burn hay fields in the fall and smoke is transported by a west to southwesterly flow. Since the area is fairly wide open with rolling mountainous terrain, particulate matter is somewhat limited during inversions; however, dust and blowing sand are a contributing factor of particulate matter during windy periods. There are no known large stationary point sources of air pollutants in the area.

On the Fremont-Winema National Forests, prescribed burning is accomplished during spring and early summer when dilution, dispersal, and mixing conditions are generally good to excellent; and late summer and early fall when conditions may be more restrictive. Spring burning often uses existing snow packs as "check lines" to help limit fire spread thus facilitating controlled burning. Prescribed burning in the spring usually produces less particulate matter as fuel moistures are higher hence less smoldering combustion of fuels plus optimal atmospheric dispersion conditions are fairly prominent. Early fall burning conditions may include high fire danger, adverse weather, and fuel loading which limit controlled burning. Late fall often has weather patterns and cool nights with more frequent atmospheric inversion conditions which limit burning opportunities. Prescribed burning in any season is only done when atmospheric dispersion for smoke is favorable.

Emissions from Wildland fire and Prescribed Fire

Roger Ottmar and others (1996), as referenced in *Wildland Fire in Ecosystems* (2000), developed a methodology to assess emissions from wildland fire and prescribed fire. The amount of smoke produced can be derived simply by determining the total fuel load (tons per acre) and modeling fuel consumption (tons per acre). Fuel loading is the amount of fuel present quantitatively in terms of dry weight of fuel per unit area and is a critical variable required for the calculation of fuel consumption and the resulting smoke produced. Since the fuel loading variation across the landscapes often is very large, this variable is the largest error contributor (up to 80 percent) in predicting emissions production. (Ottmar 2000, Peterson 1987) Fuel consumption is that amount of fuel consumed during a fire (both flaming and smoldering stages). As with fuel loading, extreme variations can be associated with this variable resulting in an error contribution of 30 percent when

estimating emissions production from wildland fires (figure 3.33) Estimating fuel consumption can be accomplished using one of several fuel consumption software programs, including First Order Fire Effects Model (FOFEM.). This analysis used FOFEM to estimate emissions from some recent wildland fires that impacted Central Oregon.

Over 115,000 acres of Fremont National Forest, State of Oregon (Lakeview District), and private lands burned during the wildland fires of 2002. Assuming a PM-10 emission factor of 242.6 pounds per acre, these fires produced an estimated 14,000 tons of PM-10. Other smoke that impacted North Lake County originated from the Rogue/Siskiyou (150 miles west). About 500,000 acres burned, which produced approximately 60,000 tons of PM-10, assuming a PM-10 emission factor of 242.6 pounds per acre.

During 2002, the Silver Lake Valley in North Lake County also experienced smoke from wildland fires in California and other parts of Oregon but this analysis does not try to estimate their contribution. High smoke concentrations occur periodically in Lake County throughout an average summer due to fires that burn to the south-southwest.

"Average" emission factors have been calculated for the following: (PM=Particulate Matter)

- Grass - PM = 15 lbs per ton of fuel consumed
- Sage - PM = 30 lbs per ton of fuel consumed
- Pine/Fir -PM = 25 lbs per ton of fuel consumed
- Piles - PM = 28.4 lbs per ton of fuel consumed

These averages are used as a simple approach to estimate emissions production (Smoke Management Guide 420-1 NFES 1279 and Hardy, 1992).

Landing Pile Emissions

The average landing pile size used in this analysis was 12 feet high by 14 feet wide. A nomogram in *Estimating Volumes, Biomass, and Smoke Production for Piled Slash* (Hardy, 1992) displays the volume (cubic feet) of an average landing pile as 924 cu. ft. The following calculations demonstrate the method used to determine pounds of emissions per average landing pile.

Wood-to-pile volume ratio = 20% (.20)
Proportion of mass consumed = 90% (.90)
Emission factor for piled slash = 28.4 lbs per ton of fuel consumed

924 cu.ft. x .20 = 185 cu.ft. Average density of piled slash is 30 lbs/cubic foot.

185 cubic foot wood
x 30 lb/cubic foot
5,550 pounds of wood

5,550 pounds of wood
x .90 (90% consumed)
4,995 **pounds of wood consumed**

4,995 pounds of wood consumed divided by 2000 pounds (1 ton) = 2.5 tons

28.4 lb/ton of emissions
x 2.5 tons of wood consumed
71.0 lbs of emissions per average landing pile

Broadcast Burn Emissions

Several factors remain the same in determining the amount of emissions from broadcast burning as in pile burning, i.e. the volume of wood (tons per acre), the moisture content of the wood, and the amount of wood consumed. Given the high variation of factors involved, i.e. moisture content, time of year and variability of tons per acre (TPA) across the landscape, studies show with a 90 percent proportion of mass consumed, the emission factor of an average broadcast burn is 25 lbs per

ton of fuel consumed. Specialists agree an average of 35 TPA would be left on the ground post-helicopter operations. All broadcast burning associated with the Toolbox EIS would be in conjunction with helicopter operations.

Underburn Emissions

Outside of Harvest Units - Understory burning produces varying amounts of emissions depending on the same factors that influence broadcast burn emissions. All understory burning applied outside of harvest units will strive to meet objectives of creating a mosaic of shrub habitat and cover while increasing forest sustainability. Objectives also include burning to maintain a 40 to 60 percent burned/unburned mosaic. Because of the burned/unburned mosaic, emissions will be half that of broadcast burning, due to approximately half of the fuels being consumed. Average fuel loads should not exceed 20 TPA.

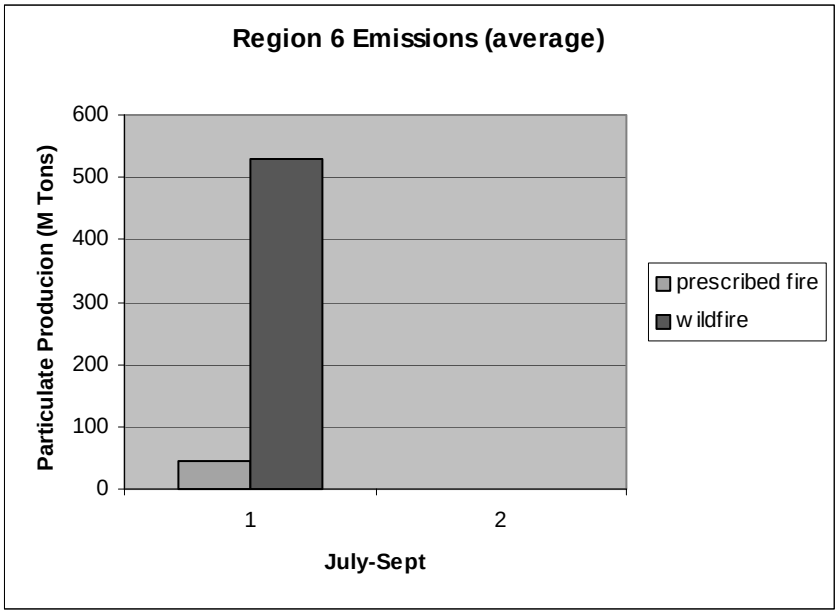
Within Harvest Units - Understory burning within commercial salvage areas may include increased slash loads from that of underburns outside of harvest areas due to an increase of slash due to harvest activities. Dead and down fuel loads will increase an average of 10 to 15 percent from that of dead and down fuel loads outside of harvest units. Average fuel loads should not exceed 35 TPA. The emission factor for underburning will stay at 25 lbs. per ton of fuel consumed.
Note: Underburn acres will be divided in half to reflect the 40 to 60 percent burn/unburned mosaic.

Jackpot Burn Emissions

The burning of scattered accumulations of fuel usually associated with harvest residues is commonly referred to as Jackpot burning. It is usually performed in early spring or late fall when one and ten hour time lag fuel moistures are high enough to prevent fire from "creeping" along the ground. The amount of fuels consumed per acre is small in comparison to the other types of burning previously mentioned. The amount of fuel consumed for outputs of particulate emissions from jackpot burning has been estimated at an average of 10 tons per acre. The emission factor stays the same at 25 lbs. per ton of fuel consumed.

The following chart displays prescribed fire and wildfire emissions for the Forest Service's Pacific Northwest Region (Region 6) for July through September 2002.

Figure 3.33 Region 6 Prescribed Fire and Wildfire Emissions



Existing Air Quality Concentrations

Air quality in Lake County is considered good to excellent during most of the year. There are no non-attainment areas for PM-10 or PM-2.5 within 80 miles. Lakeview and Klamath Falls periodically fall below the NAAQS levels set by the EPA. The Air Quality Index (AQI) reporting stations closest to the Toolbox Fire Recovery Project are Bend and Klamath Falls (2 of 16 Oregon DEQ field offices).

Daily (24-hour averages) rather than annual averages of PM-10 monitoring at Bend and Klamath Falls range from lows near 20 micrograms per cubic meter in very clean air during rainy weather to 30 - 60 micrograms per cubic meter during winter inversions. The AQI is a daily average and does not reflect heavy short-term smoke impacts that may be unhealthy. Emissions from woodstoves, automobiles, and road sanding contribute to winter concentrations. From spring through fall, concentrations can be between 10 - 60 micrograms per cubic meter. During spring and fall, smoke from wildland fire and prescribed fire both inside and outside of North Lake County can contribute to those concentrations.

Smoke Contributions to Existing Air Quality

The Toolbox Complex Fire in 2002 was much larger than usually experienced on the Fremont-Winema National Forests. Approximately 125,000 acres burned on the Fremont-Winema National Forests, including the Toolbox Fire Complex (85,000 acres) and other fires. Smoke from wildland fires is considered a "natural event" by the EPA, and is not subject to the NAAQS. PM-10 concentrations from the Toolbox fire exceeded the NAAQS for an estimated 20 days in the Silver Lake Valley. PM-2.5 concentrations exceeded the standard for an estimated 30 days.

Smoke from the Biscuit wildland fire north of Cave Junction on the Rogue River National Forest moved east for 100 miles into North Lake County, contributing to PM-10 concentrations. The annual DEQ report of Ambient Air Quality Standards for 2002 has not been released yet; therefore, the 24-hour average of micrograms per cubic meter at Klamath Falls is not available. Spring 2002 prescribed burning on the Fremont-Winema National Forests resulted in minimal PM-10 concentrations across North Lake County.

Smoke Sensitive Areas

FOFEM modeling was done for the North Lake County geographic areas of Silver Lake, Fort Rock, and Christmas Valley. "Smoke sensitive" areas were identified for each area. In the Silver Lake geographic area, the community of Silver Lake is approximately ten miles downwind of the prevailing winds in the Toolbox project area. The Fort Rock area has a very small population and is approximately 20 miles downwind. The town of Christmas Valley is the most populated and is 25 miles downwind.

Environmental Consequences

Direct and Indirect Effects

Effects Common to All Alternatives

Wildland Fires

In the absence of fuel reduction, and in the event of future wildland fire occurring, varying levels of smoke could persist in North Lake County for several weeks, depending on local climatic conditions, level of dispersion (poor, good, etc.) and amount of smoke/emissions produced. Health and visibility could be adversely affected. Alternative A does not propose to conduct any harvest activities or fuel reduction treatments to mitigate current and future heavy fuel loadings. Therefore, it is the least effective in reducing potential smoke emissions and associated pollutants from future wildland fires. Alternatives A does not propose to conduct any prescribed fire; therefore, in the short-term no smoke would occur from this activity. Alternatives C and G would be the most effective in reducing potential smoke emissions and associated pollutants in the long term, with Alternative H and D being quite similar in effectiveness. Alternative E does not propose to conduct prescribed fire other than activities fuels-related treatment, and would be less effective in the long term, while still providing a larger measure of effectiveness than Alternative A. Alternative C, D, E, G and F all propose to conduct prescribed fire and would produce varying levels of smoke in the short term. Forest Plan standards for meeting EPA and State air quality standards for PM-10 and PM-2.5 would be met with all alternatives, including Alternative A.

Smoke from wildland fires would occur with all alternatives, the amount dependent upon climate. Wildland fires locally, or anywhere in the northwest and Northern California, can affect regional haze in the North Lake County. Frequently, wildland fires on the Modoc National Forest are carried by southwesterly winds into the North Lake County affecting visibility, but not exceeding NAAQS PM-10 standards. Natural phenomena like volcanic eruptions and windstorms over deserts also produce particulate matter. Dust from as far away as China in 1998 and 2001 impacted the area. Metropolitan areas upwind like Medford and Portland can also generate enough particulate matter to create haze in the area. Smoke and dust from agricultural areas like the Willamette Valley of Western Oregon also affect particulate matter in the North Lake County. Wind across sand dunes and alkali flats in the surrounding areas affect particulate matter and visibility whenever winds exceed 20 mph.

Wildland fires will continue to produce smoke, primarily during the summer months. The draft paper, "Coarse Woody Debris and Succession in the Recovering Forest" (Brown et al., 2001) states that the risk of severe fire is relatively low within 10 years, moderate from 10 to 30 years, and high over 30 to 60 years after the fires of 2002. All alternatives have wildland fire smoke potential.

Smoke Exposure and Hospital Admissions

No formal studies have been conducted to determine if increases in respiratory and cardiovascular hospital admissions occurred during the summer 2002 forest fires in North Lake County. Lake District Hospital in Lakeview informally attributed two hospital admissions to smoke exposure during that period. North Lake Clinic in Christmas Valley treated approximately 30-40 patients for conditions related to smoke exposure during that period, although none were referred for hospital admission.

Effects Common To All Action Alternatives

Prescribed Fire

Daily particulate matter standards should be met by following the Oregon State Implementation Plan. That is, NAAQS for PM-10 and PM-2.5 would be met with all action alternatives. (The National Ambient Air Quality Standards are a complex mixture of concentration limits for air pollutants when measured over specified time limits.) Smoke from prescribed burning would cause short-term impacts on recreation and transportation in and near the project areas. The size and location of a prescribed burn and weather conditions (e.g., temperature, wind, atmospheric stability and mixing, and fuel moisture) determine how much and in what direction smoke travels. Residents in or near the mouths of drainages may experience short-term periods of smoke during early morning inversions. The mitigation measure pertaining to all smoke-producing operations may be found in the Mitigation and Resource Protection Measures section of Chapter 2.

Emissions

Prescribed burning is proposed in these alternatives. Excess slash produced by treatment activities would be piled and burned, and some areas would be underburned or jackpot burned (accumulations burned in place). Smoke emissions vary with combustion efficiency and quantity of fuel burned. Machine piles and hand piles tend to produce more smoke (per ton of fuel consumed) than other burns because much of the consumption occurs during the inefficient smoldering phase of combustion. The overall factor in the amount of emissions produced lies solely in the amount of fuels consumed. The alternatives differ in the number of acres treated by each treatment method and in the quantity of smoke that would be produced. The following table and chart shows the total tons of PM produced for each alternative depending on the type and quantity of fuel treatments. Smoke emissions modeled with FOFEM can be tabulated in PM-2.5 and PM-10. PM-2.5 is about 85 percent of PM-10.

For the action alternatives that use prescribed burning, estimated PM-10 emissions are much less than those estimated during the 2002 Toolbox Complex Fire (approximately 20,000 tons). Additional details on total particulate matter by alternative can be found in the Air Quality Resource Report in the Toolbox Analysis File at the Silver Lake Ranger District.

Table 3.201 Total Tons of Particulate Matter Produced by Burn Type and Alternative

Burn Type	Tons of Particulate Matter (PM)					
	Alt. A	Alt C	Alt. D	Alt. E	Alt. G	Alt. H
Landing Piles	0	46.1	17.7	35.5	46.1	41.7
Underburn	0	401.8	275.6		401.8	275.6
Broadcast		160.6	141.7	120.8	176.7	0
Jackpot	0	70.2	33.9	53.1	53.3	0
Total PM	**0**	**678.7**	**468.9**	**209.4**	**677.9**	**317.3**

The following charts display expected emissions by burn type and alternative for the Toolbox Fire Recovery Project.

Figure 3.34 Total PM Emissions

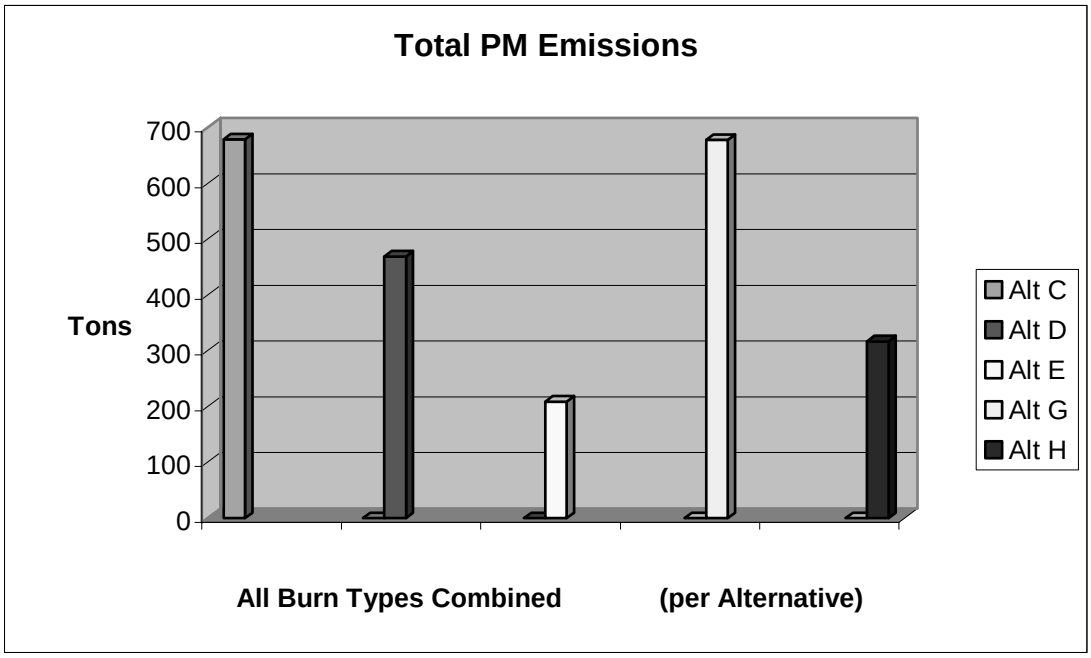


Figure 3.35 Alternative C by Treatment Type

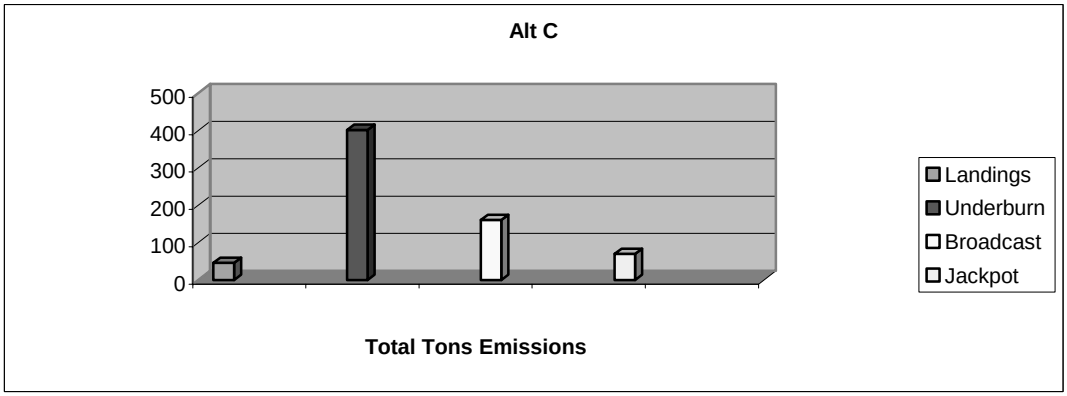


Figure 3.36 Alternative D by Treatment Type

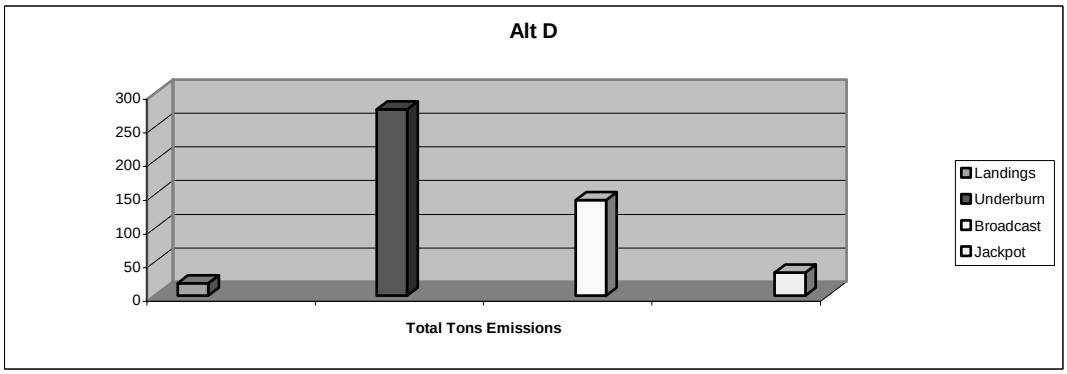


Figure 3.37 Alternative E by Treatment Type

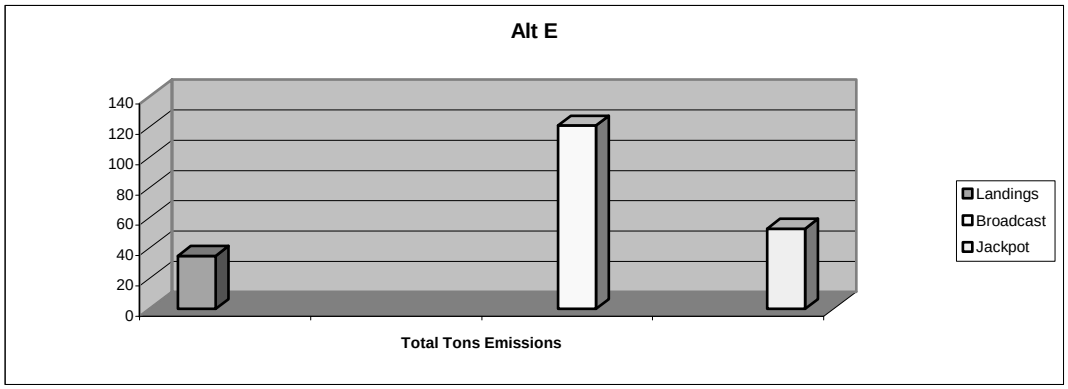


Figure 3.38 Alternative G by Treatment Type

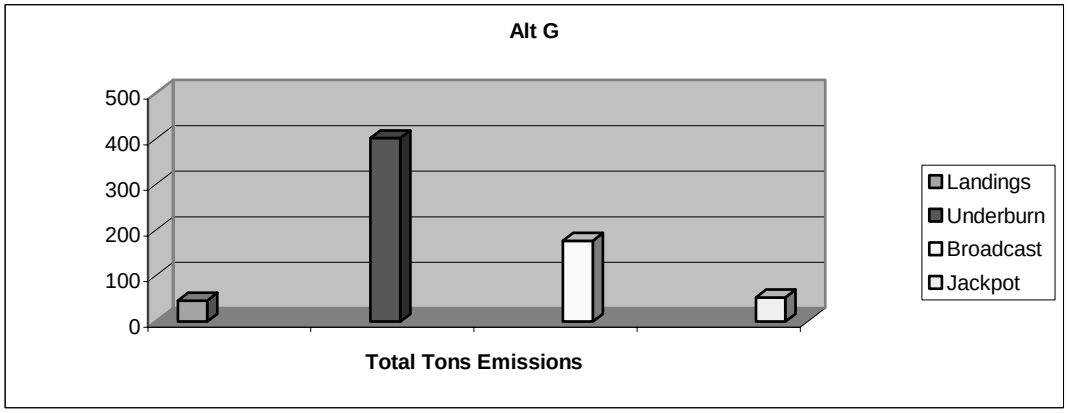
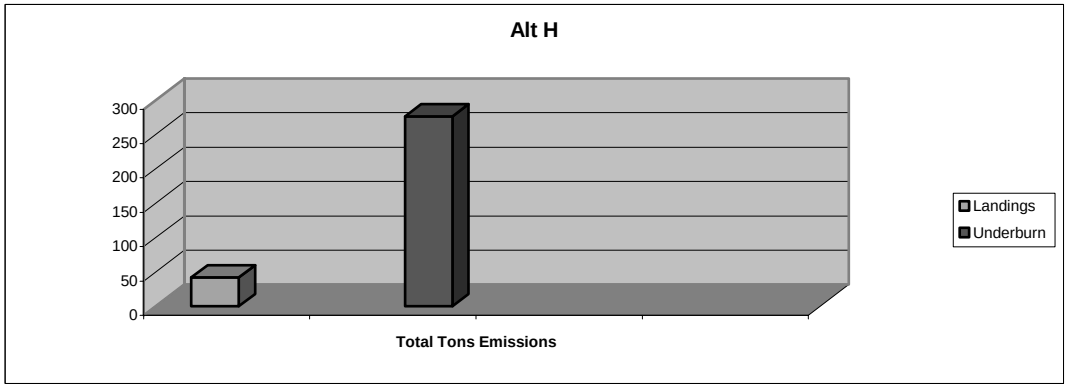


Figure 3.39 Alternative H by Treatment Type



Cumulative Effects

Although the Fremont-Winema National Forest districts try to conduct prescribed burning during periods of good or better smoke dispersion, there may still be some cumulative smoke impacts from concurrent private, Forest Service, and other federal agency prescribed burns common to Alternatives C, D, E, G, and H. At this time, the largest industrial private land owner in the project area, U.S. Timberlands Company, has no plans to burn existing landing piles. The Bureau of Land Management, Lakeview District, may use prescribed fire to treat juniper and Medusa head in the Squaw Ridge area, east of the Toolbox Project Area. The Forest Service plans to use prescribed fire to treat approximately 6, 000 acres in areas outside the Toolbox project area. The modeling for this analysis assumes that all the prescribed burning is likely to occur

over several years, making less cumulative smoke at any one time and location than that modeled. The mitigation measure for all smoke-producing operations may be found in the Mitigation and Resource Protection Measures section of Chapter 2.

Monitoring

A plan for monitoring Air Quality for the Toolbox Fire Recovery Project can be found in Appendix D – Monitoring

Consistency with Fremont Forest Plan and Other Regulatory Direction

All prescribed burning would be implemented in full compliance with Oregon DEQ air quality programs through cooperation with the Oregon State Implementation Plan (SIP). The Fremont National Forest Land and Resource Management Plan includes air quality goals, standards, and management direction that are to, "maintain existing air quality" (Forest Plan, 1989). The Forest cooperates with the Oregon air quality regulators through the State Implementation Plan. Further, the Forest participates in the State of Oregon smoke management program to meet National and State air quality standards for PM-10 and PM-2.5. This project meets all criteria to protect air quality.

OTHER DISCLOSURES

- Short-term Uses and Long-term Productivity
- Unavoidable Adverse Effects
- Irreversible and Irretrievable Commitments of Resources

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

An examination of productivity or long-term productivity in relation to both forested vegetation and soils, as well as some aspects of wildlife habitat, is presented elsewhere in Chapter 3. An examination of short term uses, as they pertain to the products that would be made available by the proposals is included in the Economics section of Chapter 3, particularly under the heading "Economic Impact." The section titled "Future Management Analysis" examines economic returns to society from future management of the area, in light of the present proposed actions.

Unavoidable Adverse Effects

Several expected adverse effects, including some that are minimal and/or short term, were identified during the analysis. Resource protections measures or mitigations were identified and considered for each of these as a means to lessen or eliminate such effects of specific resources. See Chapter 2 "Alternatives and Design Elements Considered/Design Elements," Table 2.11, for a display, by resource area, by alternative, by expected adverse effect, and by mitigation or protective measure considered. The reasons for not adopting prospective mitigations measures, and therefore going forward with the expectation that an adverse effect may occur, are documented in Chapter 2, Table 2.11. These adverse effects are briefly described in Table 2.11 and in the appropriate section of Chapter 3. See the following sections:

- Forested Vegetation
- Wildlife: mule deer, elk, all birds (other than those species for which mitigations have been designed -bald eagle, peregrine falcon, and raptors), pine marten, pacific fisher, northern leopard frog, and northwestern pond turtle
- Fisheries
- Recreation
- Scenery
- Social and Environmental Justice
- Treaty Rights
- Roadless

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. It relates to the permanent loss of future options and applies primarily to nonrenewable resources. For all action alternatives there would be an irreversible commitment of resources involving the use of pit run cinders for road surfacing or re-surfacing. This varies by alternative, with Alternatives C, E, G, and H involving an estimated 11,000 cubic yards of material applied to 10.8 miles of haul road. Alternative D would involve approximately 6,000 cubic yards applied to 6.1 miles of road. The cinder would come from three cinder pits that are currently developed:

- Rim Cinder Pit: NW, SE, Sec.34, T.29S., R.16E
- Thompson Cinder Pit: NW, Sec.24, T.30S., R.13E.
- 3004 Cinder Pit: NE, NE, Sec.5, T.31S., R.16E.

Irretrievable commitments are those that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road. Under active management, irretrievable resource commitments are unavoidable, because managing resources for any given purpose necessarily precludes the opportunity to use those resources for other purposes. With the implementation of any of the alternatives (including No Action), a variable portion of one primary resource (standing dead trees) would be irretrievably lost to use either as a natural resource for the production of commercial forest products or as a component of wildlife habitat, particularly cavity dependent species. These tradeoffs, as they relate to each of the alternatives, are explored in discussions of two of the "Key Issues":

- Economic Efficiency and Economic Opportunities
- Effects on Wildlife Habitat

See "Economics" and "Wildlife - Snag and Down Wood Dependent Species" elsewhere in Chapter 3 of this document. The analysis revealed no significant irreversible or irretrievable commitment of resources associated with implementing the alternatives that are not already identified in the Forest Plan EIS or the Regional FEIS for Managing Competing and Unwanted Vegetation.

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