Chapter 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 FIRE AND FUELS

3.1.1 Analysis Area

National Forest System Lands within the Robert-Wedge Post-Fire Project boundary served as the analysis area of the proposed project. These lands are located within a much larger ecosystem, which expands across the Northern Rocky Mountains. In most years, fire commonly occurs throughout this area. Fires are occasionally large and have widespread influence on social and biological resources. The following is intended to provide an overview of how fire has affected the landscape conditions within the Robert-Wedge Post-Fire Project area.

3.1.2 Regulatory Framework

Flathead National Forest Plan

The appropriate management response for all wildland fires under the existing Flathead National Forest forest plan requires that all fires be suppressed (excluding wilderness areas covered under an approved Fire Management Guide or Plan) using the appropriate management response. The National Forest System lands within the Robert-Wedge Post-Fire Project area lie within Fire Management Units (FMU) B (Mixed Values) and C (Developed Area Concerns). The appropriate management response for both FMUs is suppression with safety of fire management personnel being the first priority. FMU C values to be protected would be a higher priority during multiple fire situations than FMU B. Initial attack in both FMUs would be aggressive initial attack actions to control a wildland fire.

Federal Wildland Fire Policy and Program Review

In 1995, the Federal Wildland Fire Policy and Program Review was initiated (USDI/USDA *et al.* 1995). The principles of this review include the following: 1) firefighter and public safety are the first priority; 2) wildland 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 Wildland Fire Use and prescribed fire to restore fire's natural role in appropriate areas where approved plans are in place. Such fires are managed under the 1995 Federal Wildland Fire Policy (USDI/USDA *et al.* 1995) and the 1998 Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide (USDI/USDA 1998).

National Fire Plan

The National Fire Plan provides national direction for hazardous fuels reduction, restoration, rehabilitation, monitoring, applied research and technology transfer and established the framework for a 10-Year Comprehensive Strategy.

3.1.3 Affected Environment

Fire Behavior and Severity

Fire behavior is the manner in which a fire reacts to weather, topography and available fuels (Agee 1993). These three elements comprise the fire environment, the surrounding conditions, influences, and modifying forces that determine fire behavior. A change in any of these components results in a change in fire behavior (DeBano 1998). Fire behavior is most often characterized by fireline intensity, severity, flame length, and rate of spread and is important to determining firefighter strategies and tactics during fire suppression operations (Rothermel 1983).

While the terms fire intensity and fire severity are commonly used interchangeably, the two terms do refer to different aspects of wildfire occurrence. Fire severity is an important factor in shaping the vegetation in a forest. Fire severity describes an ecosystems response to a wildfire's effects on soil and water, flora and fauna, the atmosphere, and the human environment (Simard 1991). Fire intensity is a term that is used to describe the rate at which a fire produces thermal energy and refers to the amount of energy released from fuels (Pyne *et al.* 1989).

Weather and topography are important factors in wildland fire events. Fires are often influenced through both long-term climate and short-term weather. Weather influences fire growth, ignition of fuels, and resistance to control. Fire managers deal with adverse topography by choosing suitable topographic locations relative to fire spread and intensity. However, land managers have control neither over weather nor topographical conditions.

Wildland fuels consist of organic material that could contribute to combustion. Land managers have the ability to modify fuels, which has a direct result on fire behavior. In a national survey nearly 80% of all wildland firefighters identified fuel reduction as the single-most important factor for improving their margin of safety on wildland fires (Tri-Data 1996). Manipulating fuels allows firefighters and land managers the most control in wildland fire management. Fuels management is intended to modify fire behavior, ameliorate fire effects, and reduce fire suppression costs and fire danger. Common fuels management practices include reducing the loading of available fuels, converting fuels to those with a lower flammability or isolating or breaking up continuous bodies of fuels (DeBano 1998).

Wildland Fire History and Suppression

Wildland fire was a dominant disturbance in the North Fork area prior to the 1930s. Field surveys by H.B. Ayres for the U.S. Geological Survey in 1898 provide the earliest glimpse of the role fire has played in the watershed. Maps and narrative of the Flathead Forest Reserve describe large areas as "recently burned", where most of the areas in the Whitefish Range had burned within the 20 years prior to his survey

Fire history for the North Fork indicates that large fires occurred in 1910, 1919, and 1926. Summer lightning storms occur frequently over the North Fork area. Lightning strikes are numerous, and occur on ridges and mid-slopes, and are less frequent at lower elevations. Most storms are accompanied by precipitation. Fire ignitions, although common, do not often result in large fires. Fire often occurs in this area during dry periods of July and August, and can become a significant disturbance event. During severe drought periods fire activity could last well into September. The area averages one large wildland fire (greater than 100 acres) within its boundary every 15-20 years (See Figure 9.)

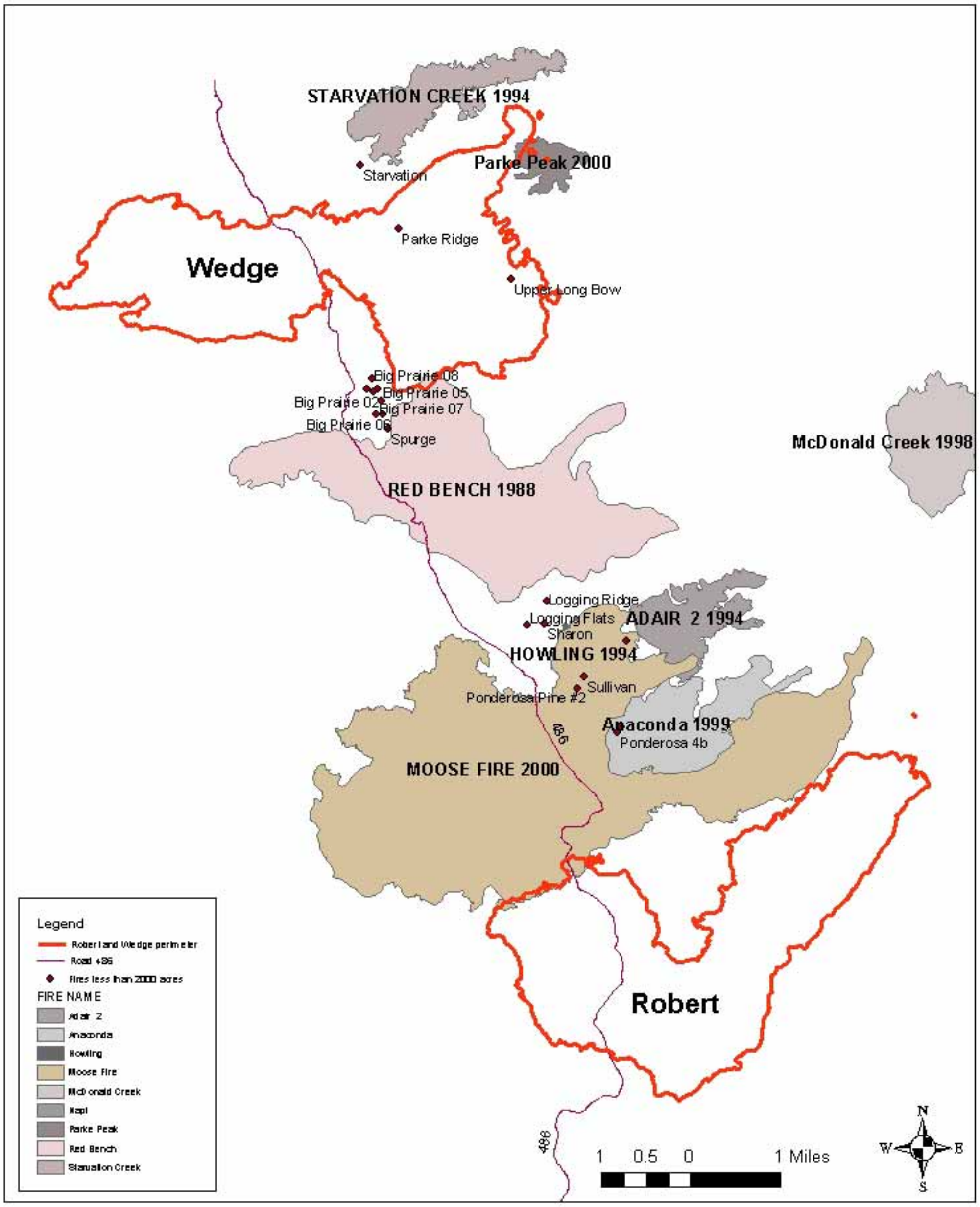

Figure 9. Fire History Map

In the Nearby Big Creek watershed, prior to the Moose fire, sixty percent of the Big Creek watershed had not been disturbed by large wildland fire between 1864 and 2001, much of it undisturbed for over 200 years (Big Creek EAWS, 1999). Thirty-one percent of the Big Creek watershed total acreage was burned in the 1910 fires. Wildland fires in 1919 and 1926 also burned thousands of acres. Four wildland fires greater than 1000 acres occurred within the watershed from 1864 to 1926, which signifies the beginning of effective fire suppression. Fire regimes, fuel loading, and historic fire occurrence for the Robert and Wedge Canyon fire areas are similar to the Big Creek watershed, which lies between the two fires. Historic fires were both a mixed severity and lethal fire type, resulting in a mosaic of effects. In some areas, nearly all existing trees were killed; in other areas more of an under burn occurred, leaving varying amounts of the larger over story trees or patches of unburned areas. This pattern and frequency of fire probably reflects what has been occurring within the project area for many centuries, with some variation depending upon climatic cycles and change in vegetative conditions over time. Near the end of a natural fire cycle, increased fuel loading and greater continuity of fuels results in the increased probability that any fire could quickly develop into a mixed to lethal severity fire and involve burning large areas with uniform lethal severity. The adoption of aggressive fire suppression policy in the early 1900's and the increase in effectiveness of wildland fire suppression has contributed to the changing vegetative conditions and therefore how future fires will affect the wildland fuel complex (structure, composition and fuel loading) within the analysis area.. Large fire histories show typical patterns of fire spread. Large fires in the area tend to spread from west or southwest in an easterly direction (See Figure 9).

Although fire starts have occurred at regular intervals as a result of frequent lightning storms in the area, most of these starts have been rapidly extinguished. Notable exceptions have been the 1988 Red Bench, and the 2001 Moose fire. Historic fires in the North Fork area have helped create forest communities dominated by western larch and lodgepole pine and to a lesser extent, Douglas-fir.

The Robert and Wedge Canyon fires burned 52,874 and 54,404 acres respectively in 2003. Of these acres approximately 13,123 acres of the Robert fire and 21,526 acres of the Wedge Canyon fire were on National Forest System lands. The areas identified for proposed harvest are located in stands where most of the trees were killed. The majority of the herbaceous ground cover within the proposed treatment areas was consumed by the fire, but in some of the areas charred course woody debris still exists. Like many wildfires, both the Robert and Wedge fires burned in a mosaic pattern. Some areas within the fire perimeters did not burn, others were lightly burned. However, there were large areas that burned at moderate or high severity levels. This variation resulted in differing effects on the vegetation and soil. These effects are referred to as the ecological effects of fires, usually on the dominant organisms of the ecosystem, i.e. a stand dominated by lodgepole pine (Agee 1997). Muraro (1971) discusses a typical diurnal wildfire burning cycle in lodgepole pine that highlights the interaction of fuels, humidity, and temperature, which typically results in a mosaic burn.

Table 16 displays the approximate acres burned by mortality level in the Robert and Wedge Fire perimeters as mapped by aerial photo interpretation following the fires. The matrix used to determine mortality was based upon the amount of crown scorch. The following values were used to determine these parameters. High = >80% of the trees are black/brown (i.e. killed by fire). Moderate = 30-80% of the trees had black/brown Canopies, and there may be variable amounts of mortality, depending upon tree species.

Low = <30% black/brown (tree crowns mostly green, though underburning may have occurred). There may be variable amounts of mortality in areas classified as low, depending upon tree species.

Although fire suppression for over 80 years on these sites has resulted in changes to forest communities, fire behavior, and resulting fire severities were not outside the likely range of what has historically occurred in this area. The coarse scale mosaic of lethal and non-lethal burn patterns is typical of what occurs in this fire regime. Suppression has been and would continue to be the appropriate management response for these forested systems given the current forest plan direction.

Table 16. Acres Burned by Intensity Level & Percent of Total Fire.

Vegetation Burn Severity By Percent Of Burned Area			
Mortality	High	moderate	Low
Robert Fire	50	23	27
Wedge Fire	51	25	24

Succession for forested stands that have experienced stand replacement crown fires such as occurred within areas of the Robert and Wedge Canyon fires can expect fuel succession to follow this scenario:

- Year 0 (post-fire), little forest floor fuel available;
- Year 1-10 increasing fine fuel availability with some larger fuels starting to falldown and become surface fuels;
- Year 10-30 increasing duff buildup with herbaceous and shrub fuels, plus coniferregeneration increasing, and more large fuels from standing dead trees increasing downed woody fuel loads and fuel bed depth;
- Year 30-60 high fuel loads, as much of the remaining large fuels fall down, duff, dead and live fuel loads increase especially as conifer regeneration increases both in density and vertical arrangement.

Fire Ecology

In the fire-adapted ecosystems of the Northern Rockies, fire is undoubtedly the dominant process in terrestrial systems that affects vegetation patterns, habitats, and ultimately, species composition. The presence or absence of fire plays a key role in the composition and structure of the vegetation that occurs across the landscape. The mosaic patterns of the current forested communities are the result. Fuel loading before the fires varies according to recent fire history and forest structure. Fire occurrence across the landscape can cause high mortality to all life forms found within each community. However, many of the vegetative species are well adapted to this fire-dependent environment and display unique survival characteristics which allow them to continue to exist within a specific areas disturbance regime.

Prior to the Robert and Wedge Canyon fires, much of the project area has not had a significant fire event for the last 80-100 years with some portions fire free for over 250 years. Although fire starts occur frequently from lightning in summer storms, fires greater than one acre are rare. Most, if not all, of the forested communities on the Flathead National Forest have been disturbed by fire in the last 2-3 centuries.

Fire Effects

The effects of fire on vegetation are the result of an interaction between the two and is not limited to a unidirectional effect. Vegetation provides the fuel that makes fire possible, and fire has variable but predictable effects on individual plants. (Agee 1993) Fire commonly results in top kill to the above ground portion of plants. To survive fire many species have adaptive traits that allow them to regenerate and reproduce. Examples of these traits include growth from underground stems or root crowns that are not killed in the fire (Stickney 1990). This unique adaptation to a fire-frequented environment provides a readily available, on-site colonization event following the fire. This is particularly true in areas where low to moderate intensity fires are common. However, areas with heavy fuel loadings can burn at intensity and severity levels that would result in greater mortality to more of the understory plant community. Therefore the potential is much greater for more severe and long-term effects to the pre-burn community. This type of fire activity has been termed lethal fire and is becoming more common throughout the Northern Rocky Mountain landscapes.

Fire Regime

The November 2000 Forest Service report Protecting People and Sustaining Resources in Fire-adapted Ecosystems- a Cohesive Strategy, specifies that fire-adapted ecosystems shall be classified by fire regime group and condition class. Such groups are useful to catalog fire and ecological information. This system is based upon the effects of fires on dominant vegetation, from low to high severity. More than all others, this type of system recognizes the variability in fire that occurs within or between fires on a site (Agee 1993).

The fire regime classification system is to describe areas of similar fire behavior across an ecosystem. Forests that experience fires of similar frequency and severity over time are said to have similar fire regimes. Broadly speaking, the term “fire regime” as used by many ecologists, incorporates the concepts of disturbance frequency and severity. They consist of a generalized description of fire’s role in an ecosystem, characterized by fire frequency, seasonality, intensity, duration and scale as well as regularity or variability. Plant species within specific fire regimes adapted to fire by developing survival or recovery mechanisms such as thick tree bark, an ability to sprout, seeds that require heat to germinate, or an ability to flourish in recently burned landscapes.

The majority of the area for both the Robert and Wedge fires consists of a lethal fire regime with a 200+ year fire return interval based on the vegetation and cover types. Under a lethal fire regime, large fires often burn tree canopies and can result in high mortality to overstory trees. Mortality levels can vary widely in these regimes depending on time of day when the fire burned through an area, fuel conditions and loading, terrain, and weather.

A smaller portion of the Wedge fire area was classified in a mixed severity fire regime with a fire return interval of 35-100 years. This regime typified the drier south and west aspects in the Douglas-fir and Larch cover types.

Currently, within the analysis area the majority of the land area remains in a lethal fire regime with a 200+ year fire return interval based on the fuels and cover type typical for the area.

Condition Class

Condition classes are used to describe the degree of departure from historical fire regimes, and thus potential fire effects in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. The relative risk of losing one or more key components that define an ecological system (such as hydrologic function and vegetative attributes) is the basis for defining current condition class within a project area. Table 17 displays Condition Class attributes and examples of potential management options.

Table 17. Condition Classes and Management Options

Condition Class	Attributes	Example management options
Condition Class 1	* Fire regimes are within or near a historical range. * The risk of losing key ecosystem components is low. * Fire frequencies have departed from	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.

	historical frequencies by no more than one return interval. * Vegetation attributes (species composition and structure) are intact and functioning within a historical range.	
Condition Class 2	* Fire regimes have been moderately altered from their historical range. * The risk of losing key ecosystem components has increased to moderate. * Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. * Vegetation attributes have been moderately altered from their historical range.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
Condition Class 3	* Fire regimes have been significantly altered from their historical range. * The risk of losing key ecosystem components is high. * Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. * Vegetation attributes have been significantly altered from their historical range.	Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.

Subsequent to the Robert and Wedge Fires, most of the burned area is considered in condition class 1; the area unburned is also in condition class 1 but nearing the end of its natural fire cycle.

Wildland/ Urban Interface

The risk of a wildland fire affecting private property continues to increase as settlement patterns increase along the private-public interface. The North Fork area includes many residences that are in heavily wooded areas and are relatively remote. No zoning or building restrictions currently exist in Flathead County that address fire hazard around these homes or the flammability of the structures themselves.

Research by Jack Cohen (1999) has shown that structures with typical ignition characteristics (wood sided, wood framed, asphalt composition roof) are at risk of catching on fire from one of three sources. The first is direct exposure to intense flames from a nearby source, which could be intensely burning vegetation or another structure. His research shows that the structures may be at risk if the flame front is less than approximately 100 feet away. Structures may also be ignited from less intense sources against or close to the side of the structure. This can occur if firewood or other flammable material next to the structure is ignited by a ground fire or firebrands. In addition, firebrands falling directly on roofs can ignite the structure if the roof is flammable, or if flammable debris is present. The implication of these findings is that the construction type and maintenance of structures is important to their survivability in the event of a wildfire.

An important difference between the behavior of fires in urban areas from those in wildland is that structures, homes, garages, and other buildings, are part of the fuel conditions. Research by Dr. Cohen and others have provided information on how structures catch on fire, and how once on fire they contribute to the spread of the fire. Once a structure ignites, the fire can spread to other nearby structures, sometimes without igniting the surrounding vegetation. This is important because for homes that do ignite, firefighters must be very close by to put the fire out before it overwhelms the capacity of the limited firefighter resources that typically occurs during large fires within the Wildland \ Urban interface zone. Fire suppression activities in the urban interface become more complex and hazardous to firefighters when fire behavior in the adjacent wildands is more intense.

3.1.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 (No Action)

In Alternative 1, no vegetation or fuel treatment would be implemented beyond the suppression rehabilitation identified in the BAER plan. The no action alternative would not reduce future fuel loads and thereby would not alter the spread and intensity of future fires that may occur within the project area.

Within much of the fire areas, the majority of the surface fuels were consumed by the fire. Future surface fuel loading at the stand level will vary according to burn intensity and severity, and the amount of mortality in each stand. In areas that experienced high severity most of the live foliage was consumed and therefore will not be a source of future fuel loading. In areas of moderate and low severity, the majority of the needles on the trees killed by the fire are expected to drop within 1-2 years, but would not present a significant fire hazard because the fuels would be generally light and patchy in nature. A fire occurring under these fuel conditions would not burn intensely or spread rapidly. Over time fine fuels such as grasses, forbes, brush and regenerating conifers will provide a fuel bed that will conduct active fire spread. Falling snags would contribute substantially to the surface fuel loading in the project area. These surface fuels would continue to accumulate over time until most of the dead trees have fallen. Large fuels (greater than 3 inches) from the dead trees would decay slowly and may remain on the landscape until it burns again.

Reburns

Large, severe fires create a large mass of heavy fuels, starting 12-15 years after the fire when much of the dead timber has fallen (Arno, Parsons and Keane 1999, Lyon 1984). This becomes a new dense fuel bed with small conifers and large shrubs, which can readily support another severe wildfire, called a reburn or “double burn” (Arno, Parsons and Keane 1999). In the initial years after the Sleeping Child Fire (1961) tree seedling densities averaged 34,000 per acre (Lyon 1984). Similar tree densities were noted post-fire in the Red Bench Fire (1988) area.

Incidences of high fuel loads and reburns have been observed. Recently, reburns have occurred with some regularity in the Northern Rockies. Locally, the 2002 Moose Fire reburned portions of the Adair (1994) and Anaconda (1999) fires in Glacier National Park. The Biggs Flat Fire (2001) on the Lewis & Clark National Forest reburned over 4000 acres of the Gates Park Fire (1988). The McDonald II Fire (2000) and the Cabin Creek Fire (2001) burned portions of the Canyon Fire (1988). Within the project area, the Robert fire reburned a small portion of the 2001 Moose fire. Reburns have been documented in the Tillamook area in Oregon (Heinrichs 1983, Arnst 1983, Lucia 1983), the Clearwater National Forest in Idaho (Barrett 1982), Yellowstone National Park (Miller 2000), and a cycle of fires beginning with the fires of 1910 (Brown and Davis 1973).

The size, spread, intensity and severity of a reburn fire are affected by many factors. Factors such as the seasonal timing of the initial ignition, drought, weather, wind, terrain and fuels can effect not only the spread of a wildfire, but also the final size, intensity, and severity of that fire. Reburns may not undesirable in and of themselves, but can be problematic where the effects of such fires are inconsistent with land management goals and objectives (i.e. desired watershed, soil, fisheries, wildlife, vegetation, or social conditions). Recently, a study following the Cerro Grande fire in Los Alamos New Mexico indicated that the removal of fire-killed trees can reduce fire behavior. Greenlee (2000) studied the change in fire danger around the town of Los Alamos from the pre-fire fuels condition to the post-fire fuels condition. Utilizing annual post-fire photographs after the 1977 La Mesa fire near Los Alamos, this study concluded that areas that have burned with high mortality, when re-burned 6-12 years later, could be a greater threat to communities than the initial fire due to intense fire behavior. Because of falling snags mixed with the developing understory of grasses, trees, and shrubs, the fire hazard would increase markedly by year six. These findings seem to concur with Brown et al (2003), and Rothermel (1983), who assert that the potential for spotting and crown fires is greater where large woody fuels have accumulated.

Based on Brown's (2003) paper, the potential of a future fire in the areas that burned at a moderate to high severity are described as follows:

- **0 to 10 years post fire** – Severe fire is unlikely because large woody fuels would still be accumulating and there would not be enough decay to support prolonged smoldering combustion.
- **10 to 30 years post fire** – Most of the large woody fuels would have fallen down, with some decay to support prolonged burning. A duff layer would not be well established. High severity burns would primarily occur where large woody material was lying on or close to the ground. High severity burns could be substantial where a large portion of the soil surface was directly overlain by large woody pieces.
- **30 to 60 years post fire** – Large woody fuels would have considerable rot; a duff layer may be well established depending on the amount of overstory conifer. More severe burning is possible, depending on extent of soil coverage by large woody pieces. If a conifer overstory is present, crowning and burnout of the duff could amplify the burn severity.

Utilizing the Forest Vegetation Simulator (FVS), Fire and Fuels Extension, modeling was done on sample stands to determine future potential fuel loading. The modeled results are similar to the predicted fuel bed in Brown's report. For the stands modeled, 80 to 90 percent of the standing dead material less than 3 inches in diameter was on the ground within 5-7 years of the fire. Of the larger than 3 inch diameter snags, 30 to 40 percent had fallen in the same amount of time. In 10 years 40 to 50 percent of the greater than 3 inch snags had fallen. By year 30, only 10 to 20 percent of the 3 inch and larger snags remained standing. The additional fuel loading would be expected to increase fire behavior in both the short (5-7 years) and long term (20-30) years. However, fire severity would not likely be substantially impacted in the short term due to the fuels consisting mostly of small diameter woody and fine herbaceous material. Most stands would, however, contain substantially more coarse woody debris than the threshold that Brown identifies as having high resistance to control and the potential for high fire hazard and severity in the long term. Projected fuel loads range from 30 to in excess of 100 tons per acre in 20 – 30 years. Variation in the fuel loading is primarily due to the level of mortality, number of stems per acre, and species.

Under the Fire Management Plan for the Flathead National Forest, the appropriate management response for an unplanned ignition within the Robert and Wedge fire areas is full suppression. This means that for any wildland fire start, aggressive fire suppression actions would be taken to contain and control the fire.

Resistance to control is defined as the relative difficulty to constructing and holding a control line as affected by resistance to line construction and fire behavior. Resistance to line construction can be measured by the fire line production rate from the NWCG Fireline Handbook (1998). A rating of High resistance to control means "slow work for dozers, very difficult for hand crews; hand line holding will be difficult." See Table 18 below for High and Extreme ratings for resistance to control occur in the following combinations: (Brown 2003). Resistance to control ratings reflect a combination of 0-3 inch and 3-10 inch fuels. It is the addition of certain volumes (tons/acre) of 3-10 inch fuels to a base of 0-3 inch fuels (tons/acre) that leads to either a high or extreme resistance to control rating.

Table 18. Resistance to control ratings.

0-3 inch fuels		3-10 inch fuels	Resistance to Control
5 tons/acre	with	25 tons/acre	High
	with	40 tons/acre	Extreme
10 tons/acre	with	15 tons/acre	High
	with	25 tons/acre	Extreme
15 tons/acre	with	5 tons/acre	High
	with	15 tons/acre	Extreme

Presence of pieces greater than a 10-inch diameter reduces the loading of 3-10 inch fuels necessary to reach high and extreme ratings. The number of large pieces (>10 inches) is more important than their loading in determining resistance to control (Brown et al 2003). If a stand has more than 10-20 pieces larger than 10" in diameter, less fuel loading of smaller size classes would be required to reach high and extreme resistance to control.

Fire behavior can be rated based upon differing fuel beds burning under the same environmental conditions. 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). Brown (2003) states that large woody fuels do not greatly impact spread and intensity of the initiating surface fire in current fire behavior models, but they can contribute to the development of large fires and high fire severity. In addition, he found that fire hazard and resistance to control reach high ratings when large woody fuels exceed 25 to 30 tons per acre in combination with small woody fuels of 5 tons per acre or more. Similarly, Rothermel (1991) showed that 30 tons per acre of 6 inch sound pieces increased the energy release of surface fuels in the flaming front, but not substantially unless it is beginning to decay. Rothermel (1991) also states that personal observations have shown the important contribution made to fire intensity by accumulations of larger sizes of dead and down fuel. Increased fire behavior and resistance to control resulting from these fuel loads can slow suppression actions and increase firefighter exposure to environmental hazards. Fireline construction rates are slower in fuel models with larger diameter fuels than in the other common fuel types (Anderson 1982, NWCG 1998), which can substantially increases the time and effort required to contain a wildfire. Over the long term (15-30) years, the fuels in the Robert and Wedge Fires are expected to average over 30 tons per acre and contain large diameter fuels. The sample stands modeled with FVS estimated combinations of fuel loading that were high to extreme after approximately 10 years (See Table 19).

Alternative 2 (Proposed Action)

This alternative would salvage approximately 5,821 acres within distinct harvest units. This alternative would salvage only dead trees and trees most likely to die because of severe fire injury or beetle-infestation. Actions taken under this alternative would reduce the eventual downed fuel loading within the salvaged areas. Future fuel loading would be variable based upon tree species, level of mortality, and harvest method. Units that are tractor logged will be whole tree yarded and the tops will be piled and burned at the landings. Units which would be cable or helicopter yarded would not have the tops of harvested trees or the sub-merchantable trees removed from the unit. These units will have higher fuel loading than tractor logged areas, particularly in the less than 3 inch size class. Mechanical piling and burning of harvested tops in these units will not be done due to slope steepness, cost, and value of removed material. In addition, the slash remaining on the site will provide additional ground cover on the generally steeper slopes in the short term. Broken tops, branches, and small trees left over from harvest operations would increase surface fuel loads above current post-fire levels. Burning of landing piles would occur under specified conditions to reduce the likelihood of escaped fire and adverse effects. The risk of an escaped fire from the planned brushpile burning would very low due to the lack of continuous fuels as a result of the fires and the location of the piles at the landings.

The Forest Vegetation Simulator was used to compare estimated fuel loading, fuel model, and fire behavior for both alternatives at various intervals following harvest. For analysis purposes, the assumption was made that in areas of high burn severity, 85 % of the pre-fire stand would be harvested. For purposes of comparison, it was assumed that all harvesting was done in 2005. While it is not likely that all of the harvest activity would be completed by the end of 2005, if the proposed action is selected, it does provide a comparison with a common baseline.

Sample units were selected to compare the differences between no action, and proposed harvest with the differing yarding techniques. Cable and helicopter units are expected to be similar in the percentage of material removed and are grouped together for comparison. Fuel loading under alternative 2 would be much lower in tractor yarded areas than in alternative 1 throughout the simulation period. In areas proposed for cable or helicopter yarding, fuel loading of less than 3” woody fuels would rise above no-action levels immediately following harvest, and be about equal in 2010. For the same period, greater than 3”woody fuels would be approximately the same, with slightly more of these fuels under alternative 1 in 2010. Woody fuels at this time would be patchy in distribution. During this period, fire behavior could be expected to be slightly higher in the helicopter/cable yarded units provided that enough light fuels such as dead grasses, shrubs and forbs accumulate on the forest floor to provide a continuous fuel bed that will carry fire. From 2013 through 2023, fuel loads under alternative 1 are the highest, with high to extreme resistance to control ratings. The addition of multiple pieces per acre of large diameter (>10” diameter) fuels during this time frame can have an effect on the resistance to control.

Due to whole tree yarding techniques tractor logging showed the greatest decrease in fuel loading, and therefore the associated fire behavior and resistance to control were also lowest over time. Actual fuel loading will vary depending on tree density, size and level of mortality. The outputs from a stand that represents average conditions are displayed in Table 19. Resistance to control was rated according to the matrix in Table 18. 2006 is the year immediately following harvest in the simulation. Using the information from brown (2003) it was assumed that resistance to control would be low for all alternatives because fuels would be patchy and not well decomposed, resulting in reduced fire spread rates and coverage. In addition, if there were more than 10-20 pieces of greater than 10 diameter material present, the resistance to control rating was raised to compensate (Brown 2003). In this example stand, the large fuel load under no action is in excess of 60 tons per acre, as compared to approximately 26 tons per acre if harvested using helicopter/cable yarding, and about 18 tons per acre using tractor yarding.

Table 19. Future Fuel Loading by Treatment Type

		Fuel Load (tons)		Presence	
Year	Treatment Type	0-3”	>3”	>10-20” large pieces	Resistance to Control
2006	No action	7.2	16.1	N	Low
	Helicopter or cable yard	11.9	15.5	N	Low
	Tractor yard whole tree	3.7	17.5	N	Low
2010	No action	9.2	27.1	N	High
	Helicopter or cable yard	8.9	24.9	N	High
	Tractor yard whole tree	3.0	18.2	N	Low
2013	No action	7.6	34.4	N	High/Extreme
	Helicopter or cable yard	6.6	28.1	N	High
	Tractor yard whole tree	2.3	18.6	N	Low
2018	No action	5.2	45.0	Y	Extreme
	Helicopter or cable yard	4.0	28.2	N	Moderate
	Tractor yard whole tree	1.4	18.5	N	Low
2023	No action	3.1	54.4	Y	High
	Helicopter or cable yard	2.3	27.8	N	Moderate
	Tractor yard whole tree	0.08	18.2	N	Low
2030	No action	1.5	62.4	Y	High

	Helicopter or cable yard	1.0	26.6	N	Low
	Tractor yard whole tree	0.4	17.5	N	Low

To put the difference in fuel loading into perspective, the fireline production rates from the fireline handbook (NWCG 1998) were compared for no action (Fuel Model 13) and helicopter/cable (Fuel model 11) . For a Type I (hotshot) crew, fireline production was 5 chains per hour for Fuel model 13, and 15 chains per hour for fuel model 11. In 2030 the differences for tractor logging and cable logging would be fairly small, and would impact production rates only slightly.

While fuel loading and associated fire behavior within the proposed units would be reduced in this alternative, they represent a small portion of the overall fire areas and are not necessarily located strategically. For this reason, large-scale fire movement across the landscape would not be significantly impacted.

The number of wildland fire ignitions within the project area will not be affected by either alternative. As such, the potential for a reburn exists under either alternative. The difference in potential fire intensity between the two alternatives is directly related to the resulting fuelbed. The proposed action would reduce the fuel loading, continuity and associated fire behavior in the salvage units, but would not have a substantial impact on landscape level fire spread in the future. Under this alternative, there will be a short-term rise in fuel loading as compared to the no action alternative. In time this would equal out, and then be surpassed due to natural accumulation of fuels in the no action alternative. There would be a minor amount of road closures under this alternative. These closures would not have a substantial impact on the ability to suppress future wildfires in the analysis area.

Cumulative Effects

Alternative 1 (No Action)

Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. Although a list of all known activities, past, present, and future are listed earlier in this chapter, few of them have any direct, indirect, or cumulative impact to fire/ fuels management in conjunction with the no action alternative. The closure of some amount of road is a reasonably foreseeable action with the no action alternative because it is required under the amended Forest Plan. Former roadbeds will slowly colonize and become vegetated. Vegetative succession will gradually change the composition and structure of the current fuel bed within the fire area. Over time the increasing fuel loads associated with natural processes will increase potential fire behavior

Past, present and reasonably foreseeable actions as described in this chapter (refer to Section 3.18: Robert-Wedge Post-Fire Project Past/Ongoing/Foreseeable Actions), are not expected to greatly influence the fuel loading or future fire severity when combined with salvaging fire-killed trees. Rates of downfall of fire-damaged or fire-killed trees may increase as a result of existing harvest openings, but only slightly. Road closures and decommissioning have been occurring and will likely continue to occur. The cumulative effect of this is a continuous reduction in access for both the public and for management activities. The anticipated amount of road closures will not have a substantial effect on future fire suppression.

Alternative 2 (Proposed Action)

The removal of dead trees, in conjunction with the past, present and reasonably foreseeable activities will not have a significant impact on Fire/Fuels Management. Future fuel loading will be reduced in limited areas, to a varying degree depending on the harvest method. Artificial regeneration would introduce species diversity in areas that would otherwise be more monoculture. Disturbances caused by suppression activities have all undergone rehabilitation; no lasting effects to fuels management are expected from these actions.

It is unlikely that mushroom harvesting during the spring and summer of 2004 will affect the rate of regeneration with the burned area. Large numbers of people will likely visit nearly all of the fires. It is not possible to determine the degree of seedling mortality and therefore the future fuel load change from possible reduced regeneration under these conditions. A very minor amount of mushroom harvesting activity can be expected in future years as green plants become established and conditions for the flush of fungi are no longer present.

Road closures and decommissioning have been occurring and will continue to occur. The cumulative effect of this is a continuous reduction in access for both the public and for management activities. The effect of closing a small amount of access roads, in addition to additional closures that may occur in the future is not anticipated to have a substantial effect on future fire suppression.

Cumulative Effects Outside of National Forest Service System Lands

Park managers have no known plans for any actions within the fire areas that would alter the natural course of fuel accumulation. In addition, there are no known activities planned on private property within the fire areas that would alter fuel conditions created by the fires.

3.2 FOREST VEGETATION

3.2.1 INTRODUCTION

This forest vegetation section describes the existing conditions and components of the vegetation resources that might be affected by the proposed action. This section also discusses certain topics of interest to decision makers and the public. These additional discussions do not necessarily disclose detailed analysis, but provide important information for consideration in the broader context of the analysis, or provide information about commonly asked questions.

This section will focus on four primary areas of concern. These are the subject of more detailed analysis and discussion and are followed as “analysis indicators” through the remainder of this section.

- Timber resources, including acres, volume harvested, and acres capable of meeting forest plan management direction for timber production in the future.
- Species composition and structural stage distribution after salvage harvest, including late seral conditions, (“old growth”) remaining after harvest.
- Acres of artificial and prescribed natural reforestation in and outside units after treatments.
- Spruce and Douglas-fir beetle habitat affected and bark beetle hazards.

Analysis Area

The analysis areas used for forest vegetation coincide with the fire perimeters for the Robert Fire and for the Wedge Fire, where they are within National Forest System boundaries. While some conditions outside these fire perimeters may be discussed in general terms (bark beetle hazards, for example), the direct effects of the proposals and the effects to forested vegetation conditions are entirely within these analysis areas. These areas include all the proposed activities that have quantifiable effects on vegetation. The fires burned on other ownerships, but actions are not proposed in those areas.

Data Sources

Information used in this analysis was gleaned from several sources. Forest inventory (stand exams) was available for many, but not all of the affected sites (project file). Geographic Information System (GIS) coverages were available for many features, including general forest attributes, pre-fire conditions (project file), and many geophysical attributes (slope, aspect, elevation, etc). A post-fire aerial photo mosaic was used in conjunction with GIS (project file). Post-fire walk-through assessments were conducted on some, but not all, burned areas in the fall 0f 2003 (project file). These walk-through assessments produced qualitative information for many of the burned areas. Burn severities for vegetation were derived from an aerial photo interpretation (project file). Proposed treatment units were created by logging system engineers, using aerial photographs, maps, field visits, and local knowledge of the area (project file). Where information was unavailable, interpretations were made based on a comparison with neighboring stands that did have information, or on photo interpretation, and on professional experience with these forest types. Interpretations concerning bark beetle hazards and risks are based on available attributes such as forest type, size class, species composition, stand density, as well as walk-through assessments conducted in the fall of 2003. Burned Area Emergence Response (BAER) reports, prepared in the fall of 2003, were used for their values as immediate post-fire assessments of the fire's potential effects (project file).

While some information will remain unavailable, reasonable interpretations and extrapolation of existing data were made to fill information gaps. The lack of information is not so large as to make the analysis itself unreliable. The fires were large, unplanned events that now require a response. Reasonable conclusions can be drawn with existing and interpreted data.

Regulatory Framework

The National Forest Management Act (NFMA) (16 USC 1604) requires that forest plans "preserve and enhance the diversity of plant and animal communities… so that it is at least as great as that which can be expected in the natural forest" (36 CFR 219.27). Additional direction states that "management prescriptions, where appropriate and the extent practicable, shall preserve and enhance the diversity of plant and animal communities, including endemic and desirable naturalized plant and animal species, so that it is as least great as that which could be expected in a natural forest and the diversity of tree species is similar to that existing in the planning area."

Flathead National Forest Plan (LRMP) goals include maintaining a diversity of vegetation and habitats across the forest to meet the needs of a variety of wildlife species, and to provide for a sustained yield of timber products. NFMA implementing regulations also require that management consider the existing diversity of plant and animal communities. The LRMP further defines timber management goals of providing a sustained yield of timber products that is cost-effective, responsive to the needs of the local economy, and is consistent with other forest management goals (LRMP II-5, project file). These goals are discussed in forest-wide timber management objectives described on pages II-7 to II-9 of the LRMP.

The NFMA requires that "timber will be harvested from national forest system lands only where there is assurance that such lands can be restocked within five years of harvest." Determination of adequate stocking would be based on regeneration surveys conducted one, three, and five years following tree planting or prescribed natural regeneration. Numbers of trees per acre and stocking percentages would be calculated from these surveys, and compared to the minimum and desired stocking levels identified in the harvest prescription, which are completed prior to harvest, for each particular stand.

Amendment 21 to the Flathead Forest Plan (management direction related to old forests) was adopted in January 1999. It has a goal to "maintain and recruit old growth forests to an amount and distribution that is within the 75 percent range around the median of the historical range of variability. Where current conditions are below this amount, actively manage to recruit additional old growth." Another goal is to "ensure that Forest Service actions do not contribute to the loss of viability of native species". For species associated with old growth forests, there are objectives to "maintain ecological processes and provide for natural patch size distribution" and to "manage landscape patterns to develop larger old growth patch sizes where needed to satisfy wildlife habitat requirements." Across the landscape, "sufficient retention of forest structure (large-diameter live trees, snags, and coarse woody debris)" should be left to provide for future wildlife movement through the matrix surrounding old growth forests. At the landscape level, there is also a standard that states that "treatments within existing old growth may be appropriate where current insect and disease conditions pose a major and immediate threat to other stands." Another standard states that vegetation treatments should be modified "as needed to meet habitat needs of old growth associated species." If needed to "satisfy wildlife habitat requirements, limit associated human disturbance, or reduce excessive mortality risk", the timing, extent and intensity of vegetation treatments should be modified.

Forest plan direction specifies that landscapes should be managed to reduce the risk of undesirable fire, insect and pathogen disturbances, and to apply an understanding of natural disturbance regimes, landscape patterns and dynamics to management of the forest. Forest plan standards for insect and disease specify that integrated pest management strategies should be considered in project analysis design and that "project silvicultural prescriptions would emphasize treatments that reduce losses due to insects and/or disease." In accordance with this direction, the area has been analyzed and determined that all action alternatives are within the standards of, and consistent with, the forest plan.

Discussion of "other issues"

Salvage prescriptions

Salvage harvest would remove dead and dying merchantable trees ten inches DBH and larger, across the units, including trees killed and damaged directly by the fire and/or infested with bark beetles. Trees to salvage are determined by degree of fire injury to bole or crown of tree, as guided by the post fire mortality guidelines in Appendix B.

In all units, many trees (both live and dead) would remain on the site after salvage. These consist of unmerchantable trees of all sizes, as well as those designated for retention to meet snag and coarse woody debris requirements, and live trees most likely to survive the effects of the fire. Live trees would be relatively sparse in some areas due to fire severity and relatively plentiful in other areas again, depending on fire severity. Leave patches are designed to maximize extent, longevity and quality of habitat for snag dependent wildlife.

Unroaded areas

Salvage harvest and reforestation activities are proposed in unroaded parts of the project area. The physical setting of these areas will not change because of salvage or reforestation. The ecological integrity of the area will remain intact following these actions. In fact, by emphasizing the re-establishment of whitebark pine and western white pine in certain areas, the species composition and species diversity will regain those elements in the new developing landscape, which were in a downward trajectory prior to the fires. Long-term ecosystem processes will be intact and operating normally. Aside from the stumps and slash remaining after treatments, little evidence of the activities will remain, and in time, those will diminish substantially. The areas where logging and planting have taken place will appear natural to most people who visit when seedlings and saplings have regained the foreground view. The new forest stands, as they develop will appear to have been affected by the forces of nature, and will appear less and less "man-made" as vegetative recovery continues through its normal sequence.

Huckleberry scarification test area

Members of the public have indicated an interest in increasing the extent and production of huckleberries in the area for the benefit of wildlife and people. A suggestion was made that some improvements might be gained by light soil scarification in certain areas. This attempt will require a determination of the most suitable area in which to conduct the test. That will require summer field visits to be conducted and recommendations made between this draft EIS and the final, scheduled for the fall of 2004. It is anticipated that from 30 to 100 acres may be selected to conduct this test.

Bark Beetle Monitoring

Monitoring of spruce and other bark beetles in summer 2004, and site visits to vulnerable stands will provide information needed to assess the immediate effect of the fire on beetle infestation levels and to specifically locate trap tree or funnel trap stations where they will be most effective. Suggested areas are identified in this report, and general effects of the trapping program described. Revisions to the locations may be necessary after field reviews in summer 2004.

Douglas-fir Beetle

Douglas-fir beetle is specifically addressed as a concern in this analysis only for the Wedge Fire, because there is relatively little habitat in the Robert Fire in which Douglas-fir beetle populations could build. Monitoring of both Douglas-fir beetle and spruce beetle populations over this summer (in particular) and for several years more, will provide information with which future plans to react to Douglas-fir beetle may be made for the Robert Fire area. At this time, however, it seems unlikely that Douglas-fir beetle populations will increase substantially in the Robert Fire as a result of the fires.

Validation

Field verification of salvage harvest units in summer of 2004 is necessary to confirm assumptions made in this report. Major changes are not expected, but some revisions to unit size, shape and logging systems may be necessary after field reviews. Some units may be eliminated. It is not expected that new units would be recommended for addition to the project, but that possibility should be allowed until final reviews are complete.

Mortality guidelines

Fire salvage proposals normally acknowledge the fact that some trees that appear healthy are damaged and dying from direct, or indirect fire effects, or from secondary effects such as bark beetle attack. While there is general agreement with the notion that many green trees in the area are "dead but don't know it", and they should be considered, at least, for salvage, there is disagreement surrounding the precise definition of "dying". One question focuses on how much green crown a tree needs in order to survive. There are others. The tree mortality guidelines that will be applied to the Robert and Wedge Fires (Appendix B) are based on the guidelines used for the 2001 Moose Fire. They have been modified somewhat based upon observations of tree survival on the Moose Fire, effects of the continuing drought on tree stress levels, and the burn conditions observed in the 2003 fires. Field reviews will be conducted in the summer of 2004 to assess tree survival, and may result in further modifications of the tree mortality guidelines, which will be disclosed in the Final EIS.

Deadfall

Standing dead trees will fall as a natural consequence after fires. Fall rates vary by species and diameter (Everett *et al.* 1999). Fall rates are lowest for western larch and subalpine fir (DeNitto *et al.* 2000). Douglas-fir trees fall rates increase after five years, as the volume of decay increases in the lower stem. On the Sleeping Child burn in Montana, only 28 percent of lodgepole pine were still standing after ten years (Lyon 1977). The riparian areas have already experienced some blowdown, primarily among the live, mature spruce trees, and more is expected. Trees with extended use as snags will be those with moderate to low crown scorch that remain alive for at least two years after injury. Although a majority of trees will fall the first 10 to 20 years, the trees that remain standing after that time may do so for a very long time (e.g. 50 to 70 years).

Deterioration of fire-killed/fire-damaged timber

Fire-killed trees are a perishable commercial resource. Relatively rapid deterioration of fire-killed or fire-damaged trees can be expected, causing a decline in its commercial value. Factors affecting the rate of deterioration are tree species, species characteristics, tree diameter, growth rate, age, site conditions, fire severity, and time of year. The agents affecting deterioration are insects, stem and decay fungi, and weather. Although the rates of staining and cracking (52 to 80% volume affected) are high the first five years, decay rates are much lower (USDA 2000). Cracking allows the sapwood to dry out, retarding or arresting decay. This is more common in thin-barked species such as Engelmann spruce, subalpine fir, and lodgepole pine. Field surveys conducted the summer following the Moose fire indicated that cracking and checking had resulted in 20 to 30% volume reduction within one year, mostly in trees of smaller diameter.

Disease

Forest diseases of all varieties decline following fires. This is generally accepted as one of the benefits of fire, in that they tend to clean forests of diseases that increase as stands age. Fire removes susceptible trees, thins stands and reduces sources of infections directly. Younger stands that follow are less susceptible to most forest diseases until they reach later stages of development. Specific concerns for forest diseases have not been identified in either the Robert or Wedge fire area.

3.2.2 PAST, ONGOING, AND FORESEEABLE ACTIONS

ROBERT FIRE

- Timber management has taken place in the Robert Fire area since 1946, including precommercial thinning and reforestation. Approximately 50% percent of the fire area on NFS lands has been treated (includes the range of light, partial cuts to clearcuts, and some acres may have had more than one treatment). The most recent timber activity occurred in 1993.
- Personal-use firewood cutting, Christmas tree harvesting, post and poles, and bough collection are historical uses of the area, and have been for many years. They are expected to resume in the future.
- Fire suppression since 1910 has been successful, generally, in suppressing the majority of fire starts while those fires were small.
- Trees adjacent to roads within the Robert Fire area that were identified as a hazard to firefighters and the public were felled during fire suppression actions. Removal of these trees began in the winter following the fire (some removal will occur this summer).
- Robert Fire Burned Area Emergency Rehabilitation (BAER) projects on NFS lands during September/October 2003 included grass seeding and hazard tree falling in the Great Northern Flats area.
- Private land development has altered, to varying degrees, the forest composition and structures on those lands.
- Small amount of private land clearing/logging has occurred in areas adjacent to the North Fork Road since the Robert Fire. In addition, Stoltze Land and Lumber Company has salvage logged their portions of land in the lower reaches of the McGinnis Creek drainage.
- Since the 1950s, regeneration timber harvest (clearcut, seedtree and shelterwood) has occurred on 3,169 acres, or about 24 percent of the area. (project file). About 2,111 of these were moderately or severely burned and 1,058 acres were burned at low severity. Planting of conifer seedlings will occur in units where natural regeneration will be hindered by a lack of seed source, or where species diversity is desirable. An estimated 1000 to 1300 acres of previously regeneration harvest areas would be planted over the next 2 to 3 years.
- Mushroom Harvest – A signed decision authorized commercial and personal mushroom harvesting within the Robert Fire area. Mushroom harvest began in May 2004 and is expected to continue through July. Generally the first year after fires yield the largest mushroom crops and commercial harvesting declines significantly after that. Some harvesting is likely in 2005 and beyond, but it is expected to be light in comparison to 2004.
- Special forest product gathering for personal use is likely to occur, such as berry picking, firewood and Christmas tree cutting, evergreen bough and cone collection, particularly in those areas unaffected by the fire.

- The closure order for firewood cutting in the fire area currently in effect will be rescinded after harvest activities. Additional signs will be placed in riparian areas prohibiting firewood cutting in these areas (which are also specified in all firewood cutting permits) once the closure order is lifted.
- Monitoring in the fire-affected area will include: revegetation, hill slopes, whitebark pine, tree seedling establishment, and bark beetle occurrence.

WEDGE FIRE

- Timber management has taken place in the Wedge Canyon fire area since 1951, including precommercial thinning and reforestation. Approximately 32% percent of the fire area on NFS lands has been treated (includes the range of light, partial cuts to clearcuts, and some acres may have had more than one treatment). The most recent timber sale analysis occurred in the Hornet Wedge Project (Decision Notice was signed in December 1996.)
- Personal use firewood cutting, Christmas tree harvesting, post and poles, and bough collection have been occurring for many years and are expected to continue.
- Fire suppression since 1910 has been successful, generally, in suppressing the majority of fire starts while those fires were small.
- Trees adjacent to roads within the Wedge Canyon area that were identified as a hazard to firefighters and the public were felled during fire suppression actions. Removal of these trees began in the winter following the fire (some will occur this summer).
- Wedge Canyon Fire Burned Area Emergency Rehabilitation (BAER) projects occurred on NFS lands during September/October 2003, included grass seeding and straw mulching.
- Private land development has altered to varying degrees, the forested cover and structure in areas adjacent to National Forest System lands. Some extensive clearing/logging of private lands particularly in the Teepee Lake area occurred immediately after the fire.
- Since the 1950s, regeneration timber harvest (clearcut, seedtree and shelterwood) has occurred on 4,465 acres, or about 21 percent of the area. (project file). About 3,029 of these were moderately or severely burned and 1,436 acres were burned at low severity. Planting of conifer seedlings will occur in units where natural regeneration will be hindered by a lack of seed source, or where species diversity is desirable. An estimated 300 to 500 acres of previously regeneration harvest areas would be planted over the next 2 to 3 years.
- Mushroom Harvest – A signed decision authorized commercial and personal mushroom harvesting within the Wedge Fire area. Mushroom harvest began in May 2004 and is expected to continue through July. Generally the first year after fires yield the largest mushroom crops and commercial harvesting declines significantly after that. Some harvesting is likely in 2005 and beyond, but it is expected to be light in comparison to 2004.

- Special forest product gathering for personal use is likely to occur, such as berry picking, firewood and Christmas tree cutting, evergreen bough and cone collection, particularly in those areas unaffected by the fire.
- The closure order for firewood cutting in the fire area currently in effect will be rescinded after harvest activities. Additional signs will be placed in riparian areas prohibiting firewood cutting in these areas (which are also specified in all firewood cutting permits) once the closure order is lifted.
- Monitoring in the fire-affected area will include; Revegetation, whitebark pine, tree seedling establishment, and bark beetle occurrence.
- Further private land development will reshape forest structure and composition to some degree.
- The Montana Department of Natural Resources and Conservation (DNRC) is logging Section 16. They plan to finish soon.

3.2.3 AFFECTED ENVIRONMENT

ROBERT FIRE

Timber Resources Existing Conditions

Virtually all the commercial timber stands and sites in the area were affected by the fire. Mortality of standing timber and future commercially valuable stands (represented by seedling, sapling, and pole-sized trees) was significant. Not all timber was available or technically feasible to harvest under current management framework and not all was near rotation age or ready for scheduling for harvest. Initial estimates of salvageable dead timber in the area (timber that is dead or dying, sawlog size, technically feasible to harvest with available logging systems, and economically feasible to remove) are about 22 million board feet if unconstrained.

The fires also killed timber resources in the seedling, sapling, pole, and small sawtimber size classes. These stands represented future harvestable products, and the sites are no longer carrying fully stocked, manageable stands. In forest plan management areas designated as suitable for timber production (most of the acreage of the Robert Fire), investments may be needed to restock those sites.

Pre-fire Forest Composition

The area affected by the Robert Fire was composed almost entirely of conifer dominated plant communities, with only minor inclusions of grass, forb, shrub cover types, or rock and water (See Table 20).

Tree species found in the Robert Fire include subalpine fir, Douglas-fir, lodgepole pine, western larch, Engelmann spruce, whitebark pine, western redcedar, and western white pine. A minor component of ponderosa pine can be found here as well. Whitebark pine was historically a minor species at the upper elevations where it was often mixed with spruce and subalpine fir. Widespread blister rust infections, in addition to the mountain pine beetle outbreaks of the last few decades, have caused a serious decline of whitebark pine. Western white pine is also susceptible to blister rust, but some natural resistance is evident. Common shrubs include Sitka alder, red osier dogwood, huckleberry, snowberry, and several others characteristic of moist forest communities.

Table 20. Pre-Fire Forest Cover Types (acres and percent)

Cover Type	Acres	Percent
LARCH/DOUGLAS-FIR	6,703	50
LODGEPOLE PINE	647	5
MIXED	1,696	13
NON-FOREST	101	1
SPRUCE/ALPINE FIR	4,160	31
WHITEBARK PINE	8	Trace

In the Interior Columbia River Basin, Hessburg and others (Hessburg 1999) detected some trending away from historic coverages of cover types at the province-scale Ecological Reporting Unit (ERU, the Northern Glaciated Mountains). Generally, a shift away from early seral species, toward late successional species was found. Western larch coverage has declined in the Unit. White pine has decreased from the reference conditions, as has whitebark pine. Grand fir, spruce, and subalpine fir coverages (late successional species) are increasing.

Analysis of landscape conditions conducted for the Flathead National Forest indicates that these trends generally hold true at the watershed scale, for the ecological subunit that the Robert Fire is within (project file). Within the Robert Fire area, the proportion of cover types prior to the fire was probably within the range of historical conditions, with a relatively high proportion of seral cover types and lower proportion of late successional cover types. The primary factor contributing to this was the 1926 wildfire that burned over about 1/3 of the Robert Fire area. Dense forest of seventy year old early seral species (larch, lodgepole pine and Douglas-fir) dominated in this area prior to the Robert Fire. Loss of both western white pine and white bark pine cover types are known to have occurred in the Robert Fire area as well, due to disease and bark beetle mortality.

Pre-fire Forest Structure

Forest structural stages prior to the fire are displayed in Table 21. This table shows the aerial extent of each structural developmental stage at the time the fire occurred. It is displayed here to form a basis for discussion on the relative amounts of changes the fire caused in the area, versus what changes are expected as a result of the proposal.

Table 21. Pre-fire Forest Structural Stages (acres and percent)

Structural Stage	Acres	Percent
BARE/GROUND/ROCK/SNOW	29	Trace
GRASS/FORB	6	Trace
HARVESTED/NONSTOCKED	118	1
IMMATURE-SAWTIMBER-ALL SPECIES-	313	2
IMMATURE/POLE/NON-LP	59	Trace
MATURE-SAWTIMBER-ALL SPECIES	5,675	43
OVERMATURE-OLDER FOREST	245	2
POLE/LP	537	4
POLE/MIXED	3,176	24
PRIVATE/HARVESTED/NONSTOCKED	23	Trace

SAPLING	2,521	19
SEEDLING	621	5
SHRUB/HARDWOOD	8	Trace

In the Interior Columbia River Basin, Hessburg and others (1999) found that some structural stages were trending away from the expected or historical conditions in the Northern Glaciated Mountain ERU. Proportions of stand initiations stages (seedling and sapling, grass-forb generally) of development are declining, and patch sizes are decreasing. Old forest structures have declined as well. Corresponding increases were noted in the intermediate structural stages of development (mature, immature and pole classes).Interestingly, in the Northern Glaciated Mountain ERU, significant fuel load increases were identified, and in 1999, 60 percent of the ERU exhibited moderate to extreme crown fire potential. A discussion of post-fire structure follows later in this report

Within the Robert Fire area, the proportion of the stand initiation, seedling/sapling stage of forest succession were probably within the historical ranges at about 25% of the area. These patches were created through past regeneration harvesting, and thus were relatively small patches compared to the large areas of young, newly regenerated forest that would typically be created by fire, the dominant natural process on this landscape.Fire Groups were estimated for the area using habitat type classifications, which were then grouped into broader categories because their fire and successional responses are similar (Fischer and Bradley 1987) (project file). Fire Groups are areas of similar habitat conditions described by moisture, temperature, and soils, which lead to similar late-seral forest conditions in the absence of disturbance. They also respond to fire similarly and are helpful in understanding the variety of responses the forests exhibit. They help define the natural fire regime for a forest, and its probable successional development after a fire. Table 22 displays the major groups and their coverages in the Robert Fire area.

Table 22. Fire Group Classifications (Acres, Percent coverage)

Fire Group	Vegetation Burn Severity	Acres	Total Acres in Group	Percent Group Coverage
7	High	378	495	4
7	Low	94		
7	Moderate	9		
7	Unburned	14		
8	High	297	686	5
8	Low	153		
8	Moderate	236		
9	High	4,862	8,959	70
9	Low	1,699		
9	Moderate	2,398		
10	High	41	158	1
10	Low	72		
10	Moderate	45		
11	High	734	2,413	20
11	Low	1,470		
11	Moderate	209		

Fire Group 9, representing 70 percent of the Robert Area, is a collection of moist, lower alpine habitats types in the spruce and subalpine fir series. Downed dead fuel averages 25 tons per acre in these types, but considerable variation is noted, and loadings can be much higher. Combined with typically deep duff layers, fires here can be severe under dry conditions. Where dense understories exist, those fires can spread to the crowns and result in stand replacement fires. Even in low intensity fires, cambium heating can kill overstory trees. In northwestern Montana, fire-free intervals may average 146 years. Fires in this group range from small, low intensity underburns to infrequent, large severe fires, depending on weather, fuel and moisture conditions. (Fischer and Bradley 1987)

Stand development following fire in Fire Group 9 is variable, and is influenced by the stand composition at the time of the fire (species, seed dispersal habit, size, age), and the fire itself (intensity, severity, duration). Late seral ("climax") conditions would tend to high occupancy of spruce and subalpine fir, given a long developmental period without fire. Since that is rare, a near-climax condition is more common. In that case, understories might be dominated by subalpine fir, but overstories could contain Douglas-fir, lodgepole pine, larch, and spruce or white pine. Stand replacement fire results in stand initiation or grass-forb-shrub stage structure, followed by seedling stages. Seedlings of any of the species mentioned above many be present, depending on site conditions, but two general pathways are identified, one dominated by Douglas-fir, and the other by larch or lodgepole pine. (Fischer and Bradley 1987)

Fischer and Bradley (1987) suggest that available evidence indicates fires are infrequent and normally low or high severity. Moderate severity fires are less common, generally, but do occur. All three were observed in the Robert Fire (Table 22).

Based on the habitats, fire severities, and presence of many species, we can expect a very diverse range of forest types to develop in Fire Group 9 habitats following this ecosystem disturbance.

The next most important group is Fire Group 11, representing 20 percent of the area. These warm, moist habitats occur in valley bottoms, benches, and protected sites. Fuel loading averages 25 tons per acre and Fire Group 11 carries, on average, the highest fuel loads in Western Montana. Even with heavy fuels, fire hazard is low to moderate under normal conditions. In drought conditions, the accumulated fuels can result in large, severe, stand-replacing fires. Stands then would revert to pioneer species. Fire-free intervals have been reported to be between 50 and 200 years in this Fire Group. Post-fire stand development is influenced more by the pre-existing stand and seed conditions than on the fire. After stand replacement fire, succession begins with grass-herb-shrub stages. Duration of the shrub stage depends on seed availability and the absence of fire. In some instances, a second fire within 10 to 30 years results in persistent shrub fields. Pioneer stages begin with larch and lodgepole pine, but in 50 years, white pine, Douglas-fir, and larch normally dominate. This stage can persist, especially the larch component, if low severity fire returns. Without follow-up fire, the sites eventually regain their shade intolerant species such as grand fir and redcedar. Larch can persist as a long-lived seral in these stands for long periods. (Fischer and Bradley 1987).

Fire Groups 7 and 8 are present, but represent only 9 percent of the area. Fire Group 8 is similar to Fire Group 9, but more frequent and often less severe fire is expected there, given it is warmer and dryer than group 9. Douglas fir and lodgepole pine dominate these sites as long-term seral species. Occasionally larch and western white pine are found. Fire Group 7 are habitats that are usually dominated by lodgepole pine, but they can also support Douglas-fir, spruce, subalpine fir, and whitebark pine. These sites can carry significant fuel loads and if supporting young stands can be destroyed quickly by fire. Fire Group 7 sites are typically lodgepole pine dominated, and fire perpetuates that dominance. In the absence of fire, in some of the habitats, Douglas-fir, spruce or subalpine fir may ultimately dominate.

There is no indication the Robert Fire burned outside of these descriptions. The fire seems to have behaved predictably in these types (and under weather and fuel conditions at the time). There is every reason to conclude that forest succession will progress along similarly predictable trajectories. On an individual site basis, stand progression can be assessed and reasonably predicted with field investigations into habitat type, burn severity, seed sources, current stand conditions, and bark beetle risk.

Old growth forest conditions

Prior to the fire, inventoried old growth occupied a little over 12 percent of the fire area, or 1,643 acres (project file). This is old growth forest that had been field verified in the past 10-15 years, as part of a project level analysis. Definition of old growth was based primarily on Western Montana Zone Definitions for Old Growth (Green et al 1992). The extent of old growth was reduced by the fire to about 470 acres, or 4 percent (project file). Many stands burned with a moderate to high intensity and reverted to stand initiation successional stages. Other stands were reclassified to the understory reinitiation stage because the fires burned at low to moderate severity and the fire's major effect was to reduce the understory. The understory reinitiation stage is characterized as having an overstory of low to moderate density where gaps have been created due to mortality and blowdown, allowing an understory to become established. Some late seral stands retained their character and function if they experienced a light ground-fire and mainly comprised fire-resistant species such as western larch. Late seral stands of spruce were changed by low severity fire to understory reinitiation due to spruce's susceptibility to girdling by fire.

The range of natural variability in the amount of late seral or old forest in the watershed representing most of the Robert Fire area is wide, and may occupy from zero percent to nearly 38 percent of the land area (project file). This is not surprising, considering the large, stand-replacing wildfires with long fire-free intervals that characterize the natural disturbance regime in these moist, cool forests. This disturbance pattern would result in large patches of burned forest, converting many if not most of the older forests in the watershed into a seedling/sapling stage of development. Over time, through natural succession, some of this would eventually develop into an old forest structure again, composed of larger-diameter trees and multi-storied canopies.

Fire (Burn) Severity

The fire burned with varying intensity (BTUs) across the landscape, from creeping and smoldering to fast moving crown fires. Temperature, humidity, wind, topography, and fuel moistures can all influence how intensely a fire burns (DeBano *et al*. 1998). This evaluation of fire intensity and the effects on the duff and soils is referred to as "burn severity". Classification and definitions of burn severity for the Robert and Wedge fires can be found in the section on soils.

Another commonly applied evaluation of a fire considers the effects of the fire on the primary vegetative component, typically the tree component in a forested landscape. This classification is referred to as "fire severity" in this analysis, but is sometimes called "vegetation burn severity". For the 2003 fires, aerial photographs of the area after the fire were evaluated to determine fire severity, or the extent to which vegetation was affected by the fire (project file). Three broad categories were used to classify the effects of fire on the vegetation component of the landscape.

- Low fire severity: Most of the trees have green crowns, with less than 30 percent brown (scorched) or black trees. Sometimes these areas are mosaics of very small patches of burned trees amidst patches of unburned forest. Other times these areas have been mostly underburned, with ground vegetation scorched and blackened but tree crowns green and intact. Mortality of trees may vary widely in this category, depending primarily upon tree species. Thin barked species such as spruce and subalpine fir are usually killed with only the lightest of ground fires, whereas the fire tolerant larch, Douglas-fir and ponderosa pine usually survive such fires.
- Moderate fire severity: This is a broad category of conditions, where 30 to 80 percent of the trees are brown (totally scorched but retain most of the small branches and needles) or black (total crown consumption). Most of these trees have been directly killed by the fire, though mortality may vary somewhat depending upon tree size and species (fire tolerance).
- High fire severity: Greater than 80 percent of the trees are brown (totally scorched) or black, and thus have been immediately killed by the fire.

Figure 10 and Table 23 display the fire severities across the Robert Fire area.

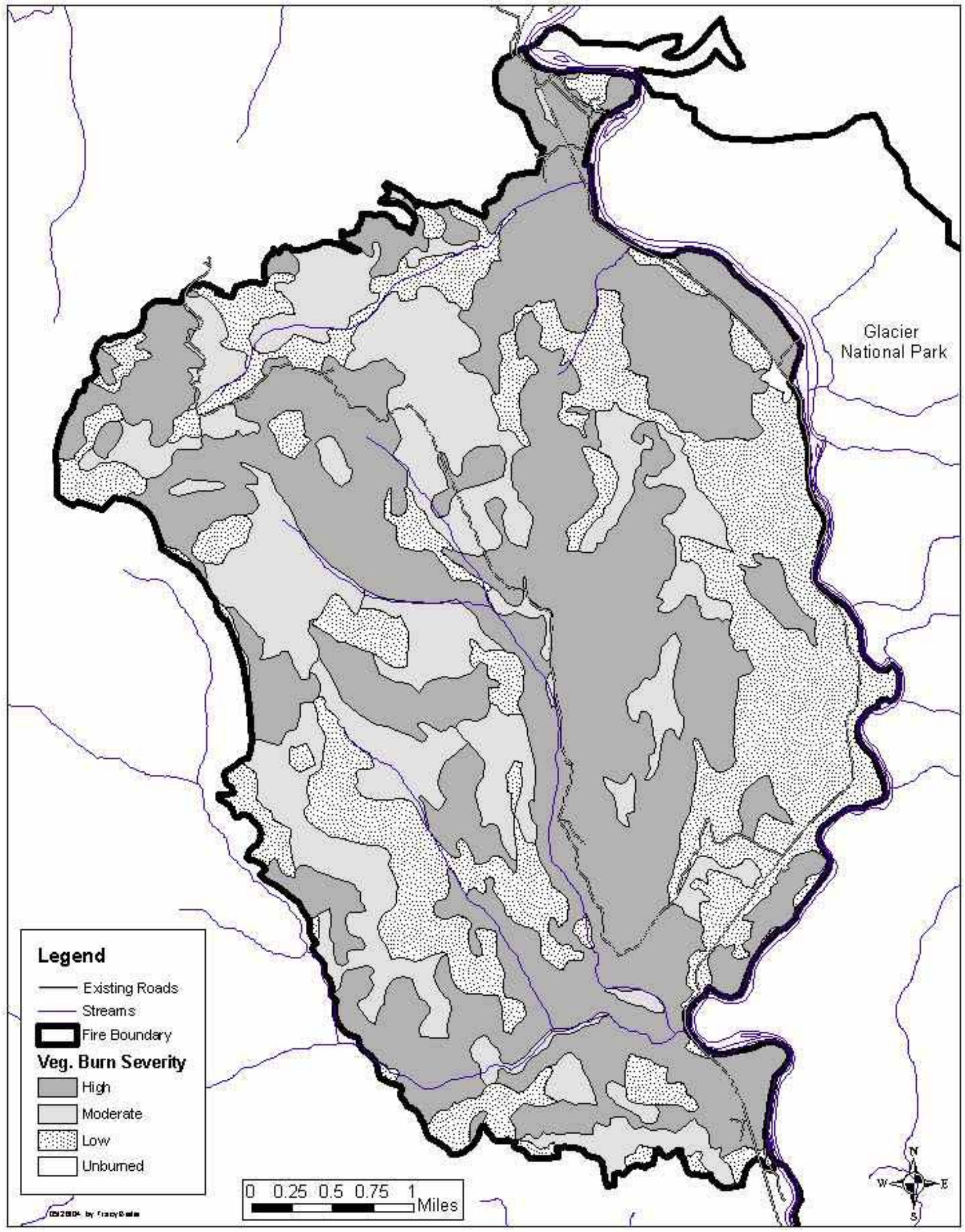

Figure 10. Burn Severities for the Robert Fire Area

Table 23. Burn Severity Classes for National Forest System Lands in the Robert Fire Area (acres, percent)

	Robert Fire	
Vegetation Burn Severity	Acres	Percent
High	6,312	49

Low	3,488	27
Moderate	2,897	22
Unburned	14	Trace
(unclassified, rock, water, etc)	206	2

Post-fire Composition

The fire affected forest cover type proportions and tree species mixes substantially. Estimates of post fire composition and cover type were made by professional foresters, based on mapped fire severity, existing cover type (and knowledge of species resistance to fire); stand density, aerial photography and walk-through assessments so that a portrayal of existing forest conditions could be established (project file). While it is useful to understand forest conditions prior to the fires, because that knowledge can help predict vegetation responses, it is perhaps more important to understand the actual post-fire conditions. Table 24 displays estimates of the current cover types (species composition) for this new forest.

Table 24. Estimated Forest Species Composition Post-Fire (Acres, Percent, Percent Change)

Cover Type	Acres	Percent	Percent change
Larch, Douglas-fir	6,665	50	No significant change
Lodgepole pine	5,696	43	+38
Mixed	165	1	-6
Spruce-fir	594	4	-27
Non-forest	101	Trace	No change
Whitebark pine	0	0	No change

Post Fire Forest Structure

Disturbance processes alter the successional pathways of forest vegetation. The change in structure classification is a function of the fire severity and the existing structure. A severe fire with total consumption of all live vegetation will set a forest habitat back to the grass/forb/seedling or stand initiation stage, while the vertical structure provided by snags would persist for some years. In the burned area, grasses and sedges are already sprouting. Revegetation of shrubs is expected in about six years (Stickney 1990). The proportions and arrangement of vertical and horizontal forest structure, certainly, are re-ordered by lethal, mixed and even low severity burns.

Before the fire, 28 percent (about 3,700 acres) of the area was in a stem exclusion stage. This stage is characterized as having trees of similar sizes (in this case pole sized trees from 5-9” diameter at breast height) occupying all of the growing space, allowing little or no light to the forest floor for new seedlings to become established (Oliver & Larson 1996). Most of these pole-sized stands were unmanaged, and provided a continuous fuel matrix. Most of these stands originated after the fire of 1926 and had regenerated to dense stands of larch, lodgepole pine and Douglas-fir (about 3,000 acres). High mortality from the fire returned these stands primarily to stand initiation, or grass-forb stages (Table 25 and Figure 11).

Spruce and subalpine fir stands will experience nearly complete mortality with even low to moderate intensity fire and return to stand initiation stages of forest development, dominated by seedlings, saplings and grass/forb/shrubs. Older western larch and Douglas-fir stands experiencing the same fire intensity may lose the understory but few or none of the overstory trees (Fischer and Bradley 1987). These Douglas-fir and larch stands are now classified as either having not changed structurally if burned at low severity (50% of the stands), , or changing to grass-forb stages (Table 25 and Figure 11) (project file).

The understory reinitiation structural stage is characterized by having an overstory of larger trees above an understory layer of smaller seedlings or saplings. It can be created by disturbance, such as fire, which kills understory trees but not overstory trees. Or it can develop over time as trees in the overstory begin to die, creating openings for sunlight to reach the forest floor, making nutrients and water available to new vegetation. Seedlings then become established to create an understory layer (Oliver & Larson 1996). As the stand ages, this understory can eventually reach a height where, in conjunction with remaining overstory trees, a multi-storied stand dominated by larger, older trees in the upper canopy is created. This is then referred to as a late seral or old forest, stage. A young forest multi-storied structural stage represents stand development over time resulting from intermittent mortality to the overstory (i.e. fire, partial harvest, insect or disease). A forest dominated by trees of mixed sizes and canopy layers can result (Hessburg *et al.* 1999). This table shows the estimated changes using existing classifications in the forest's databases and estimates of fire effects to those structures.

Table 25. Change in Structure Classification (Acres) – Pre-and Post-Fire

Forest Vegetation	Robert Pre-fire (Acres)	Robert Post-fire (Acres)	Acre Change
GRASS/FORB	6	8,000	7,994
HARVESTED/NONSTOCKED	118	118	0
IMMATURE -SAWTIMBER-ALL SPECIES	313	120	-193
IMMATURE/POLE/NON-LP	59	9	-50
MATURE -SAWTIMBER-ALL SPECIES	5,675	1,638	-4,037
OVERMATURE-OLDER FOREST	245	68	-177
POLE/LP	537	232	-305
POLE/MIXED	3,176	1,663	-1,513
PRIVATE/HARVESTED/NONSTOCKED	23	23	0
SAPLING	2,521	1,287	-1,234
SEEDLING	621	137	-484

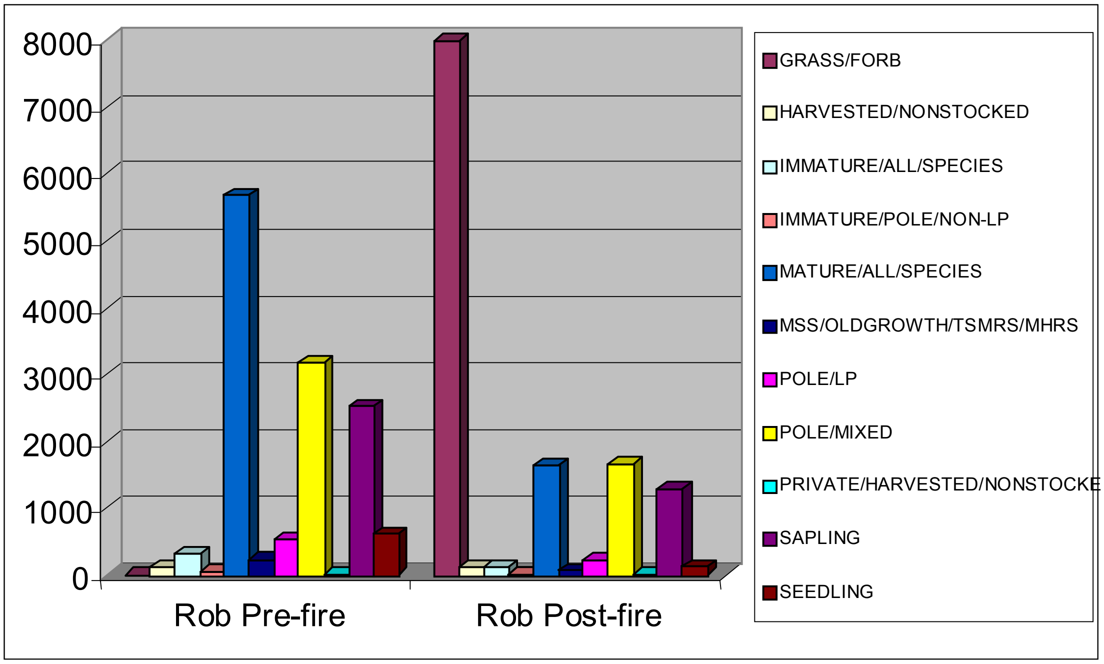

Figure 11. Change in Structure Classification (Acres) – Pre-and Post-Fire

Past harvest activities, natural disturbances, and fire suppression created a mosaic of stand structures across the landscape. Acres harvested in the last four decades were in the stem exclusion (sapling), understory reinitiation (thinned sapling/pole), or the stand initiation (seedling) stage prior to the Robert Fire. About 7,994 acres of the area (project file) reverted to a grass (stand initiation) stage, while keeping some vertical structure provided by the stems of burned trees (snags).

Post Fire Old Growth Conditions

About 470 acres of inventoried old growth are estimated to remain in the burned area and would continue to provide the structure and function of old growth stands. (project file).

Regeneration in the fire area

There is a large body of research on post-fire regeneration based on data gathered locally on the Flathead National Forest at Miller Creek (project file). This body of knowledge from several studies, some with a longevity of 35 years, allows us to confidently predict what to expect. The initial community establishing in the fire area is expected to be grasses and shrubs. Their source will be from one of three components: survivor, residual colonizer, and offsite colonizer (Stickney 1990). Trees may become established on a disturbed site in a number of ways, such as residual seed in the soil, from cones on trees that survived the fire, from seed that blows in from off-site, or from animal transport. Diverse natural conifer regeneration may be delayed or below desirable levels in some areas due to lack of a seed source. It is likely that a majority of the fire area has surviving residual lodgepole pine seed in the soil, but other species, especially larch, will not become established unless a cone crop coincides with these first few years when the germination substrate is favorable (Shearer 1989). Some of these areas may occur in the center of larger burn areas with complete mortality, or at upper elevations and south facing aspects with thin soils.

The length of time for natural revegetation on dry potential vegetation types (PVTs) is expected to be slow and spatially discontinuous. Immediate post-fire species composition is largely dependent on seed from adjacent unburned areas, persisted through the fire, or repsrouted from plant parts surviving the fire (DeBano *et al.* 1998). Native grasses and shrubs will colonize the burned areas (Noste and Bushey 1987). Although the tree component will be influenced by competition, generally the community that was present before the fire is the community that will return successionally (Stickney 1986). For example, ceanothus was present in some stands before the fire, and is expected to return, especially on south-facing slopes.

The Northern Region Overview Summary (project file) categorizes the forest and rangeland species at risk for the Northern Rockies Zone as western white pine, western larch, ponderosa pine, upland grasses/shrub,s and whitebark pine. They are considered most at risk in this zone due to "past and potential future loss in the aerial extent of the cover type, significant changes in landscape level heterogeneity (fragmentation), significant changes in structure (both density and change in distribution of structural stages), and susceptibility to spread of identified exotic plants."

There is a low probability for natural regeneration of western white pine and whitebark pine due to the size of the burned area, the severity of the burn, lack of surviving seed source, and the topography.

In some areas within the fire, there are good cone crops predicted and survivors of western larch, Engelmann spruce, and lodgepole pine. Abundant seedlings are expected this summer in many, though not all, areas. A recently burned soil substrate favorable for tree seedlings, especially western larch, to become established; however, an abundant cone crop, accompanied by adequate summer precipitation must occur within two or three years of the fire for larch to establish successfully. Good larch cone crops are produced at about five year intervals. Larch is an early seral species, highly intolerant of shade, and if it gets a late start on a site, it is often out-competed and out-shaded by shrubs and other tree species (Schmidt *et al.*1976).

There are large areas of high severity burn where distance to the seed wall exceeds 3000 feet. These areas may have lodgepole pine in the soil seed bank or already regenerating from cones opened by the heat of the fire, but species diversity will be lacking as these patches regenerate without other seed sources.

The majority of the Robert Fire occurred on lands classified in the forest plan as Management Area 15 (8,553 acres), where cost-efficient production of timber is emphasized, while protecting the productive capacity of the land and timber resources. Planting may be necessary on some MA 15 lands to restore the productive capacity of the land in a timely manner. Vegetation treatments are appropriate and expected on MA 15 lands.

Forest plan resource goals include designing treatments to encourage development of diverse vegetation native to the site. Larch was historically a dominant species, and much of the mature larch was harvested in the 1960s, 1970s, and 1980s (Bollenbacher pers. comm.). Encouraging this species before lodgepole pine or other species fully occupy the sites would contribute to restoring historical conditions.

Landscape level goals from the forest plan include protecting or restoring riparian vegetation to provide for shade, large woody debris, sediment filtration, and normal hydrologic function, consistent with the site potential and natural disturbance process. Riparian areas may need to be planted with shrubs or conifers to shorten the amount of time it takes for riparian vegetation to provide the benefits listed above.

Spruce Beetles

The area affected directly by spruce beetles is defined as the National Forest System Lands within the fire perimeters. For evaluating indirect and cumulative impacts of bark beetles, the area affected is expanded to include lands within a 5-mile radius of the fire perimeter (Figure 12). This distance is based on our knowledge that bark beetles will only fly as far as necessary to find a suitable host, but will fly as far as 30 miles if necessary (Schmid and Frye 1977). Flight tests indicate few beetles can fly more than 7 miles nonstop (Chansler 1960 in Schmid and Frye 1977). Therefore, it is reasonable to assume the generations of beetles produced in the fire area might fly up to five miles from whence they were bred. In subsequent years, given a continuation of favorable beetle breeding conditions and high beetle populations, their influence could extend beyond this zone, but those occurrences are speculative.

There are many insects and pathogens that may capitalize on the changed forest condition in the Robert Fire, and some have already been observed in the area. This includes the flatheaded fir borer, which typically attacks only dead and dying trees, but has been noted attacking alive but weakened larch trees within the fire area (project file). Spruce beetle is the primary concern to land managers because of their potential to develop large populations within the fire area, spread into live trees inside and outside the fire area, with possible effects to other resource values. Douglas-fir beetle, while often exhibiting behaviors similar to those of spruce beetle, are less of a concern within the Robert Fire area because only small amounts of potential habitat exist in the fire area (less than 300 acres) and is of low susceptibility to Douglas-fir beetle due to Douglas-fir size, numbers and density (project file).

Disturbances such as insects, disease, and fire, are all a natural part of the ecosystem, with the wildlife, vegetation, and other components of the ecosystem responding to the influence of these processes for many thousands of years. Most commonly, bark beetle populations are "endemic" in the forest, with relatively low annual tree mortality. However, periods of high beetle population levels occur periodically, typically in response to disturbances that stress and weaken the host trees (such as drought, fire, blowdown). These insects have evolved to fully capitalize on just such a disturbance as the Robert Fire, where fire-killed and stressed trees represent ideal habitat conditions. A bark beetle outbreak in and around the fire area would be normal and natural from an ecological context, however, high tree mortality may conflict with management objectives and create undesirable consequences.

Bark beetle outbreaks following fires are not a foregone conclusion, but they are not unprecedented (FHP 2000b). Each situation is unique, with widely ranging fire severity, vegetation and site conditions, beetle population levels, and other influencing factors. Several conditions must exist for bark beetles to take advantage of fire-damaged hosts (ibid). These include the following:

First, the fire area must have sufficient numbers of host tree species, and the host trees must have an adequate supply of undamaged inner bark (phloem). Beetles feed and lay eggs in this phloem. Hot, stand-replacing types of fires, or fires in thin-barked tree species, may render the inner bark dry and unusable to the beetles. But, particularly in low severity burns, spruce trees affected by ground fire can be sufficiently weakened to become excellent spruce beetle habitat. These trees are slow to die, and inner bark is normally not denatured by the fire.

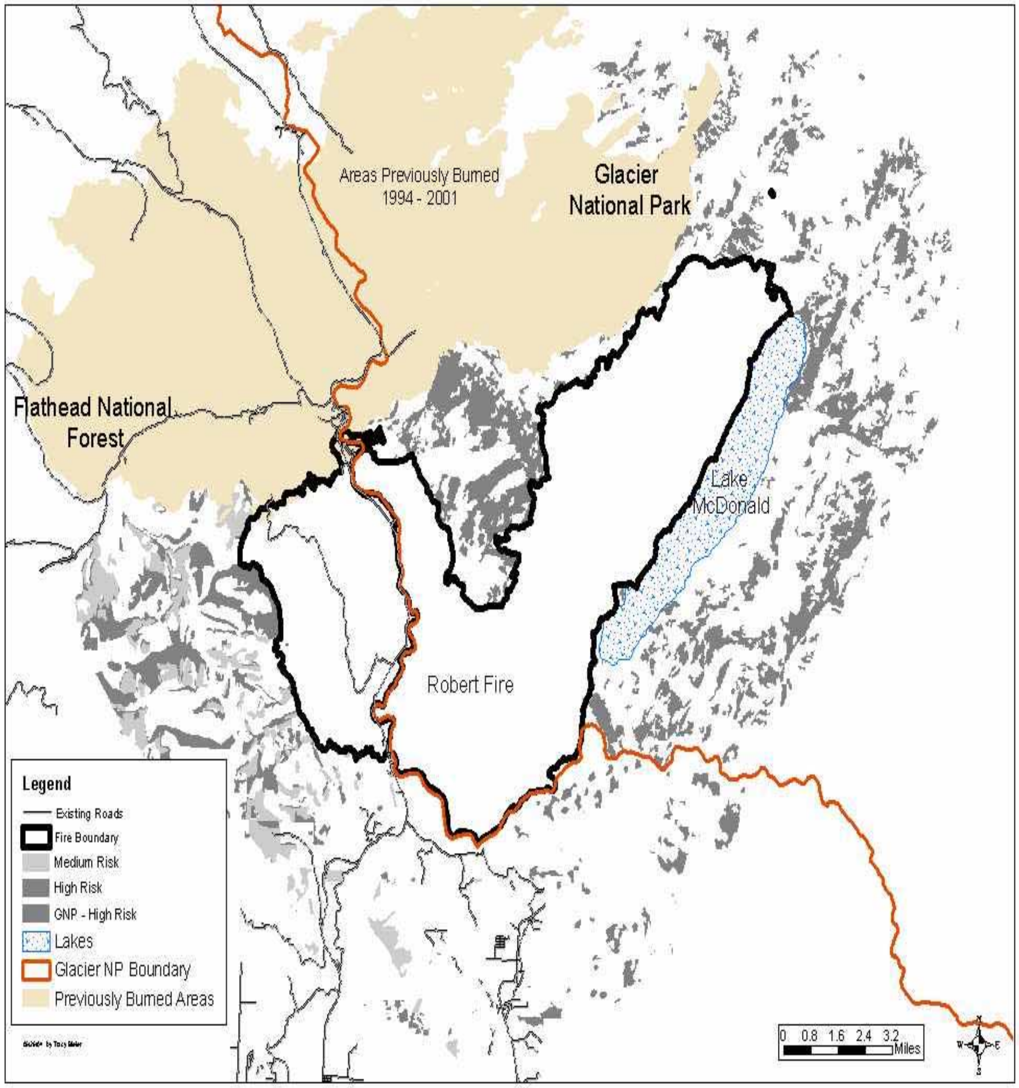

Figure 12. Spruce Beetle Hazard Stands in 5-Mile Radius of Fire – Robert Fire Area

Second, fires must occur at a time when beetles are able to capitalize on the new feeding and breeding habitat. Fires in late summer or early fall may occur after adult beetles have flown, and a burned tree's inner bark may become too dry, or in some cases "sour", before the next years flight season. The Robert Fire occurred after the height of the beetle flight season in 2003. The fire killed many spruce trees, though the inner bark on many trees is still moist and able to support a new generation of beetles. Many other trees not directly killed by the fire have experienced crown and bole scorch and are highly stressed. These trees are the most at risk to beetle infestation, and the most able to support and produce high numbers of new adult beetles in subsequent years.

Third, there must be a population of beetles within a reasonable distance to take advantage of weakened trees that become available. Spruce beetles are currently at endemic population levels in Northwest Montana, not in excessively high numbers, but expected to be fully capable of exploiting the new, highly desirable feeding and breeding sites in the Robert Fire area. Monitoring of spruce beetle activity in the 2001 Moose Fire area immediately to the north showed that spruce beetles had infested the fire-killed and injured trees in high numbers in the year immediately after the fire (2002). However, by the fall of 2003, most of the infested trees had fallen, were exposed to the sunlight and excessively dry conditions of that summer, and most of the spruce beetle brood had not survived. Extremely high infestation levels of wood boring beetles, which consume everything in their path (including spruce beetle brood), were also thought to contribute to the decline in spruce beetle populations. Though there are certainly some spruce beetles that have survived in the Moose Fire area and will most likely spread into the Robert Fire area, the threat of a damaging spruce beetle outbreak is believed to have passed in the Moose Fire area (project file).

Spruce beetle activity has been at low, endemic levels in and around the project area for the past 40 years, causing scattered, limited mortality nearly every year. There have been spruce beetle outbreaks in the past on the Flathead National Forest, and the precedent exists for outbreaks in this area of the Flathead National Forest. In addition, past bark beetle outbreaks in the Northern Region precipitated by fire-damaged stands are well-documented (Amman & Ryan 1991, FHP 1999b, Gibson & Oakes 1993, 1994). Monitoring in the fire areas will allow continuing evaluation of the risk of outbreak.

Predicting bark beetle outbreaks is not an exact science. "Impact" models are useful in predicting beetle-caused mortality in stands of certain characteristics (Cole and McGregor 1983, Negron *et al.* 1999). Our best efforts are directed towards risk management – recognizing when "outbreak conditions" are present, considering potential effects on various resources should an outbreak be realized, and implementing strategies to prevent or lessen the effects of an outbreak if management objectives deem that a prudent course of action.

The greatest benefits in dealing with actual or potential spruce beetle infestations are derived from efforts aimed at preventing outbreaks rather than suppressing them (Schmitz and Gibson 1996). This involves modifying live susceptible stands to the extent possible to make them less vulnerable prior to some type of stand disturbance, which may trigger an outbreak. Actions may include altering tree densities and species compositions. Once disturbances occur (common ones being blowdown, fire and drought), removal of bark beetle susceptible trees before they are infested is the most effective course of action to prevent an outbreak or influence beetle populations. Risk of large-scale bark beetle infestation can also be reduced by removing as many infested trees as feasible before the adult beetles emerge and spread to live trees in the vicinity (Gibson 2001, USDA 1995,1999d). Alternatives include use of pheromones to trap beetles, burning/peeling infested logs to destroy brood, treating infested trees with chemicals, and using trap trees to attract beetles and then removing these trees. All these methods have utility and are applicable in under certain conditions and in specific situations. Refer to Chapter 2 for discussion on proposed treatments.

Shortly after the fire, many stands on National Forest System Lands were evaluated for risk of spruce beetle infestation, (project file). Criteria used were average diameter of spruce over 10” dbh, proportion of spruce in the canopy; basal area (density) of the stand, and physiographic location (i.e. creek bottoms vs. lower productivity sites). Post fire field surveys within the fire area provided site specific information on conditions of spruce and its risk of beetle infestation. This subjective rating was integrated with the fire severity and its effect on the susceptible spruce trees.

A GIS routine was used to estimate where and how much spruce beetle habitat is available in the assessment area. Summarizing the findings regarding spruce beetle potentials, we find that about 1,962 acres inside the assessment area have characteristics that could support a spruce beetle outbreak. These particular acres were directly affected by the fire and support a high proportion of weakened spruce trees, where outbreak populations often develop. They are estimated to be a moderate to high hazard for spruce beetle mortality. See Figure 13 for those stand locations.

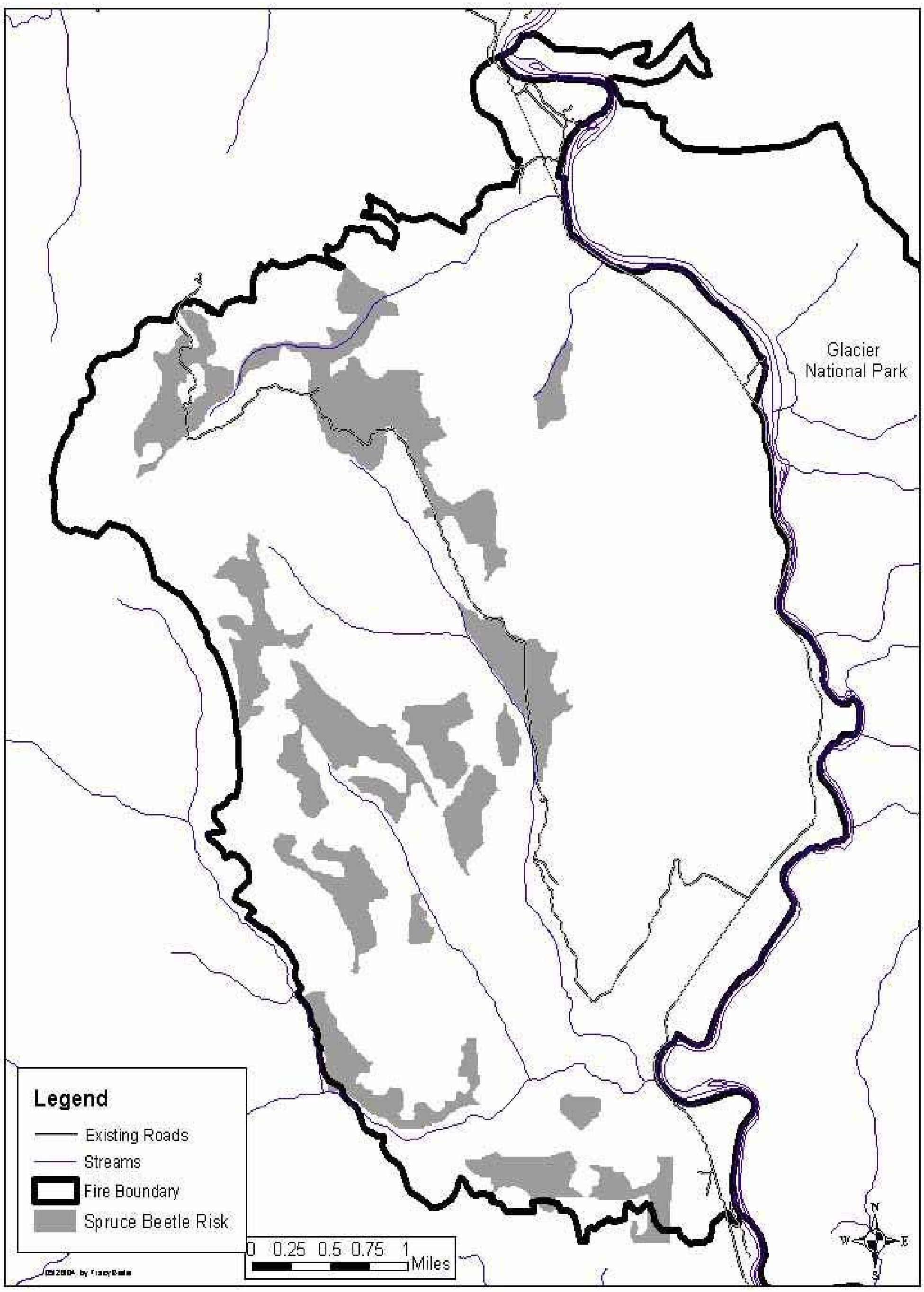

Figure 13. Spruce beetle hazard stands inside fire perimeter, on FS system lands – Robert Fire Area

In the area within five miles of the fire perimeter, on National Forest System lands, about 9,883 acres show characteristics leading to classifications as high or moderate spruce beetle hazard. While these stands are well distributed and are made up of varying patch sizes and arrangements, the area south and west of the fire is most susceptible. Reducing the overall susceptibility of the landscape surrounding the Robert Fire was the occurrence of a major spruce beetle epidemic in northwest Montana and northern Idaho following a windstorm in 1949. Thousands of acres of blowdown resulted in drainages of the North Fork Flathead River. This precipitated a beetle epidemic that lasted through the 1950s. The blowdown, beetles, and subsequent salvage converted many of these stands to an early seral seedling and sapling forest. As a result, the vulnerability of the landscape to spruce beetle was reduced from the pre-1950 condition for a while. In the intervening years, stand hazards have again increased.

In the area within five miles of the fire perimeter on National Park System lands, about 9,475 acres are classed as moderate to high hazard stands. The areas around McGee Meadows and Howe Lake seem to have the largest expanses of hazardous spruce stands, but many other areas of spruce stands surround the burn perimeter in Glacier National Park.

Low hazard stands are typically those where larger (>16” dbh) spruce may be present, but at low numbers. Individual trees may be infested and killed by spruce beetle, but the stand as a whole does not provide abundant beetle habitat.

Medium risk stands are typically well-stocked stands on productive sites, composed of spruce of large average diameter (>16”), but where spruce comprise less than 50 percent of the overstory stand stocking. Spruce beetle has the capability of causing high mortality to the larger diameter trees in these medium hazard stands, but net losses would be lower than the high hazard stands, because there are fewer of these susceptible trees present.

The high hazard stands generally are of similar character as medium hazard, but have higher proportions of spruce in the canopy, often over 65 percent of the stocking. Given high beetle populations, these stands would experience the greatest net losses and would be able to support and contribute substantially to high beetle population buildup.

Wedge Fire

Timber Resources Existing Conditions

Virtually all the commercial timber stands and sites in the area were affected by the fire. Mortality of standing timber and future commercially valuable stands (represented by seedling, sapling and pole-sized trees) was significant. Not all of that was available or technically feasible to harvest under current management framework and not all was near rotation age or ready for scheduling for harvest. Initial estimates of salvageable dead timber in the area (timber that is dead or dying, sawlog size, technically feasible to harvest with available logging systems, and economically feasible to remove) are about 20 million board feet, if it were otherwise unconstrained.

The fires also killed timber resources in the seedling, sapling, pole, and small sawtimber size classes. These stands represented future harvestable products, and the sites are no longer carrying fully stocked, manageable stands. In forest plan management areas designated as suitable for timber production (most of the acreage of the Wedge Fire), investments may be needed to restock those sites.

Pre-fire Forest Composition

The area affected by the Wedge Fire was composed almost entirely of conifer dominated plant communities, with only minor inclusions of grass, forb, shrub cover types, or rock and water (Table 26).

Tree species found in the Wedge Fire include subalpine fir, Douglas-fir, lodgepole pine, western larch, and Engelmann spruce. A minor component of ponderosa pine, western white pine, and western redcedar can be found here as well. Whitebark pine was historically a major species in many stands at the upper elevations, often mixed with spruce and subalpine fir. Widespread blister rust infections, in addition to the mountain pine beetle outbreaks of the last few decades, caused a serious decline of whitebark pine. Common shrubs include Sitka alder, red osier dogwood, huckleberry, snowberry, and several others characteristic of moist forest communities.

Table 26. Pre-fire Forest Cover Types (acres and percent)

Cover Type	Acres	Percent
LARCH/DOUGLAS-FIR	6,799	28
LODGEPOLE PINE	4,147	17
MIXED	1,049	11
NON-FOREST	1,754	7
SPRUCE/ALPINE/FIR	7,943	33
WHITEBARK PINE	2,143	9

In the Interior Columbia River Basin, Hessburg and others (Hessburg 1999) detected some trending away from historic coverages of cover types at the province-scale Ecological Reporting Unit (ERU, the Northern Glaciated Mountains). Generally, a shift away from early seral species, toward late successional species was found. Western larch coverage has declined in the Unit. White pine has decreased from the reference conditions, as has whitebark pine. Grand fir, spruce, and subalpine fir coverages (late successional species) are increasing. .

Analysis of landscape conditions conducted for the Flathead National Forest indicates that these trends generally hold true at the watershed scale, for the ecological subunit that the Wedge Fire is within (project file). Within the Wedge Fire area, the proportion of cover types prior to the fire was probably within the range of historical conditions, with a relatively high proportion of seral cover types and lower proportion of late successional cover types. The primary factor contributing to this was the 1910 wildfire that burned over nearly 4900 acres (24%) of the Wedge Fire area. Dense forest of ninety year old early seral species (larch, lodgepole pine and Douglas-fir) dominated in this area prior to the Wedge Fire. Loss of white bark pine cover types are known to have occurred in the Wedge Fire area as well, due to disease and bark beetle mortality.

Pre-fire Forest Structure

Forest structural stages prior to the fire are displayed in Table 27. This table displays the aerial extent of each structural developmental stage at the time the fire occurred. It is displayed here to form a basis for discussion on the relative amounts of changes the fire caused in the area, versus what changes are expected as a result of the proposal.

Table 27. Pre-fire Forest Structural Stages (acres and percent)

Structural Stage	Acres	Percent
BARE/GROUND/ROCK/SNOW	13	Trace
GRASS/FORB	370	2
HARVESTED/NONSTOCKED	43	Trace
IMMATURE SAWTIMBER-ALL SPECIES	2,691	11
IMMATURE/POLE/LP	38	Trace
IMMATURE/POLE/NON-LP	323	1
MATURE -SAWTIMBER-ALL SPECIES	7,130	30
MATURE/POLE/MIXED	0	0
OVERMATURE-OLDER FOREST	2,526	11
POLE/LP	1,983	8
POLE/MIXED	2,584	11
PRIVATE/HARVESTED/NONSTOCKED	331	1
SAPLING	4,721	20
SEEDLING	747	3
SHRUB/HARDWOOD	330	1

In the Interior Columbia River Basin, Hessburg and others (1999) found that some structural stages were trending away from the expected or historical conditions in the Northern Glaciated Mountain ERU. Proportions of stand initiations stages (seedling and sapling, grass-forb generally) of development are declining, and patch sizes are decreasing. Old forest structures have declined as well. Corresponding increases were noted in the intermediate structural stages of development (mature, immature and pole classes).Interestingly, in the Northern Glaciated Mountain ERU, significant fuel load increases were identified, and in 1999, 60 percent of the ERU exhibited moderate to extreme crown fire potential. A discussion of post-fire structure follows later in this report

Within the Wedge Fire area, the proportion of the stand initiation, seedling/sapling stage of forest succession was probably within the historical ranges at about 25% of the area. These patches were created through past regeneration harvesting, and thus were relatively small patches compared to the large areas of young, newly regenerated forest that would typically be created by fire, the dominant natural process on this landscape.

Fire Groups were estimated for the area using habitat type classifications, which were then grouped into broader categories because their fire and successional responses are similar (Fischer and Bradley 1987) (project file). Fire Groups are areas of similar habitat conditions described by moisture, temperature, and soils, which lead to similar late-seral forest conditions in the absence of disturbance. They also respond to fire similarly and are helpful in understanding the variety of responses the forests exhibit. They help define the natural fire regime for a forest, and its probable successional development after a fire. Table 28 displays the major groups and their coverages in the Wedge Fire area.

Table 28. Fire Groups and Burn Severities (Acres, Percent)

Fire Group	Vegetation Burn Severity	Acres	Total Acres in Group	Percent Coverage
4	High	37	68	<1
4	Moderate	31		

6	High	123	189	1
6	Low	8		
6	Moderate	58		
7	High	982	1,582	8
7	Low	192		
7	Moderate	407		
7	Unburned	1		
8	High	1,259	1,839	9
8	Low	248		
8	Moderate	332		
9	High	6,150	14,032	67
9	Low	4,272		
9	Moderate	3,545		
9	Unburned	65		
10	High	1,877	3,131	15
10	Low	405		
10	Moderate	849		
11	High	1	50	<1
11	Low	25		
11	Moderate	24		

Fire Group 9, representing 67 percent of the Wedge Fire area, is a collection of moist, lower alpine habitats types in the spruce and subalpine fir series. Downed dead fuel averages 25 tons per acre in these types, but considerable variation is noted, and loadings can be much higher. Combined with typically deep duff layers, fires here can be severe under dry conditions. Where dense understories exist, those fires can spread to the crowns and result in stand replacement fires. Even in low intensity fires, cambium heating can kill overstory trees. In northwestern Montana, fire-free intervals may average 146 years. Fires in this group range from small, low intensity underburns to infrequent, large severe fires, depending on weather, fuel, and moisture conditions. (Fischer and Bradley 1987)

Stand development following fire in Fire Group 9 is variable, and is influenced by the stand composition at the time of the fire (species, seed dispersal habit, size, age), and the fire itself (intensity, severity, duration). Late seral ("climax") conditions would tend to high occupancy of spruce and subalpine fir, given a long developmental period without fire. Since that is rare, a near-climax condition is more common. In that case, understories might be dominated by subalpine fir, but overstories could contain Douglas-fir, lodgepole pine, larch, and spruce or white pine. Stand replacement fire results in stand initiation or grass-forb-shrub stage structure, followed by seedling stages. Seedlings of any of the species mentioned above many be present, depending on site conditions, but two general pathways are identified, one dominated by Douglas-fir, and the other by larch or lodgepole pine. (Fischer and Bradley 1987)

Fischer and Bradley (1987) suggest that available evidence indicates fires are infrequent, and normally low or high severity. Moderate severity fires are less common, generally, but do occur. All three were observed in the Wedge Fire (Table 28).

Based on the habitats, fire severities, and presence of many species, we can expect a wide range of forest types to develop in Fire Group 9 habitats.

Fire Group 10 represents the next highest amount in the assessment area at 15 percent coverage. Fire Group 10 includes cold, moist upper subalpine habitats and timberline conditions. Subalpine fir climax conditions can develop here, and some sites contain spruce, whitebark pine, or lodgepole pine. Fuel loadings develop more slowly here and average about 18 tons per acre. Often these loads are dominated by individual large pieces contributed by insect mortality or storm damage and fine fuel is somewhat limited. Fire frequencies range from 35 to over 300 years in individual stands. When continuous forest cover develops, and extreme fire weather occurs, large, stand replacement fires result, with frequencies of perhaps 200 years. One study (Arno 1986 in Fischer and Bradley 1987) suggests that fire has been important in perpetuating whitebark pine.

Stand development following severe fire begins with herb-shrubs stages which persist for considerable periods. Conifer establishment and growth into mature forest conditions may take 100 years. Large scale fire disturbance is unlikely during this long developmental stage. Subalpine fir, Engelmann spruce, and whitebark pine are dominant species in this group and will dominate the new forest again.

Fire Groups 7 and 8 are present, representing 17 percent of the area. Fire Group 8 is similar to Fire Group 9 but more frequent and often less severe fire is expected there given it is warmer, and dryer than group 9. Douglas fir and lodgepole pine dominate these sites as long-term seral species. Occasionally larch and western white pine are found. Fire Group 7 includes habitats that are usually dominated by lodgepole pine, but they can also support Douglas-fir, spruce, subalpine fir and whitebark pine. These sites can carry significant fuel loads and if supporting young stands, can be destroyed quickly by fire. Fire Group 7 sites are typically lodgepole pine dominated, and fire perpetuates that dominance. In the absence of fire, on some of the habitats, Douglas-fir, spruce, or subalpine fir may ultimately dominate.

There is no indication the Wedge Fire burned outside of these descriptions. The fire seems to have behaved predictably in these types (and under weather and fuel conditions at the time). There is every reason to conclude that forest succession will progress along similarly predictable trajectories. On an individual site basis, stand progression can be assessed and reasonably predicted with field investigations into habitat type, burn severity, seed sources, current stand conditions, and bark beetle risk.

Old Growth forest conditions:

Prior to the fire, inventoried old growth occupied a little over 6 percent of the fire area, or 1,339 acres (project file). This was old growth forest that had been field verified in the past 10-15 years, as part of a project level analysis. Definition of old growth was based primarily on Western Montana Zone Definitions for Old Growth (Green et al 1992). The extent of old growth was reduced to about 788 acres, or 4 percent (project file). Many stands burned with a moderate to high intensity and reverted to stand initiation successional stages. Other stands were reclassified to the understory reinitiation stage because the fires burned at low to moderate severity, and the fire's major effects was to reduce the understory. The understory reinitiation stage is characterized as having an overstory of low to moderate density where gaps have been created due to mortality and blowdown allowing an understory to become established. Some late seral stands retained their character and function if they experienced a light ground-fire and were mainly comprised of fire-resistant species such as western larch. Late seral stands of spruce were changed by low severity fire to understory reinitiation due to spruce's susceptibility to girdling by fire.

The range of natural variability in the amount of late seral or old forest within the watershed representing the Wedge Fire area is wide, and may occupy from zero percent to nearly 38 percent of the land area (project file). This is not surprising, considering the large, stand-replacing wildfires with long fire-free intervals that characterize the natural disturbance regime in these moist, cool forests. This disturbance pattern would result in large patches of burned forest, converting many if not most of the older forests in the watershed into a seedling/sapling stage of development. Over time, through natural succession, some of this would eventually develop into an old forest structure again, composed of larger-diameter trees and multi-storied canopies.

Fire (Burn)Severity

- Refer to discussion under the Robert Fire for definitions of fire severity (Page 73).

Figure 14 and displays the fire severities across the Wedge Fire area. Table 29 below displays the fire severities.

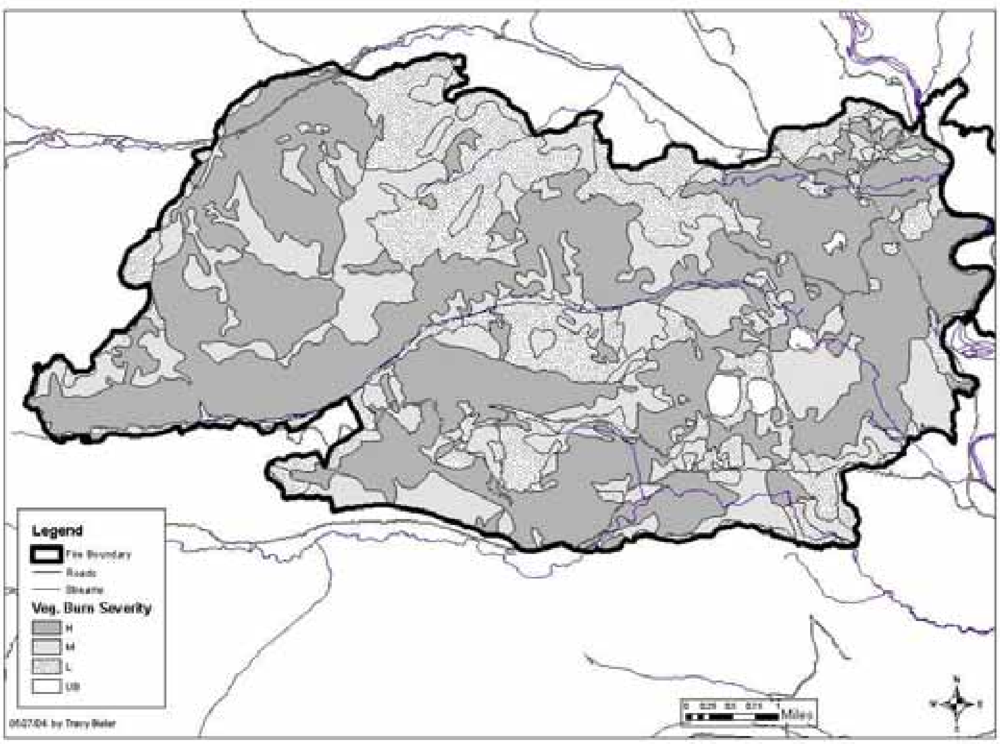

Figure 14. Burn Severities for the Wedge Canyon Fire Area

Table 29. Burn Severity Classes for National Forest System Lands in the Wedge Canyon Fire Area (acres and percent)

Vegetation Burn Severity	Acres	Percent
High	10,429	50
Moderate	5,426	25
Low	5,150	24

Unburned	66	Trace

Post-fire Composition

The fire affected forest cover type proportions and tree species mixes substantially. Estimates of post fire composition and cover type were made by professional foresters, based on mapped fire severity, existing cover type (and knowledge of species resistance to fire); stand density, aerial photography and walk-through assessments so that a portrayal of existing forest conditions could be established (Project Record Veg-17). While it is useful to understand forest conditions prior to the fires, because that knowledge can help predict vegetation responses, it is perhaps more important to understand the actual post-fire conditions. Table 30 displays estimates of the current cover (species composition) types for this new forest.

Table 30. Estimated Forest Species Composition Post-Fire (Acre, Percent, Percent Change)

Cover Type	Acres	Percent	Percent Change
Larch, Douglas-fir	6,789	31	+3
Lodgepole pine	12,936	59	+42
Mixed	132	1	No Change
Spruce-fir	1,738	7	-25
Whitebark pine	392	2	-7
Non-forest	1,745	7	No Change

Post Fire Forest Structure

Disturbance processes alter the successional pathways of forest vegetation. The change in structure classification is a function of the fire severity and the existing structure. A severe fire with total consumption of all live vegetation will set a forest habitat back to the grass/forb/seedling or stand initiation stage, while the vertical structure provided by snags would persist for some years. In the burned area, grasses and sedges are already sprouting. Revegetation of shrubs is expected in about six years (Stickney 1990). The proportions and arrangement of vertical and horizontal forest structure, certainly, are re-ordered by lethal, mixed and even low severity burns.

. Before the fire, 22 percent (about 4,900 acres) of the area was in the stem exclusion stage. This stage is characterized as having trees of similar sizes (i.e. pole sized trees from 5-9" DBH) occupying all the growing space, allowing little or no light to the forest floor for new seedlings to become established (Oliver & Larson 1996). Most of these pole-sized stands were unmanaged, and provided a continuous fuel matrix. Most originated after the 1910 fire and had regenerated to dense stands of larch, lodgepole pine and Douglas-fir (nearly 4900 acres). High mortality from the fire returned these stands primarily to stand initiation, or grass-forb stages (Table 31 and Figure 15).

Spruce and subalpine fir stands will experience nearly complete mortality with even a low to moderate intensity fire and return to stand initiation phases of forest development, dominated by seedlings, saplings, grass-forb-shrubs. Older western larch and Douglas-fir stands experiencing the same fire intensity may lose the understory but few or none of the overstory trees (Fischer and Bradley 1987). These Douglas-fir and larch stands are now classified as either having not changed structurally if burned at low severity (50% of the stands), or changing to stand initiation stages (grass-forb)(Table 31 and Figure 15(project file).

The understory reinitiation structural stage is characterized by having an overstory of larger trees above an understory layer of smaller seedlings or saplings. It can be created by disturbance, such as fire, which kills understory trees but not overstory trees. Or it can develop over time as trees in the overstory begin to die, creating openings for sunlight to reach the forest floor, making nutrients and water available to new vegetation. Seedlings then become established to create an understory layer (Oliver & Larson 1996). As the stand ages, this understory can eventually reach a height where, in conjunction with remaining overstory trees, a multi-storied stand dominated by larger, older trees in the upper canopy is created. This is then referred to as a late seral or old forest, stage. A young forest multi-storied structural stage represents stand development over time resulting from intermittent mortality to the overstory (i.e. fire, partial harvest, insect or disease). A forest dominated by trees of mixed sizes and canopy layers can result (Hessburg, *et al.* 1999). This table shows the estimated changes using existing classifications in the forests databases and estimates of fire effects to those structures.

Table 31. Change in Structure Classification (Acres) – Pre-and Post-Fire

Forest Vegetation	Wedge Pre-fire (Acres)	Wedge Post-fire (Acres)	Acre Change
GRASS/FORB	370	15,268	14,898
HARVESTED/NONSTOCKED	43	43	0
IMMATURE- SAWTIMBER-ALL SPECIES	2,691	1,054	-1,637
IMMATURE/POLE/NON-LP	323	102	-221
MATURE -SAWTIMBER-ALL SPECIES/	7,130	1,531	-5,599
OVERMATURE-OLDER FOREST	2,526	537	-1,989
POLE/LP	1,983	838	-1,145
POLE/MIXED	2,584	1,333	-1,251
SAPLING	4,721	1,893	-2,828
SEEDLING	747	233	-514
SHRUB/HARDWOOD	330	330	0

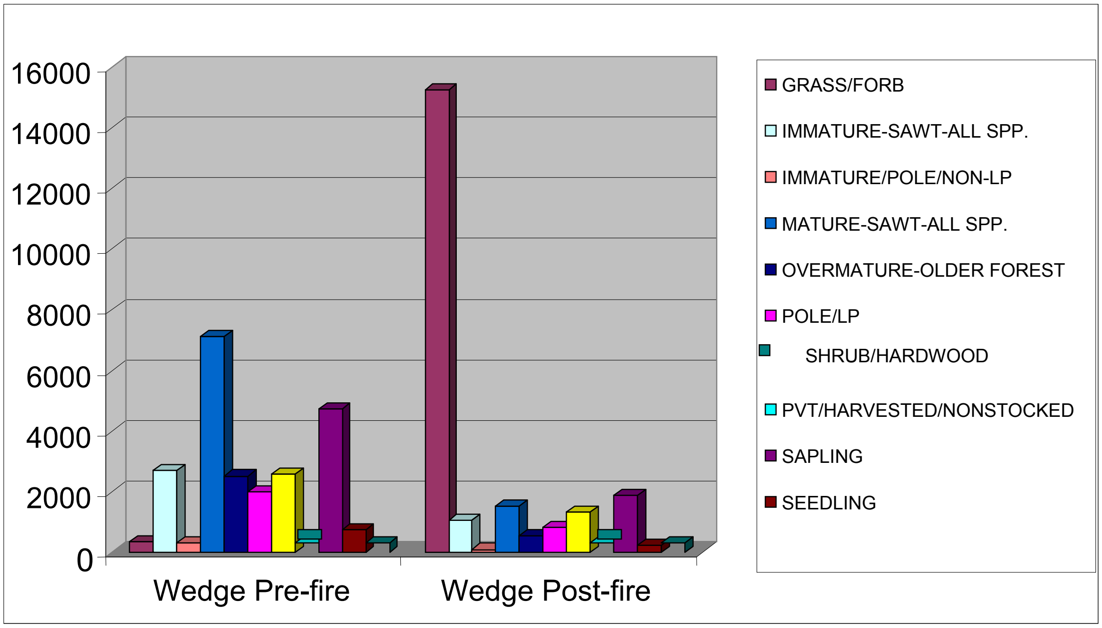

Figure 15. Change in Structure Classification (Acres) – Pre-and Post-Fire

Past harvest activities, natural disturbances, and fire suppression created a mosaic of stand structures across the landscape. Acres harvested in the last four decades were in the stem exclusion (sapling), understory reinitiation (thinned sapling/pole), or the stand initiation (seedling) stage prior to the Wedge Fire. About 15,000 acres of the area (project file) reverted to a grass (stand initiation) stage, while keeping some vertical structure provided by the stems of burned trees (snags).

Post Fire Old Growth Conditions

About 788 acres of inventoried old growth are estimated to remain in the burned area and would continue to provide the structure and function of old growth stands. (project file).

Regeneration in the fire area

There is a large body of research on post-fire regeneration based on data gathered locally on the Flathead National Forest at Miller Creek (project file). This body of knowledge from several studies, some with a longevity of 35 years, allows us to confidently predict what to expect. The initial community establishing in the fire area is expected to be grasses and shrubs. Their source will be from one of three components: survivor, residual colonizer, and offsite colonizer (Stickney 1990). Trees may become established on a disturbed site in a number of ways, such as residual seed in the soil, from cones on trees that survived the fire, from seed that blows in from off-site, or from animal transport. Diverse natural conifer regeneration may be delayed or below desirable levels in some areas due to lack of a seed source. It is likely that a majority of the fire area has surviving residual lodgepole pine seed in the soil, but other species, especially larch, will not become established unless a cone crop coincides with these first few years when the germination substrate is favorable (Shearer 1989). Some of these areas may occur in the center of larger burn areas with complete mortality, or at upper elevations and south facing aspects with thin soils.

The length of time for natural revegetation on dry potential vegetation types (PVTs) is expected to be slow and spatially discontinuous. Immediate post-fire species composition is largely dependent on seed from adjacent unburned areas, persisted through the fire, or repsrouted from plant parts surviving the fire (DeBano *et al.* 1998). Native grasses and shrubs will colonize the burned areas (Noste and Bushey 1987). Although the tree component will be influenced by competition, generally the community that was present before the fire is the community that will return successionally (Stickney 1986). For example, ceanothus was present in some stands before the fire, and is expected to return, especially on south-facing slopes.

The Northern Region Overview Summary (project file) categorizes the forest and rangeland species at risk for the Northern Rockies Zone as western white pine, western larch, ponderosa pine, upland grasses/shrubs, and whitebark pine. They are considered most at risk in this zone due to "past and potential future loss in the aerial extent of the cover type, significant changes in landscape level heterogeneity (fragmentation), significant changes in structure (both density and change in distribution of structural stages), and susceptibility to spread of identified exotic plants."

There is a low probability for natural regeneration of western white pine and whitebark pine due to the size of the burned area, the severity of the burn, lack of surviving seed source, and the topography.

In some areas within the fire, there are good cone crops predicted and survivors of western larch, Engelmann spruce, and lodgepole pine. Abundant seedlings are expected this summer in many, though not all, areas. A recently burned soil substrate favorable for tree seedlings, especially western larch, to become established; however, an abundant cone crop, accompanied by adequate summer precipitation must occur within two or three years of the fire for larch to establish successfully. Good larch cone crops are produced at about five year intervals. Larch is an early seral species, highly intolerant of shade, and if it gets a late start on a site, it is often out-competed and out-shaded by shrubs and other tree species (Schmidt *et al.*1976).

There are large areas of high severity burn where distance to the seed wall exceeds 3000 feet. These areas may have lodgepole pine in the soil seed bank or already regenerating from cones opened by the heat of the fire, but species diversity will be lacking as these patches regenerate without other seed sources.

The majority of the Wedge Fire occurred on lands classified in the forest plan as Management Area 15 (9,000 acres), where cost-efficient production of timber is emphasized, while protecting the productive capacity of the land and timber resources. Planting may be necessary on some MA 15 lands to restore the productive capacity of the land in a timely manner. Vegetation treatments are appropriate and expected on MA 15 lands.

Forest plan resource goals include designing treatments to encourage development of diverse vegetation native to the site. Larch was historically a dominant species in the south half of the fire area, and much of the mature larch was harvested in the 1960s, 1970s, and 1980s (Bollenbacher pers. com). Encouraging this species before lodgepole pine or other species fully occupy the sites would contribute to restoring historical conditions.

Landscape level goals from the forest plan include protecting or restoring riparian vegetation to provide for shade, large woody debris, sediment filtration, and normal hydrologic function, consistent with the site potential and natural disturbance process. Riparian areas may need to be planted with shrubs or conifers to shorten the amount of time it takes for riparian vegetation to provide the benefits listed above.

Spruce and Douglas-fir Bark Beetles

There are many insects and pathogens that may capitalize on the changed forest condition in the Wedge Fire. Spruce and Douglas-fir bark beetles are major concerns to land managers in the Wedge Fire area because of their potential to develop large populations within the fire area, spread into live trees inside and outside the fire area, with possible effects to other resource values. The area affected directly by these beetles is defined as the National Forest System Lands within the fire perimeters. For evaluating indirect and cumulative impacts of bark beetles, the area affected is expanded to include lands within a 5-mile radius of the fire perimeter (Figure 16 and Figure 17). This distance is based on our knowledge that bark beetles will only fly as far as necessary to find a suitable host, but will fly as far as 30 miles if necessary (Schmid and Frye 1977). Flight tests indicate few beetles can fly more than 7 miles nonstop (Chansler 1960 in Schmid and Frye 1977). Therefore, it is reasonable to assume the generations of beetles produced in the fire area might fly up to five miles from whence they were bred. In subsequent years, given a continuation of favorable beetle breeding conditions and high beetle populations, their influence could extend beyond this zone, but those occurrences are speculative.

Disturbances such as insects, disease, and fire, are all a natural part of the ecosystem, with the wildlife, vegetation, and other components of the ecosystem responding to the influence of these processes for many thousands of years. Most commonly, bark beetle populations are “endemic” in the forest, with relatively low annual tree mortality. However, periods of high beetle population levels occur periodically, typically in response to disturbances that stress and weaken the host trees (such as drought, fire, blowdown). These insects have evolved to fully capitalize on just such a disturbance as the Wedge Fire, where fire-killed and stressed trees represent ideal habitat conditions. A bark beetle outbreak in and around the fire area would be normal and natural from an ecological context, however, high tree mortality may conflict with management objectives and create undesirable consequences.

Bark beetle outbreaks following fires are not a foregone conclusion, but they are not unprecedented (FHP 2000b). Each situation is unique, with widely ranging fire severity, vegetation and site conditions, beetle population levels, and other influencing factors. Several conditions must exist for bark beetles to take advantage of fire-damaged hosts (ibid). These include the following:

First, the fire area must have sufficient numbers of host tree species, and the host trees must have an adequate supply of undamaged inner bark (phloem). Beetles feed and lay eggs in this phloem. Hot, stand-replacing types of fires, or fires in thin-barked tree species, may render the inner bark dry and unusable to the beetles. But, particularly in low severity burns, spruce and Douglas-fir trees affected by ground fire can be sufficiently weakened to become excellent beetle habitat. These trees are slow to die, and inner bark is normally not denatured by the fire.

Second, fires must occur at a time when beetles are able to capitalize on the new feeding and breeding habitat. Fires in late summer or early fall may occur after adult beetles have flown, and a burned tree’s inner bark may become too dry, or in some cases “sour”, before the next years flight season. The Wedge Fire occurred after the height of the beetle flight season in 2003. The fire killed uncounted trees, though the inner bark on many trees is still moist and able to support a new generation of beetles. Many other trees not directly killed by the fire have experienced crown and bole scorch and are highly stressed. These trees are the most at risk to beetle infestation, and the most able to support and produce high numbers of new adult beetles in subsequent years.

Third, there must be a population of beetles within a reasonable distance to take advantage of weakened trees that become available. Spruce beetles are currently at endemic population levels in Northwest Montana, not in excessively high numbers, but expected to be fully capable of exploiting the new, highly desirable feeding and breeding sites in the Wedge Fire area.

There have been spruce beetle outbreaks on the Flathead National Forest and the precedent exists for outbreaks in this area of the Flathead National Forest. In addition, past bark beetle outbreaks in the Northern Region precipitated by fire-damaged stands are well-documented (Amman & Ryan 1991, FHP 1999b, Gibson & Oakes 1993, 1994).

Douglas-fir bark beetles are at epidemic levels in Northwest Montana, and mortality due to beetles (very often associated with drought stress and/or root disease) has been very high in Douglas-fir in many locations on the Flathead National Forest and in Flathead Valley.

Predicting bark beetle outbreaks is not an exact science. “Impact” models are useful in predicting beetle-caused mortality in stands of certain characteristics (Cole and McGregor 1983, Negron *et al.* 1999). Our best efforts are directed towards risk management – recognizing when “outbreak conditions” are present, considering potential effects on various resources should an outbreak be realized, and implementing strategies to prevent or lessen the effects of an outbreak if management objectives deem that a prudent course of action.

The greatest benefits in dealing with actual or potential Douglas-fir or spruce beetle infestations are derived from efforts aimed at preventing outbreaks rather than suppressing them (Schmitz and Gibson, 1996). This involves modifying live susceptible stands to the extent possible to make them less vulnerable prior to some type of stand disturbance, which may trigger an outbreak. Actions may include altering tree densities and species compositions. Once disturbances occur (common ones being blowdown, fire and drought), removal of bark beetle susceptible trees before they are infested is the most effective course of action to prevent an outbreak or influence beetle populations. Risk of large-scale bark beetle infestation can also be reduced by removing as many infested trees as feasible before the adult beetles emerge and spread to live trees in the vicinity (Gibson 2001, USDA 1995,1999d). Alternatives include use of pheromones to trap or repel beetles, burning/peeling infested logs to destroy brood, treating infested trees with chemicals, and using trap trees to attract beetles and then removing these trees. All these methods have utility and are applicable in under certain conditions and in specific situations. …

Spruce Beetle:

Shortly after the fire,stands within and outside the Wedge fire on National Forest System Lands were evaluated for risk of spruce beetle infestation, (project file). Criteria used were average diameter of spruce over 10” dbh, proportion of spruce in the canopy; basal area (density) of the stand, and physiographic location (i.e. creek bottoms vs. lower productivity sites). Post fire surveys within the fire area provided site specific information on condition of spruce and its risk to beetle infestation. Ratings were integrated with the fire severity and its effect on the susceptible spruce trees.

A GIS routine was used to estimate where and how much spruce beetle habitat is available in the assessment area and outside the fire area. About 2,554 acres are estimated to be a moderate to high hazard for spruce beetle mortality inside the fire perimeter. These are stands that have characteristics that could support spruce beetle outbreaks. These particular acres were directly affected by the fire and support a high proportion of dead or weakened spruce trees, where outbreak populations often develop. See Figure 16 for those stand locations.

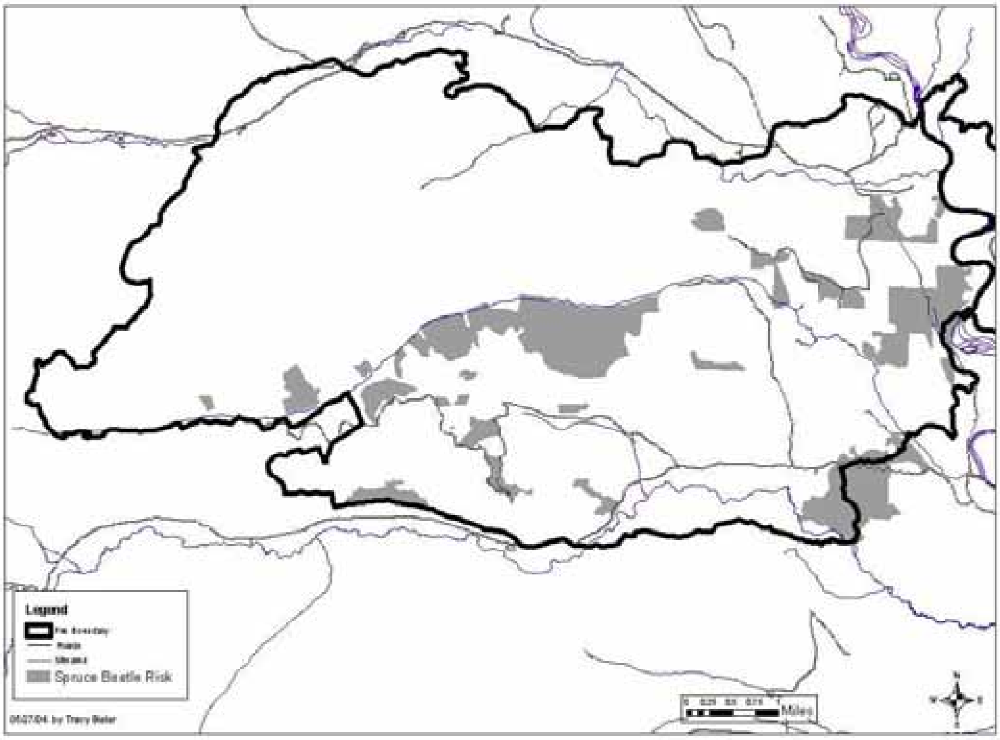

Figure 16. Spruce Beetle Hazard Stands Inside Fire Perimeter, on FS System Lands – Wedge Canyon Fire Area

Using information from a variety of sources (past field inventories, photo interpretation, satellite imagery, field knowledge), spruce beetle stand hazards were determined for the forest lands outside the burn perimeter, within a region five miles from the boundary (project file). This identifies stands with conditions that might support a beetle outbreak, and stands that could experience considerable mortality if an outbreak occurs.

In the area within five miles of the fire perimeter, on National Forest System lands, about 16,037 acres show characteristics leading to classifications as high or moderate spruce beetle hazard. While these stands are well distributed and are made up of varying patch sizes and arrangements, the area south of the fire is most susceptible. Reducing the overall susceptibility of the landscape surrounding the Wedge Fire was the occurrence of a major spruce beetle epidemic in northwest Montana and northern Idaho following a windstorm in 1949. Thousands of acres of blowdown resulted in drainages of the North Fork Flathead River. This precipitated a beetle epidemic that lasted through the 1950s. The blowdown, beetles, and subsequent salvage converted many of these stands to an early seral seedling and sapling forest. As a result, the vulnerability of the landscape to spruce beetle was reduced from the pre-1950 condition for a while. In the intervening years, stand hazards have again increased.

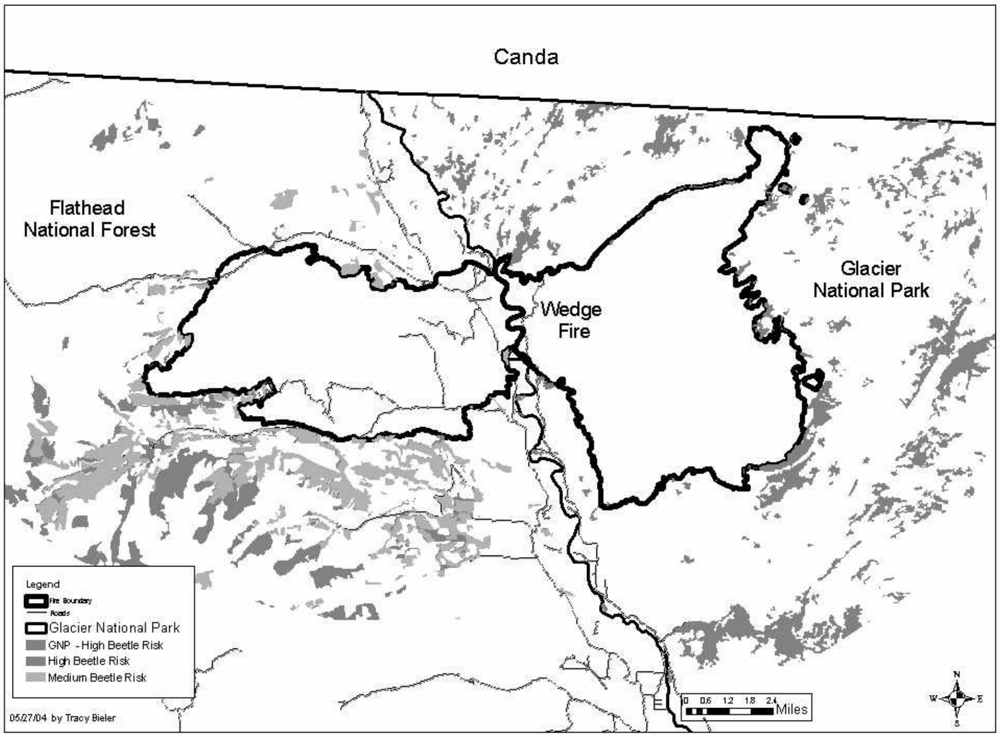

Figure 17. Spruce Beetle Hazard Stands in 5-Mile Radius of Fire – Wedge Canyon Fire Area

In the area within five miles of the fire perimeter on National Park System lands, about 11,323 acres are classed as moderate to high hazard stands to spruce beetle. These stands are well distributed, and are not concentrated in any particular direction that would stand out as an especially vulnerable location.

Low hazard stands are typically those where larger (>16" dbh) spruce may be present, but at low numbers. Individual trees may be infested and killed by spruce beetle, but the stand as a whole does not provide abundant beetle habitat.

Medium risk stands are typically well-stocked stands on productive sites, composed of spruce of large average diameter (>16"), but where spruce comprise less than 50 percent of the overstory stand stocking. Spruce beetle has the capability of causing high mortality to the larger diameter trees in these medium hazard stands, but net losses would be lower than the high hazard stands, because there are fewer of these susceptible trees present.

The high hazard stands generally are of similar character as medium hazard, but have higher proportions of spruce in the canopy, often over 65 percent of the stocking. Given high beetle populations, these stands would experience the greatest net losses and would be able to support and contribute substantially to high beetle population buildup.

Douglas-fir Bark Beetles:

All stands on National Forest System Lands within the fire area and within a 5-mile radius were evaluated for risk of Douglas-fir bark beetle infestation, (project file). Criteria used were size and age of the Douglas-fir trees, species composition in the stand, and the density of the trees. Within the fire, post-fire field surveys provided additional site-specific information on Douglas-fir beetle susceptibility. All information was integrated with the fire severity and its effect on the susceptible Douglas-fir trees.

A GIS routine was used to estimate where and how much Douglas-fir beetle habitat is available in the assessment area and outside the fire area. Over 1,000 acres within the fire are estimated to be at moderate to high risk to Douglas-fir beetle mortality(Figure 18). These stands support a high proportion of dead and weakened Douglas-fir trees, where outbreak populations of fire-killed or weakened Douglas-fir trees, where outbreak populations often develop. An additional 1000 acres are estimated to be at low/moderate risk.

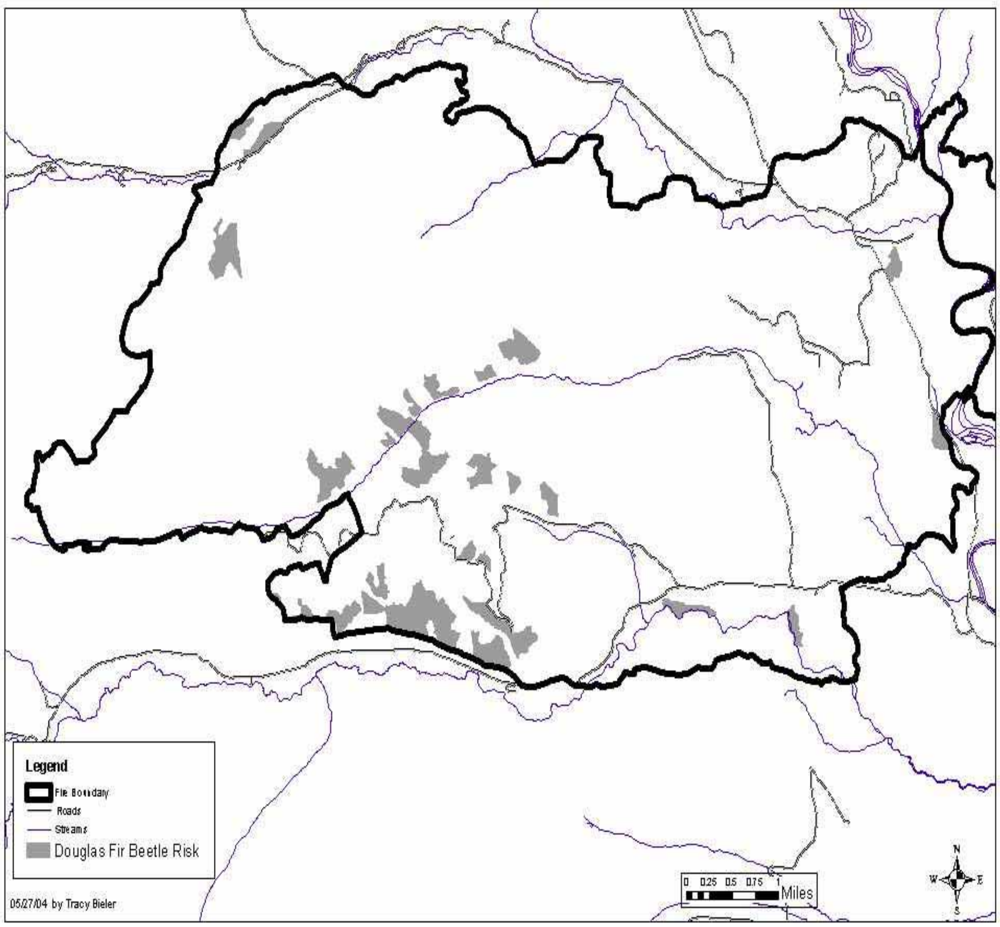

Figure 18. Douglas-fir Bark Beetle Hazard Stands Inside Fire Perimeter, on FS System Lands – Wedge Canyon Fire Area

Using information primarily from past field inventories, Douglas-fir bark beetle stand hazards were determined for the forest lands outside the burn perimeter, within a region five miles from the boundary (Figure 19) (project file). This identifies stands with conditions that might support a beetle outbreak, and stands that could experience considerable mortality if an outbreak occurs.

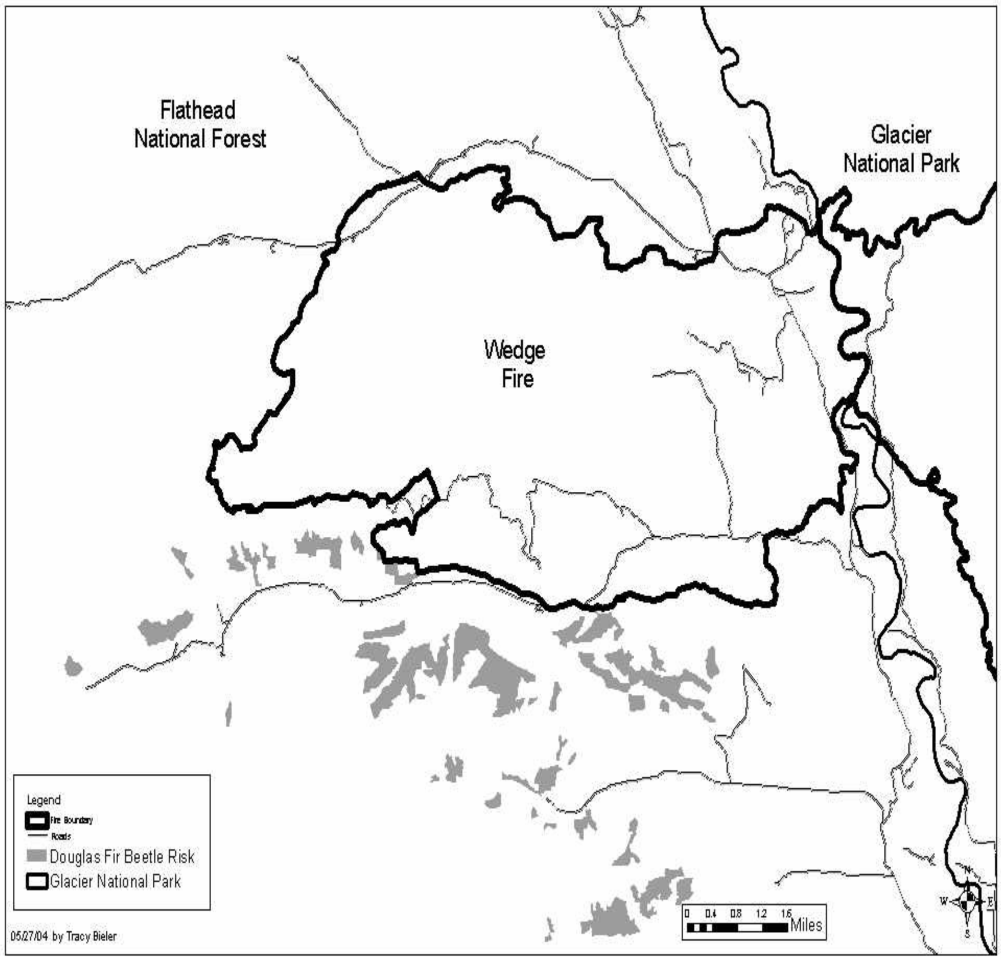

Figure 19. Douglas-fir bark beetle hazard stands in 5-mile radius of fire – Wedge Canyon Fire Area

In the area within five miles of the fire perimeter, on National Forest System lands only, about 2,600 acres show characteristics leading to classifications as moderate to high Douglas-fir bark beetle hazard. These stands have relatively high proportions and density of Douglas-fir above 14” DBH, and could support a beetle outbreak and experience mortality in the larger diameter Douglas-fir once an outbreak occurs. Another 2,400 acres are classified as low to low/moderate hazard, indicating less density and size of Douglas-fir and proportionately less able to support and generate high beetle populations. While all these stands are well distributed and are made up of varying patch sizes and arrangements, the area south of the fire appears to be most susceptible.

National Park System lands also contain some stands within and outside the fire area that are at risk to Douglas-fir beetle infestation. No site specific assessment was made as to exact acres at risk on these lands. Field reviews this summer on National Forest system lands will aid in confirming this assessment of Douglas-fir beetle hazards, and further information will be provided in the Final EIS, if it is deemed necessary.

3.2.4 Environmental Consequences

Introduction

The analysis of direct, indirect and cumulative effects on vegetation is limited to the vegetation analysis areas previously described. The effects described represent the result of analysis based on research, experience, and professional judgment.

The direct, indirect, and cumulative effects of the proposed action would result from the vegetation management activities described in Chapter 2. These activities consist of salvage harvest of fire-affected trees, tree planting inside and outside harvest units, along with prescribed natural regeneration, and spruce or Douglas-fir beetle management activities. There were no significant issues related to vegetation (refer to Chapter 2). The following effects indicators were used to focus the vegetation analysis and disclose relevant environmental effects.

- Timber resources, including acres, volume harvested, and acres capable of meeting Forest Plan management direction for timber production in the future.
- Species composition and structural stage distribution after salvage harvest, including old growth, remaining after harvest.
- Acres of artificial and prescribed natural reforestation in and outside units after treatments.
- Bark beetle habitat affected and beetle hazards in both fire areas.

ROBERT FIRE

Direct and indirect effects

Alternative 1 (No Action)

Timber Resources

There would be no salvage harvest with the No Action alternative. Deterioration of dead and dying timber would be significant within two or three years of the fire. Drying and splitting of the heartwood (checking) is a major cause of deterioration. Subjecting wood to rapid drying, which occurred in areas that burned at high intensities, causes checking. Checking will increase as a result of long periods of dry weather. Insect attack usually precedes fungal attack and provides the mechanism for introducing microorganisms that accelerate sapwood deterioration. Many variables influence deterioration, and volume and value lost vary by species (USDA 2000). By the second year, some of the sapwood will be decayed. After three years, the sapwood of most softwood species will have deteriorated beyond practical use. Fifty percent of the volume may be lost in Douglas-fir trees 11-20 inches dbh by year three (Lowell *et al.* 1992). About 20 million board feet of commercially valuable renewable resources would be forgone if not salvaged within two to three years.

Forest Structure, Composition, Old Growth

In this alternative, no vegetation management actions would be taken, but species and community biodiversity will return through succession, natural revegetation, and re-colonization processes. The early successional stage of vegetation over most of the area will consist of shrubs, perennial herbs, and grasses that sprout after fires, and conifer tree seedlings. Germination is expected from plants, including conifers, whose seeds survived the fire or disseminated from offsite sources. On north-facing slopes with limited conifer seed sources, shrubs may out-compete conifer seedlings if no artificial regeneration occurs, and may dominate those sites for a considerable period. On some south facing slopes, pinegrass establish quickly and may out-compete seedlings. High-severity fires in lodgepole pine stands result in new stands of pure lodgepole pine. The high biotic potential in seed stored in serotinous cones is important in the establishment of extensive areas of pure, dense, lodgepole pine (Lotan, Brown & Neuenschwander 1984; Volland 1984). Without the artificial reintroduction of other species (larch, white pine, whitebark pine) on these sites and without later stocking control, overstocked stands of lodgepole pine often result.

Establishing seral species of trees other than lodgepole pine is important to maintain ecosystem elements and to reduce the coverage of noxious weeds, and long-lasting shrub fields. This is not accomplished under the No Action alternative.

Stands that experienced a high-severity fire, or even a moderate-severity fire, now provide growing space for plant life. Western larch favors a germination substrate where fire has reduced both the duff layer and sprouting potential of competing vegetation (Shearer 1975). However, in the first four or five years, shrubs and herbs will dominate the site. Common species include fireweed, spirea, beargrass, and grass species. Eventually, the growing space is completely occupied by plants. In about 15 to 25 years after the disturbance, the more competitive plants and tree species exclude others from colonizing and take over the growing space of the less competitive species. As development progresses, in 80 to 100 years, overstory trees may dominate the site completely (stem exclusion). Shrubs and trees that invade the understory grow slowly in height for many years and form advanced regeneration (understory reinitiation).

The next successional stage may occur after about 150 years, provided it is not altered by another major disturbance. This stage (understory reinitiation or young forest multi-story), characterized by two or more layers of trees, but not dominated by large, old trees, may last many decades. Barring large partial or stand-replacement disturbances, the forest continues to grow until gradually some of the overstory trees begin to die. As they die, understory trees grow to become the overstory. The result may be a stand structure with many layers of foliage, a diversity of tree sizes but dominated by large older trees, and large snags and downed woody material. As tree diameters increase and senescence begins, the stand evolves into late seral or “old growth” structural conditions.

In light fire-severity stands, the fire directly killed some of the vegetation. Initially there is the appearance of greater tree survival, but due to the susceptibility of Engelmann spruce and subalpine fir to heat, subsequent mortality is impending (Miller 2000). In the next year, crown canopy will decline and continue at a reduced rate for the next four or five years. This is considered a partial disturbance. In this case, patches of growing space are available, and newly established species such as Douglas-fir, subalpine fir, spruce, and lesser amounts of shade-intolerant larch and lodgepole pine undergo similar changes to those described above for stands with complete disturbance. The invading individuals compete with other plants and trees that survived the fire. The species composition of conifers will be greatly influenced by site factors (Shearer 1986). The stands will progress in a manner similar to the more open grown stands.

Forest Structure

The No Action alternative will not change the amount of area in any of the structural classes in any fire severity class as previously described in the vegetation affected environment section. In terms of standing dead trees, the vertical structure in high intensity burn classes would change dramatically over the next 10 to 20 years. In stands near ridgetops with predominantly subalpine fir, spruce, and lodgepole pine, and where the average diameter is less than 10" dbh, blowdown can be expected in closer to ten years than twenty. In low intensity burn classes, delayed mortality will allow these areas to stand longer; however, in twenty years the majority of dead trees will have fallen. The systems used to classify forest structure typically ignore dead trees, and focus on the live standing tree components. For this reason alone, structure classifications will not change as a result of deadfall. The actual, physical structure (primarily vertical structure) will change over time as a result of natural deadfall following fire.

Composition.

The No Action Alternative will not affect the species composition expected to establish after the fires on these sites. The new forest will be dominated by lodgepole pine in many areas, because lodgepole pine is adapted to respond quickly after fires. Larch, a historically dominant species in this area, will return, but at a lower proportion than the historical coverages might have been. This is a result of lower seed source quantity from past timber harvest. The same is true for white pine, and whitebark pine. These species, in the absence of past harvest, introduced disease (blister rust) and bark beetles would normally have represented a higher coverage proportion following disturbance than is expected to result under the existing situation. While managers recognize the long-term benefits of an ecosystem that contains these historically represented species, that approach the historic proportions, the No Action alternative does not encourage establishment of species that were historically important in the area.

Old Growth

Inventoried old growth that remains after the fires (470 acres), would not be affected by the No Action alternative. No salvage would be done in any of the remaining functioning old growth stands. No tree planting would be conducted in these sites, or in sites adjacent to old growth stands. The stands, even though not burned severely, were affected by the fires and are likely to continue to change in many respects. Deadfall of fire-killed trees will continue as described previously, and windfall of some remaining unburned trees is likely as well. Understories were affected to some degree, and will go through a period of re-establishment. It is likely under the No Action Alternative that additional tree mortality will occur as a result of increased spruce beetle populations, which will further disturb these inventoried old growth stands. The No Action Alternative will not cause a reduction in wildlife snags, new snags or replacement snags. If the fire did not affect the function and structure of the inventoried old growth, then the No Action alternative will allow the continuation of that function as well.

Reforestation

No tree planting would be conducted in the burned area if this Alternative were selected. The opportunity to quickly re-establish forested conditions would not be acted upon. Some areas designated as suitable for timber production in the Forest Plan will take longer to regain their full productivity than it would if these sites were planted. Opportunities to establish whitebark pine and western white pine, as well as larch in areas and proportions that more closely resemble the proportions they occupied in the ecosystem prior to past disease, bark beetles, and harvesting, are forgone. While the fires created conditions suitable to establishment for these species, seed sources are sparse, and recovery is expected to be slow and cover smaller areas than would be expected in the proposed action.

The Robert Fire, in addition to past harvesting, left extensive areas without seed trees, and natural regeneration is expected to be slow to establish on many of the sites, particularly on the sites without lodgepole pine nearby. Regeneration is successful in areas where dead trees are left standing to provide shade (Shearer 1976). It is not a species or site requirement to remove dead standing trees in order to establish new conifer stands. Neither is forest regeneration retarded by the removal of some of the dead and dying trees. The period required for the area to return to a forested ecosystem will depend on many factors including site conditions and productivity, burn severity, future fires, weather, seed sources and seed dispersal success, but we know it will recover more slowly, and with reduced coverage of some species, than it would with active planting of appropriate species on appropriate sites.

About 800 acres inside and 498 acres outside of units are identified as important to contribute to meeting Forest Plan objectives for both timber production and ecosystem composition and would not be planted. In reforestation practices following fires, time is of the essence. For best seedling survival and initial growth, sites would be best planted within three or four years of the fire. Beyond that, sites become fully occupied by other pioneer species, planting success is diminished, and more expensive to undertake because of the delay.

Spruce Beetle

Bark beetle activity in forest stands and its resulting consequences are a normal and natural function of the ecosystem. Beetle outbreaks after disturbance events, such as fire, are not a certainty, but the possibility of increasing beetle populations is considerable. Consequences of beetle activity may conflict with management objectives for a variety of resources, potentially affecting wildlife habitat and old forests, riparian and stream stability, timber productivity, private property or other values.

On National Forest System lands within the Robert Fire boundary, about 1,962 acres of beetle- susceptible burned spruce stands have been identified as moderate or high risk for outbreaks. Few live spruce have been affected yet by spruce beetles: The beetles attack fire-killed, injured, or windthrown trees. It is reasonable to assume that spruce beetle populations will respond to increased habitat made available by the fires. If so, the beetles will complete their two-year life cycle in these trees, with a new generation of adults emerging in the early summer of 2006. There are patches and individual live, unburned spruce left within the fire area, which are vulnerable to beetle attack. Their scarcity makes them of particularly high value as an ecosystem component, especially considering their location in riparian areas. These would be the first trees the beetles attack upon emergence from the burned trees. Many remaining live spruce trees within the fire area that are greater than 14 inches DBH would likely be attacked and killed by emerging spruce beetles in 2006, and more trees would likely be attacked in 2007 and beyond as populations increase in response to favorable habitat conditions. Many beetles would also spread outside the fire area in search of breeding habitat.

Susceptible spruce stands within a few miles of the fire area will be vulnerable in 2006 and 2007 to bark beetle infestation by adult beetles moving from the fire-affected trees in the Robert Fire to areas outside the burn. The possibility exists that under conditions highly favorable to spruce beetle survival, populations could expand within the fire area and spread to forests outside the fire area. However, given relatively “normal” or wetter weather patterns, populations are likely to decline in future years, and a prolonged and widespread spruce beetle epidemic is not likely to occur.

Beetles emerging from infested stands within the fire area would find a suitable spruce beetle habitat outside the area (See Figure 19). Depending upon the rate of infestation across the 2,000 acres within the fire area, the potential exists for about 9,900 acres of spruce stands outside the fire area to be exposed to increasing beetle populations in 2006 and 2007 and later. The beetles will seek out the closest desirable breeding habitat, which (after infesting whatever live trees are left within the fire) are likely to be the high hazard stands closest to but outside the fire area. Given favorable conditions, a portion of the 9,900 acres of hazardous spruce in this 5-mile region is likely to be infested in 2006 and 2007, with some of the medium hazard stands infested as well, depending upon their proximity to the initial outbreak locations and the susceptibility of the spruce within these stands. Not all trees within these stands will be attacked the first few years. Additional trees area attacked as the populations increase. With increasing beetle pressure, increasing tree mortality occurs until either weather conditions become unfavorable and reduces populations to the point that outbreaks can no longer be sustained, or suitable host material is exhausted.

If weather and other variables continue to be favorable over the next several years, the acres affected could reach the total available, or 9,900 acres. Tree mortality over the course of an epidemic of this magnitude could exceed 80 percent of the larger diameter trees.

Based on the number of acres of susceptible spruce stands, their hazard rating, the expected level of infestation, and the spread/mortality assumptions described earlier, this section will identify some of the resource values that may be affected in a region five miles from the fire perimeter, defined as that area most immediately at risk in the next 2-4 years from an outbreak initiated in the Robert Fire area.

Many resource values outside the fire area could be negatively affected if spruce beetle epidemic conditions develop. There is a substantial acreage of the spruce-fir cover type on National Forest System Lands within five miles of the Robert Fire that is either old growth or has substantial old growth characteristics. Many stands would fall short of containing all elements of old growth in number of large overstory trees, amount and size of downed wood and snags, or diversity of canopy layers. However, it can be assumed that these stands are the ones likely to contain some of the values associated with old or late seral forests, particularly an older, larger overstory tree layer, and would be most likely to develop a full compliment of old growth characteristics sooner than other stands.

Loss of any remaining old forest or forest that could be managed in the future for old growth in the surrounding area due to beetle attack and mortality is probable, given a bark beetle epidemic.

Because of the greater tree sizes and thus generally higher beetle risk in the stands that are late seral/old forest, beetles are likely to be more attracted to these stands and mortality would be disproportionately higher than that of younger/smaller diameter stands. With continuing high beetle populations in successive years, a major impact on both amount and quality of spruce old forest/late seral habitat would likely occur.

Forests in close association with streams have particular value for wildlife, providing summer thermal cover, old forest habitat, and adding to the diversity of forest structural conditions across the landscape. The riparian forests are often highly valued as wildlife travel corridors, particularly in situations where past harvest has fragmented the forest cover to some degree and converted areas to early seral stages, as has occurred in much of the Robert Fire Area. A high amount of the old forest/late seral forest is typically located in riparian areas, containing the most productive growing sites and experiencing the longest fire-free intervals. Streamside forests influence fish habitat and stream conditions. The spruce/subalpine fir forest type dominates the riparian areas in most drainages of the North Fork Flathead River.

It follows that many of the spruce stands at risk to bark beetle surrounding the fire occur along streams and in riparian areas. Perennial streams are usually bordered by spruce stands at risk to beetle infestation, and intermittent streams flow through older spruce stands as well. Many of these riparian stands also provide late seral habitat conditions and structures. These stands are especially vulnerable. Some of these stands could experience up to 60 percent mortality of overstory spruce over a several year period.

In late seral/old forest stands, loss of many of the live, large diameter overstory trees in riparian areas would reduce the important old forest component, as described earlier. These trees will become large diameter snags and eventually downed wood, also highly valuable forest structural and wildlife habitat components. Forests in riparian areas are typically not considered suitable for timber management, so the economic value of trees killed from spruce beetle would not be a concern.

On National Forest System Lands, as much as half of the total 9,900 acres of spruce beetle susceptible stands within five miles of the fire occur on lands designated suitable for timber production by the Forest Plan. Management of these lands to produce timber, while protecting land productivity and other resource values, is a Forest Plan standard for these lands. Loss of significant numbers of trees on these lands would have a detrimental effect on timber productivity, both by the loss of these trees as potential commercial products and by the change in forest structure and species composition that may occur.

In the Robert Fire, over 22,000 acres of private and state lands lie within 5 miles of the Robert Fire. Though it is not know exactly how many acres of beetle susceptible spruce or Douglas-fir occur on these lands, it is a certainty that at least some amount does exist. It is likely that if conditions for beetles remain favorable, populations may build within the Robert or Wedge fire areas, and beetles will eventually spread onto these lands, causing varying levels of mortality in the larger diameter spruce and Douglas-fir. On State lands, managers are required by law to administer the lands to produce the largest measure of reasonable and legitimate return over the long run (Section 77-1-202, Montana Codes Annotated). Loss of larger diameter trees impacts the economic value of the lands. Also, other resource values that may be at risk given a beetle epidemic (such as old growth and stream stability) are important to state land managers. These values are important to many private land owners as well. In addition, the aesthetic value of individual trees may be of high importance to private land owners, with loss of even a few trees considered highly undesirable.

Alternative 2 (Proposed Action)

Timber resources

The Proposed Action would salvage burned and beetle infested timber from about 3,090 acres within the Robert Fire that is physically and economically feasible to salvage. These acres are "gross loggable acres" and do not include reductions for snag requirements (discussed later). Table 32 shows the acres proposed for harvest by logging system and Forest Plan Management Area. Approximately 20 million board feet (estimated net volume) of timber would be harvested. Acreages within the fire not considered for salvage were primarily areas previously harvested, on unsuitable ground, small diameter unmerchantable timber, or areas too far from a road to make helicopter yarding possible or economically feasible, riparian habitat conservation areas, and grizzly bear core habitat. Volumes and acreages given in this report are estimates based on available information. This is not final cruised volume, or traversed acres. Field verifications for logging systems and estimated volumes, as well as snag habitat quality and quantity will be conducted in the summer of 2004. Some variation in the final unit shape and size will result from field validations. It is not expected that acreages or volumes would increase from these estimates. Some units may be eliminated due to lack of adequate volume to warrant salvage. It is likely that some areas will also be reduced in size when final Riparian Habitat Conservation Areas (RHCA) are identified, and final snag density requirements are applied to each unit.

Table 32. Gross Acres by Forest Plan Management Area and Logging System (Salvage Areas Only)

Fire Area	Management Area	Helicopter	Cable	Tractor	Grand Total
Robert	MA12		0	12	12
	MA15	1,120	688	759	2,567
	MA18		0		0
	MA2A	123	0		123
	MA3	333	30	22	386
Robert Total		1,576	720	794	3,090

GIS processing and rounding result in some seemingly inaccurate totals and subtotals. This "error" is negligible Acres proposed for salvage in INFISH buffers are not included in MA12.

The proposed action was designed to salvage fire-killed timber while leaving snags and woody debris sufficient to maintain ecological processes that protect ecosystem function and provide habitat for wildlife, and excluded activities in all but a few RHCA acres.

Snag management guidelines for the project result in a reduction to the gross acres shown above. Application of the guidelines with retention of leave patches within the salvage units results in an overall reduction in proposed acres of about 692 or ~22 percent, for net acres harvested of about 2,398. Refer to Wildlife section for a description of the snag management guidelines.

The proposed action would salvage timber from 79 distinct harvest units. Units vary in size from one to 226 acres. This alternative would salvage only dead trees and trees most likely to die because of fire injury or beetle-infestation (refer to Post-Fire Mortality Guidelines in Appendix B). In units requiring a skyline yarding system, some live trees may have to be cut to access portions of the unit. Individual live trees may need to be designated for cutting to develop safe log landing areas, or for other safety considerations. The intent of the project is to avoid removal of any trees likely to survive the effects of the fire, but realistically, some green trees will be removed to accomplish the larger salvage objectives safely and efficiently. Timber salvage is appropriate in all of the proposed units within the project area. Table 32 (above) breaks out the acres planned by logging system. Harvest operations are expected to take two years. If harvest operations extend to the third year, significant loss of the value of timber products is expected due to deterioration. Deterioration will be greatest in spruce, subalpine fir, and lodgepole pine trees less than 15" dbh. Should harvest extend into the third year, an estimated 30 to 60 percent of the volume not yet harvested would be affected by cracking. This varies greatly by species (USDA 2000).

The National Forest Management Act requires that openings created in the forest by even-aged silviculture shall be less than 40 acres except in areas harvested as a result of natural catastrophic conditions such as fire, insect and disease or windstorm (36 CFR 219.27,d,iii). The Robert Fire satisfies the "catastrophic" condition. Salvage units in high fire severity areas would result in even-aged stands because the fire caused 100 percent mortality and all new trees would be one age. Units in low severity fire areas would result in two age classes because residual green trees would provide one age class and newly regenerated trees would be a distinctly younger age. Moderate severity fire areas would result in a mixture of both, because delayed mortality to trees is expected in many areas that presently display green crowns but have fatal root and/or bole scorch.

Post-salvage slash treatments are planned in units harvested with ground-based logging systems (tractor logging). This would consist of whole-tree yarding. Un-merchantable tops and limbs would be yarded to the log landings. Slash accumulates at log landings, and is a routine, normal part of the logging operation. Landing slash will be burned to reduce those concentrations.

Forest Structure, composition, old growth

Natural successional development (i.e., no planting after salvage) would occur on 11,900 acres (91%) of the approximately 13,123 acres of the Robert Fire. Even where seedlings are planted, growing space will still be available for herbs and grasses to become established. Long-term site productivity will not be adversely affected due to the abundance of coarse woody debris prescribed for all units. The removal of dead trees from salvage units would not inhibit natural successional development; however, summer logging of ground-based units might reduce the number of seedlings that establish from the residual on-site seed sources. There are 794 acres proposed for ground-based logging, and most acres of that would be planted with varying combinations of white pine, larch, Douglas-fir, or spruce. The balance of the acres proposed for natural regeneration in ground-based units are adjacent to seed walls, were serotinous lodgepole pine stands at that time of the fire, or would have islands of residual live trees left to provide a seed source for regeneration. Some of the ground-based units would be harvested in winter, causing much less damage to new seedlings. Much less damage to new seedlings would also be expected with helicopter and cable yarding methods.

Table 33 displays the acreages of structure classes affected by the proposal across the landscape. It is important to note that the fire was the disturbance that initiated a new pioneer or early seral stage of succession. Most stands that had been functioning as late seral received enough mortality that they are now in early succession (grass-forb), or seedling, stage. The proposed action affects succession to the extent that planting conifers in harvested and in unharvested areas hastens the forest regeneration process. Planting seedlings does not inhibit or prevent natural regeneration. Salvage treatments do not change the successional stage, because only dead and dying trees are proposed for harvest (as has been addressed in Appendix B Post-fire mortality guidelines, it is acknowledged that there may be some trees that are removed that would otherwise live, and some trees that are left that may die).

The potential for blowdown of remaining green trees in harvest units is greater because the areas are more open and less trees and canopy are left for wind protection. The edge created by harvest will contribute to blowdown, but will be mitigated somewhat by residual standing snags and unmerchantable trees. Potential for blowdown is a function of species, diameter, landtypes/soils, elevation, soil moisture, wind patterns and crown density. Deep-rooted species are western larch and Douglas-fir. Shallow –rooted species include spruce, subalpine fir and lodgepole pine. Dense stands of trees that have developed together mutually protect and support each other and do not have roots and boles to withstand exposure to wind if opened drastically. Residual live trees may develop windfirmness over time. Predicting when residual trees would blow down with or without harvest is difficult, but residual trees in harvest units can be expected to come down sooner than those in unmanaged stands because of increased exposure to wind. As stated earlier, research (Harrington 1996,Lyon 1977) has shown that most fire-killed trees are on the ground within ten to twenty years regardless of adjacency to salvaged trees, so blowdown patterns are not greatly influenced over the long term. The fire itself created conditions conducive to blowdown of live trees. The additional effect caused by the removal of dead trees from harvest units is judged to be a minor one.

In stands with low to moderate fire severity, the distribution of mortality is highly variable. Consequently, harvest of dead trees would leave stands with irregular forest structures. Gaps or patches of openings would be interspersed with live green trees from sapling, pole, and mature size classes. A mixture of live green trees of all sizes, small-diameter dead trees, and large-diameter snags would represent the residual structure. Residual canopy cover would be greater than in stands with high fire severity.

Some green trees may be damaged (bark skinning) during harvest operations. Skid trails and skyline corridors would be located to minimize damage to green trees. Residual cone-bearing trees will provide a seed source for natural regeneration in these less intensely burned stands. Areas that experienced ground fire may provide site preparation and the germination substrate for natural regeneration.

The potential for blowdown within harvest units in less intensely burned stands is relatively less than in the more intensely burned stands. Stands will be opened up through the removal of dead trees, but green trees are more root-firm and likely to stand. This is not to say blowdown would not happen. As mentioned earlier, elevation, wind patterns, landtypes, and species contribute to the potential for windfall. In addition, open stands with mature trees with full crowns intercept wind better than burned crowns. In time, green trees would develop windfirmness, improving their ability to stand. Delayed mortality can be anticipated after harvest activities due to cumulative stress caused by the fire and climatic conditions. The trees affected by delayed mortality would contribute to future blowdown and long-term coarse woody debris recruitment.

Direct and indirect effects of the proposed action on vegetation diversity and ecological processes will be evaluated through quantifying the amount of various communities and their characteristics (structure and fire severity classes) across the landscape. The analysis will focus on the condition of the forest communities, burned or unburned, that would result from the proposed activities and the effect they will have on future forests. It is important to remember that remnants of the pre-fire condition are present in the vertical arrangement of the burned vegetation (structure).

The importance or relevance of examining structure, especially with regard to burned forest, lies in the precept that ecosystem function is a consequence of structure. If the burned landscape is to function to the extent that burned landscapes have in the past, then a substantial representation of the burn should remain undisturbed. The degree to which the proposed action provides a fully functioning ecosystem is a measure of how well overall ecological integrity might be maintained. The amount of structural class disturbed by the fire and left untreated are the legacy acres.

Although this post-fire harvest affects snag structure, it does not affect the successional structural class. The vegetative structure (size) classes assigned are based on living trees, and the salvage is intended to remove only a portion of the dead and dying trees within the burned area. Amounts of structural class affected by alternative are shown in the tables following. Varying amounts and distributions of structure are left as legacies across the landscape. Smaller diameter trees and unmerchantable trees, and snag retention requirements will leave ten to 25 percent of the unit undisturbed inside otherwise harvestable areas. (project file).

Table 33. Forest Structural Stages (Acres) in Robert Fire Area, and Those Included in Salvage Harvest Units.

Structure Stage	Robert Fire Area Acres	Acres included in Salvage Harvest Units	Percent of post-fire Structure treated by Salvage Harvest
Grass-forb	8,000	2,391	30
Harvested, Non-stocked	118	18	15
Immature, sawtimber, all species	120	91	76
Immature pole, non-lodgepole pine	9	0	0
Mature, sawtimber, all species	1,638	685	42
Overmature/Older forest	68	67	100
Poles- lodgepole pine	232	2	4
Poles- mixed	1,663	76	5
Sapling	1,287	36	3
Seedling	137	22	16
Shrub-hardwood	0	0	0

This table includes only national forest acres in the fire perimeter.

Old Growth

Prior to the fire, several old growth inventories had been conducted, using various methods. If any method identified a stand as old growth, it was included in this analysis. Definition of old growth was based on Western Montana Zone Definitions for Old Growth (Green *et al.* 1992) and includes considerations based on tree age, sizes, stand structure, downed logs, etc. The combined result of the inventories shows that 1,642 acres were inventoried as old growth prior to the fire. The structure (ladder fuel, fuel loads, high stem and crown densities, etc) and composition (species often susceptible to fire damage) of these stands, combined with burning conditions during the fire (temperatures, dry fuels, wind, low humidity) combined to create a fire that changed most of these old growth stands to earlier successional stages. Fire changed the characteristics of the stands such that if the were inventoried now, they would not exhibit old growth characteristics sufficient to qualify as old growth, as per established definitions. Many of the sites that carried old growth stands will now host grass, forb, shrub and seedling stages (stand initiation) of succession. In estimating the amount of old growth remaining after the fires, it was assumed that old growth stands that burned at high severity are no longer old growth. Stands that burned at low severity continue to contain elements of structure and function attributable to old growth forests. Because the range of conditions found in stands burned at moderate severity is wide, it was assumed that about half of the old growth stands burned at moderate severity retained some old growth characteristics and half were assumed to have changed to early successional stages, and would not contain old growth characteristics. Table 34 displays inventoried old growth, burn severities, and the amount of old growth that remains.

Table 34. Old Growth Acres by Burn Severity, Pre- and Post-fire

Old growth Acres Pre-fire	Burn Severity	Post-Fire Old Growth
898	High	0
198	Low	198
547	Moderate	273
Total: 1,643		**471**

It is clear that the fires had a considerable impact on the amount of old growth in the burned area. Old growth, like all forest conditions, in ephemeral. All forest stands develop through developmental stages. At some point (or several points) along the developmental sequence, ecological disturbances re-direct stand development. In this area, the fire converted about 70 percent of the inventoried old growth to younger successional stages, leaving about 471 acres to continue to function as old growth. The Proposed Action includes harvest units in areas that had been old growth. Table 35 displays (pre-fire) inventoried old growth area acres, burn severity, and acres proposed for salvage harvest in those areas.

Table 35. Pre-fire Old Growth, Fire Severity, and Estimated Post-fire Old Growth (acres) Inside Salvage Units

Old growth Acres Pre-fire that are inside proposed harvest units	Burn Severity	Post-Fire Old Growth Estimate
455	High	0
0	Low	0
290	Moderate	145
Total: 744		**145**

From Table 35 we see that the low severity burned old growth, which most likely continues to function as old growth, is not affected by the proposed action. Old growth burned at high severity is no longer old growth, and therefore there would be no effect if salvage logged.

The moderately burned old growth planned for salvage (gross acres 290) assumes that about half no longer has old growth characteristics. In the remaining half (145 acres), several considerations lead to a conclusion that old growth will not be seriously affected by the proposed action.

Considering the project area as a whole, the fire reduced old growth by 70 percent. Moderate severity fire burned 547 acres of inventoried old growth, changing some to early successional stages, and some retained some old growth characteristics. Of those, the proposed action salvages from 290 acres. Of those, it is estimated that half (145 acres) no longer act as old growth, and half (145 acres) may continue to contain old growth characteristics. In those 145 acres, the proposed action only removes dead or dying trees and leaves snag habitat according to the snag guidelines. The guidelines assign the highest emphasis to pre-fire old growth stands, recognizing that those areas are important, and require leaving more dead trees here than under any other condition. Those requirements, along with design features that leave all live trees assure the retention of many of the old growth characteristics in these areas, if they exist at all. Even if mapping is inaccurate, other project requirements (snags, leave trees, coarse woody debris retention, etc) will result in the retention of most old growth elements that currently exist. Ground truthing this summer will determine whether portions of these moderately burned areas are still live, functioning old growth stands, and if they are, they will not be included in the final salvage proposal.

Fire Severity

Another component of the situation that provides a measure of the effects of the proposed action is the number of untreated acres in each fire severity class, where no disturbance would occur from salvage activities. Table 36 discloses the number of acres in each burn severity class where harvesting is proposed (project file) and the percent of national forest system land left unharvested. At least 76 percent of the fire area would be left as legacy (Perry and Amaranthus 1997).

Table 36. Percent of Burned Acres Not Harvested

Legacy Area (Acres)			
Fire Severity	Burned Acres	Salvage Harvest Acres	% of Area Not Harvested
High	6,457	2,122	67
Moderate	2,932	804	73
Low	3,514	164	95
Unburned	220*	0	100
Total	13,123	3,090	76

*** includes 206 acres that were not classified during the vegetation burn severity identification process.**

Harvest System

As shown in Table 37, the majority of acres proposed for harvest in all alternatives would be salvaged using a helicopter system. Hand falling and helicopter yarding has the least soil impacts, but is by far the most expensive method. No heavy equipment would be on the ground, nor would trees be dragged across the soil in helicopter units. However, more dead trees may be felled for safety than would be felled in conjunction with other logging systems.

Table 37. Harvest System (acres) by Burn Severity

Burn Severity	Helicopter	Cable	Tractor
High	1,086	459	577
Low	89	33	42
Moderate	401	228	175
Total	1,576	720	794

Reforestation

Where seed sources are available, germination of lodgepole pine, larch, and Douglas-fir have a high potential for success if adequate cone crops exist due to the ash seedbed created by the fire (Schmidt *et al.* 1976, Miller 2000). Regeneration surveys will monitor this process. If natural regeneration is inadequate to meet stocking guidelines, planting would augment seedling stocking in identified areas. Conifer seedlings are planned to be planted on approximately 800 acres inside harvest units, and 496 acres outside of harvest units. Natural regeneration is prescribed on 2,290acres of treated units. Regeneration surveys subsequent to salvage would be performed to determine the success of natural regeneration as well as the planting. A variety of conifer species would be planted to add to the diversity of the early successional vegetative community. Refer to Table 38 for a summary of anticipated artificial reforestation. Planting introduces diversity in what otherwise might develop into an overstocked monoculture of lodgepole pine. Future managers may then have options and a useable resource for wood fiber if they choose, as expressed in the National Forest Management Act (NFMA).

Regeneration success on the nearby Little Wolf Fire of 1994 has been very high. All harvest units (1,175 acres) included in the fire salvage in Little Wolf have been certified as fully stocked (Moose fire project record). Early surveys of areas planted in 2002 and 2003 in the Moose Fire indicate good survival in many areas, despite drought conditions.

Prompt reforestation would minimize the time that burned stands are unstocked and unproductive from a timber management standpoint. Skidding from the logging operations in both ground-based and cable systems provides at least some of the necessary site preparation for reforestation. Regeneration activities are predicted to provide fully stocked stands within five years. Regeneration indices for past harvest and planting in the area watersheds show a high rate of success. Species diversity would be improved through reforestation. Natural regeneration would be monitored and augmented with planting in the event of poor cone crops. The following table displays the number of acres of planting and natural regeneration proposed.

Table 38. Tree Planting Acres and Species or Species Mixes

Species, or Species Mix	Acre planting inside harvest units	Acres planting outside harvest units
Douglas-fir	200	
Larch	300	98
Larch and Engelmann spruce	100	118
Larch, spruce and shrubs	100	0
Whitebark pine	50	48
Western white pine, spruce, larch and shrubs	50	232

Seedlings planted on national forest system lands usually (the exception is rust-resistant white pine) come from seed sources native to the site, and are native species found on the habitat types being planted (Beschta *et al.* 1994). This would be the case on this project as well.

Road reclamation for grizzly bear security (Forest Plan requirements) would require planters and thinners to walk long distances to access some units, increasing unit costs.

Spruce Beetle

Timing of salvage and other treatments

Monitoring for spruce beetle population increases and their locations are planned for the summer and fall of 2004. The results of monitoring will assist in refining activities, locations, and methods of treatments directed at reducing the mortality that can result from spruce beetles. Even though some areas appear likely for treatments, some refinement of those plans will be needed when we have learned more about where beetles are increasing.

Timing of beetle treatments is an important factor in the development and implementation of an effective bark beetle management plan. When using pheromone baited beetle funnel traps, placing them in selected locations in a timely manner normally does not pose a problem. Use of trap trees or baited trees also requires timely felling or baiting of the trees in late fall or early spring, before beetle flight. These trees must be removed or otherwise treated before the new generation of beetles emerges.

Timeliness of salvage efforts sometimes combined with removal of trap or baited trees, can be more difficult to achieve, because of the intensive and complex planning, preparation and implementation that is required. The window of opportunity for salvage of trees infested with spruce beetle is manageable, however, since spruce beetles in this area normally remain within the same tree for the duration of their two-year life cycle. It should be possible to complete proposed salvage efforts in the acres infested with spruce beetle within two years (by the spring of 2007), before the majority of adult beetles emerge.

Treatment methods

Spruce beetle management using salvage, pheromone-baited beetle funnel traps, and trap trees are the methods employed to address concerns with the spruce beetle population buildup. The proposed action includes about 7 sites for combinations of funnel traps and trap trees, applying traps in and near about 483 acres of beetle susceptible spruce stands. Best estimates at this time would involve the placement of about 50-80 clusters of funnel traps (3 traps per cluster) in selected locations.. In areas outside riparian zones, trap trees can be used if they are located inside or adjacent to harvest units. Standard timber sale contract provisions make this method very effective at removing infested trap trees. These acres will be confirmed by the spruce beetle monitoring scheduled for summer and fall of 2004, and continuing into 2005 and 2006.

Spruce beetles, as with many insects, rely on chemicals known as pheromones to communicate with one another. The funnel traps contain an “aggregate” pheromone, the attractant chemicals naturally released by unmated female bark beetles after locating a suitable breeding site. It attracts both males and females to a tree, and in the natural system has the function of stimulating mass attacks, which allow beetles to concentrate on a scattered resource or overcome the natural defenses of a live tree. The intent of the trapping is to draw in and capture as many of the adult beetles as possible emerging from the burned trees in 2005 and 2006 and beyond, if necessary, before they have a chance to spread, attack and kill live spruce trees in areas in and around the site of infestation (Gibson 2002a, project file). With selective placement of adequate numbers of traps, the majority of the emerging beetles on a particular infested site can be captured, which could well be many hundreds of thousands of beetles. This will aid in preventing these beetles from spreading out further from the area of infestation. Funnel traps have been used to successfully “trap out” small, isolated populations of beetles in the past (Gibson 2002a, project file).

Trap trees may be deployed under specific circumstances. This involves felling one to several live spruce, thereby creating ideal beetle habitat that attracts beetles as well or better than baited funnel traps. When the trap trees are attacked and fully occupied, they can be removed (if properly located), or the beetles can be destroyed before adults emerge, by burning or de-barking. A disadvantage with this method over funnel trapping is that otherwise healthy trees are sacrificed to lure beetles. In some situations this may be an acceptable alternative to loosing larger numbers of trees that the beetles themselves select, rather than managers.

The proposed action will result in salvage harvest within 1,090 acres of moderate and high beetle susceptibility areas, which is about 55% of the total susceptible area. Infested trees, even though they may appear green, are designated for removal as they are assumed to be dying. (see mortality guidelines in the appendix). This will reduce the available spruce beetle habitat by about 1,090 acres. Beetle infested trees would be salvaged from all these areas before adult beetles emerge in the spring of 2005 or 2006.

This integrated approach to spruce beetle management within the fire area should prove effective at lowering potential beetle populations to the degree that it removes spruce beetles and spruce beetle habitat from the fire area. It treats a relatively high proportion of the susceptible spruce, which would help considerably in the effort to successfully contain a spruce beetle population buildup within the area, and maintain the currently low beetle population levels in the region outside the fire area. About half of the susceptible habitat would still remain, though some would be treated with pheremone baited traps or trap trees. Under highly favorable conditions, the potential for a spruce beetle population buildup in the fire area still exists. Beetle populations are influenced by many variables (temperature, moisture, snow depths, predatory insects and birds, and suitable habitat), any of which may either cause an increase or decrease in population level. We are only able to influence the habitat available, and to a lesser degree have a direct influence on population levels through trapping of beetles. There would likely be some amount of mortality in remaining live spruce within the fire area, because the salvage, trap trees and beetle traps, are not expected to capture all emerging beetles. Some undetected areas of infested spruce within the fire will remain. Monitoring for spruce beetle population increases cannot realistically discover all infestations. If population levels increase in the fire area, varying levels of mortality of larger spruce in areas outside the fire area is likely to occur over the next few years. Because substantial reduction to beetle population levels is expected with implementation of the proposed action, effects to resource values and private/state land holdings as discussed under Alternative 1 should be considerably lessened. This proposal takes reasonable actions to stem outbreaks of spruce beetle. It cannot assure success, but it takes reasonable steps to reduce the available habitat, and to capture emerging adult beetles before they can attack live, healthy spruce trees.

Wedge Fire

Direct and indirect effects

Alternative 1 (No Action)

Timber Resources

There would be no salvage harvest with the No Action alternative. Deterioration of dead and dying timber would be significant within two or three years of the fire. Drying and splitting of the heartwood (checking) is a major cause of deterioration. Subjecting wood to rapid drying, which occurred in areas that burn at high intensities, causes checking. Checking will increase as a result of long periods of dry weather. Insect attack usually precedes fungal attack and provides the mechanism for introducing microorganisms that accelerate sapwood deterioration. Many variables influence deterioration, and volume and value lost vary by species (USDA 2000). By the second year, some of the sapwood will be decayed. After three years, the sapwood of most softwood species will have deteriorated beyond practical use. Fifty percent of the volume may be lost in Douglas-fir trees 11-20 inches dbh by year three (Lowell *et al.* 1992).

About 22 million board feet of commercially valuable renewable resources would be forgone. This resource is perishable. If not salvaged within two to threes years, the option will be permanently lost.

Forest Structure, Composition, Old Growth

In this alternative, no vegetation management actions would be taken, but species and community biodiversity will return through succession, natural revegetation, and re-colonization processes. The early successional stage of vegetation over most of the area will consist of shrubs, perennial herbs, and grasses that sprout after fires, and conifer tree seedlings. Germination is expected from plants, including conifers, whose seeds survived the fire or disseminated from offsite sources. On north-facing slopes with limited conifer seed sources, shrubs may out-compete conifer seedlings if no artificial regeneration occurs, and may dominate those sites for a considerable period. On some south facing slopes, pinegrass establish quickly and may out-compete seedlings. High-severity fires in lodgepole pine stands result in new stands of pure lodgepole pine. The high biotic potential in seed stored in serotinous cones is important in the establishment of extensive areas of pure, dense, lodgepole pine (Lotan, Brown & Neuenschwander 1984; Volland 1984). Without the artificial reintroduction of other species (larch, white pine, whitebark pine) on these sites and without later stocking control, overstocked stagnated stands of lodgepole pine often result.

Establishing seral species of trees other than lodgepole pine is important to maintain ecosystem elements and to reduce the coverage of noxious weeds, and long-lasting shrub fields. This is not accomplished under the No Action alternative.

Stands that experienced a high-severity fire, or even a moderate-severity fire, now provide growing space for plant life. Western larch favors a germination substrate where fire has reduced both the duff layer and sprouting potential of competing vegetation (Shearer 1975). However, in the first four or five years, shrubs and herbs will dominate the site. Common species include fireweed, spirea, beargrass, and grass species. Eventually, the growing space is completely occupied by plants. In about 15 to 25 years after the disturbance, the more competitive plants and tree species exclude others from colonizing and take over the growing space of the less competitive species. As development progresses, in 80 to 100 years, overstory trees may dominate the site completely (stem exclusion). Shrubs and trees that invade the understory grow slowly in height for many years and form advanced regeneration (understory reinitiation).

The next successional stage may occur after about 150 years, provided it is not altered by another major disturbance. This stage (understory reinitiation or young forest multi-story), characterized by two or more layers of trees, but not dominated by large, old trees, may last many decades. Barring large partial or stand-replacement disturbances, the forest continues to grow until gradually some of the overstory trees begin to die. As they die, understory trees grow to become the overstory. The result may be a stand structure with many layers of foliage, a diversity of tree sizes but dominated by large older trees, and large snags and downed woody material. As tree diameters increase and senescence begins, the stand evolves into late seral or “old growth” structural conditions.

In light fire-severity stands, the fire directly killed some of the vegetation. Initially there is the appearance of greater tree survival, but due to the susceptibility of Engelmann spruce and subalpine fir to heat, subsequent mortality is impending (Miller 2000). In the next year, crown canopy will decline and continue at a reduced rate for the next four or five years. This is considered a partial disturbance. In this case, patches of growing space are available, and newly established species such as Douglas-fir, subalpine fir, spruce, and lesser amounts of shade-intolerant larch and lodgepole pine undergo similar changes to those described above for stands with complete disturbance. The invading individuals compete with other plants and trees that survived the fire. The species composition of conifers will be greatly influenced by site factors (Shearer 1986). The stands will progress in a manner similar to the more open grown stands.

Forest Structure

The No Action alternative will not change the amount of area in any of the structural classes in any fire severity class as previously described in the vegetation affected environment section. In terms of standing dead trees, the vertical structure in high intensity burn classes would change dramatically over the next 10 to 20 years. In stands near ridgetops with predominantly subalpine fir, spruce, and lodgepole pine, and where the average diameter is less than 10" dbh, blowdown can be expected in closer to ten years than twenty. In low intensity burn classes, delayed mortality will allow these areas to stand longer; however, in twenty years the majority of dead trees will have fallen. The systems used to classify forest structure typically ignore dead trees, and focus on the live standing tree components. For this reason alone, structure classifications will not change as a result of deadfall. The actual, physical structure (primarily vertical structure) will change over time as a result of natural deadfall following fire.

Composition.

The No Action Alternative will not affect the species composition expected to establish after the fires on these sites. The new forest will be dominated by lodgepole pine in most areas, because lodgepole pine is adapted to respond quickly after fires. Larch, a historically dominant species in this area, will return, but at a lower proportion than the historical coverages might have been. This is a result of lower seed source quantity from past timber harvest. The same is true for white pine, and whitebark pine. These species, in the absence of past harvest, introduced disease (blister rust) and bark beetles would normally have represented a higher coverage proportion following disturbance than is expected to result under the existing situation. While managers recognize the long-term benefits of an ecosystem that contains these historically represented species, that approach the historic proportions, the No Action alternative does not encourage establishment of species that were historically important in the area.

Old Growth

Inventoried old growth that remains after the fires (317 acres) would not be affected by the No Action alternative. No salvage would be done in any of the remaining functioning old growth stands. No tree planting would be conducted in these sites, or in sites adjacent to old growth stands. The stands, even though not burned severely, were affected by the fires and are likely to continue to change in many respects. Deadfall of fire-killed trees will continue as described previously, and windfall of some remaining unburned trees is likely as well. Understories were affected to some degree, and will go through a period of re-establishment. It is likely under the No Action Alternative that additional tree mortality will occur as a result of increased spruce beetle populations, which will further disturb these inventoried old growth stands. The No Action Alternative will not cause a reduction in wildlife snags, new snags or replacement snags. If the fire did not affect the function and structure of the inventoried old growth, then the No Action will allow the continuation of that function as well.

Reforestation

No tree planting would be conducted in the burned area if this Alternative were selected. The opportunity to quickly re-establish forested conditions would not be acted upon. Areas designated as suitable for timber production in the Forest Plan will take longer to regain their full productivity than it would if these sites were planted. Opportunities to establish whitebark pine and western white pine, as well as larch in areas and proportions that more closely resemble the proportions they occupied in the ecosystem prior to past disease, bark beetles, and harvesting, are forgone. While the fires created conditions suitable to establishment for these species, seed sources are sparse, and recovery is expected to be slow and cover smaller areas than would be expected in the proposed action.

The Wedge Canyon Fire, in addition to past harvesting, left extensive areas without seed trees, and natural regeneration is expected to be slow to establish on many of the sites, particularly on the sites without lodgepole pine nearby. Regeneration is successful in areas where dead trees are left standing to provide shade (Shearer 1976). It is not a species or site requirement to remove dead standing trees in order to establish new conifer stands. Neither is forest regeneration retarded by the removal of some of the dead and dying trees. The period required for the area to return to a forested ecosystem will depend on many factors including site conditions and productivity, burn severity, future fires, weather, seed sources and seed dispersal success, but we know it will recover more slowly, and with reduced coverage of some species, than it would with active planting of appropriate species on appropriate sites.

About 555 acres inside units and 1,657 acres outside of units identified as important to contribute to meeting Forest Plan objectives for both timber production and ecosystem composition would not be planted. In reforestation practices following fires, time is of the essence. For best seedling survival and initial growth, sites would be best planted within three or four years of the fire. Beyond that, sites become fully occupied by other pioneer species, planting success is diminished, and more expensive to undertake because of the delay.

Spruce Beetle and Douglas-fir bark beetles

Spruce beetle:

On national forest system lands within the Wedge Canyon Fire boundary, about 2,554 acres of beetle-susceptible burned spruce stands have been identified as moderate or high risk for outbreaks. Few live spruce have been affected yet by spruce beetles: The beetles attack fire-killed, injured, or windthrown trees. It is reasonable to assume that spruce beetle populations will respond to increased habitat made available by the fires. If so, the beetles will complete their two-year life cycle in these trees, with a new generation of adults emerging in the early summer of 2006. There are patches and individual live, unburned spruce left within the fire area, which are vulnerable to beetle attack. Their scarcity makes them of particularly high value as an ecosystem component, especially considering their location in riparian areas. These would be the first trees the beetles attack upon emergence from the burned trees. Many remaining live spruce trees within the fire area that are greater than 14 inches dbh would likely be attacked and killed by emerging spruce beetles in 2006, and more trees would likely be attacked in 2007 and beyond as populations increase in response to favorable habitat conditions. Many beetles would also spread outside the fire area in search of breeding habitat.

Susceptible spruce stands within a few miles of the fire area will be vulnerable to bark beetle infestation by adult beetles in 2006 and 2007 moving from the fire-affected trees in the Wedge Fire to areas outside the burn. The possibility exists that under conditions highly favorable to spruce beetle survival; populations could expand considerably within the fire area and spread to forests outside the fire area. However, given relatively “normal” or wetter weather patterns, populations are likely to decline in future years, and a prolonged and widespread spruce beetle epidemic is not likely to occur.

Beetles emerging from infested stands within the fire area would find a suitable spruce beetle habitat outside the area (refer to Figure 17). Depending upon the rate of infestation across the 2,500 acres within the fire area, the potential exists for about 16,000 acres of spruce

stands outside the fire area to be exposed to increasing beetle populations in 2006 and 2007 and later. The beetles will seek out the closest desirable breeding habitat, which (after infesting whatever live trees are left within the fire) are likely to be the high hazard stands closest to but outside the fire area. Given favorable conditions, a portion of the 16,000 acres of hazardous spruce in this 5-mile region is likely to be infested in 2006 and 2007, with some of the medium hazard stands infested as well, depending upon their proximity to the initial outbreak locations and the susceptibility of the spruce within these stands. Not all trees within these stands will be attacked the first few years. Additional trees are attacked as the populations increase. With increasing beetle pressure, increasing tree mortality occurs until either weather conditions become unfavorable and reduces populations to the point that outbreaks can no longer be sustained, or suitable host material is exhausted.

If weather and other variables continue to be favorable over the next several years, the acres affected could reach the total available, or 16,000 acres. Tree mortality over the course of an epidemic of this magnitude could exceed 80 percent of the larger diameter trees.

Douglas-fir bark beetle:

Douglas-fir bark beetles are currently in epidemic conditions in Northwest Montana, and populations of the beetle are likely to capitalize on the increased amount of breeding and feeding habitat created by the fire and expand within the fire area over the next few years. With the continuation of favorable conditions (such as drought and increasing tree stress levels) it is likely that beetle populations will then spread outside the fire area into nearby beetle susceptible stands. Depending upon how long population levels remain high, substantial mortality of the larger diameter Douglas-fir is likely to occur within these areas.

On National Forest System lands within the Wedge Fire boundary, about 1000 acres have been identified as moderate to high risk to Douglas-fir beetle infestation. Some Douglas-fir have already been observed to be infested with beetles, but the majority of beetle attacks within the fire-killed and weakened trees will occur in the spring and summer of 2004. With the current epidemic and high population levels of Douglas-fir beetles, it is very likely that beetles will respond in great abundance to the increased amount of ideal feeding and breeding habitat within the fire.

The beetles will complete their one-year life cycle in the trees and emerge in the spring/summer of 2005. They will then most likely attack and infest remaining live Douglas-fir trees within the fire area, with the fire injured trees being most vulnerable. Some spread may also occur into stands outside the fire area, with the closest stands being the most vulnerable. Trees in the larger diameter classes are generally favored by beetles (over 14 or 16” DBH). Another generation of adult beetles will emerge from these trees in the spring/summer of 2006, to again attack remaining live Douglas-fir trees, as well as possibly spreading outside the fire area into Douglas-fir unaffected by the fire. It can be expected that the great majority of remaining live Douglas-fir trees within the fire area above about 14” DBH will be attacked and killed by beetles over the next 2 to 5 years. Continuing drought and fire injuries exacerbate this situation. Many factors can affect beetle population levels and brood success (such as predators), but weather conditions are usually the most influential. This pattern of beetle attack, population growth and spread can be expected to continue until weather conditions change, specifically a return to a wetter weather pattern and perhaps more severe winters.

Resource values at risk in the event of a spruce or Douglas-fir beetle epidemic

Bark beetle activity in forest stands and its resulting consequences are a normal and natural function of the ecosystem. Beetle outbreaks after disturbance events, such as fire, are not a certainty, but the possibility of increasing beetle populations is considerable. Consequences of beetle activity may conflict with management objectives for a variety of resources, potentially affecting wildlife habitat and old forests, riparian and stream stability, timber productivity, private property or other values.

Based on the number of acres of beetle-susceptible stands, their hazard rating, the expected level of infestation, and the spread/mortality assumptions described earlier, this section will identify some of the resource values that may be affected in a region five miles from the fire perimeter, defined as that area most immediately at risk in the next 2-4 years from an outbreak initiated in the Wedge Fire area. There is a substantial acreage of the spruce-fir or Douglas-fir cover type on National Forest System Lands within five miles of the Wedge Fire that is either old growth or has substantial old growth characteristics (late seral successional stages). Many stands would fall short of containing all elements of old growth in number of large overstory trees, amount and size of downed wood and snags, or diversity of canopy layers. However, it can be assumed that these stands are the ones likely to contain some of the values associated with old or late seral forests, particularly an older, larger overstory tree layer, and would be most likely to develop a full compliment of old growth characteristics sooner than other stands.

Loss of any remaining old forest or forest that could be managed in the future for old growth in the surrounding area due to beetle attack and mortality is probable, given a bark beetle epidemic.

Because of the greater tree sizes and thus generally higher beetle risk in the stands that are late seral/old forest, beetles are likely to be more attracted to these stands and mortality would be disproportionately higher than that of younger/smaller diameter stands. With continuing high beetle populations in successive years, a major impact on both amount and quality of spruce old forest/late seral habitat would likely occur.

Forests in close association with streams have particular value for wildlife, providing summer thermal cover, old forest habitat, and adding to the diversity of forest structural conditions across the landscape. The riparian forests are often highly valued as wildlife travel corridors, particularly in situations where past harvest has fragmented the forest cover to some degree and converted areas to early seral stages, as has occurred in much of the Wedge Canyon Fire Area. A high amount of the old forest/late seral forest is typically located in riparian areas, containing the most productive growing sites and experiencing the longest fire-free intervals. Streamside forests influence fish habitat and stream conditions. The spruce/subalpine fir forest type dominates the riparian areas in most drainages of the North Fork Flathead River.

It follows that many of the spruce stands at risk to bark beetle surrounding the fire occur along streams and in riparian areas. Perennial streams are usually bordered by spruce stands at risk to beetle infestation, and intermittent streams flow through older spruce stands as well. Many of these riparian stands also provide late seral habitat conditions and structures. These stands are especially vulnerable. Some of these stands could experience up to 60 percent mortality of overstory spruce over a several year period.

In late seral/old forest stands, loss of many of the live, large diameter overstory trees in riparian and upland areas would reduce the important old forest component, as described earlier. These trees will become large diameter snags and eventually downed wood, also highly valuable forest structural and wildlife habitat components. Forests in riparian areas are typically not considered suitable for timber management, so economic value of trees killed from spruce beetle would not be a concern.

On National Forest System Lands, as much as half of the total 16,000 acres of spruce beetle susceptible stands and well over half of the Douglas-fir beetle susceptible stands within five miles of the fire occur on lands designated suitable for timber production by the forest plan. Management of these lands to produce timber, while protecting land productivity and other resource values, is a forest plan standard for these lands. Loss of significant numbers of trees on these lands would have a detrimental effect on timber productivity, both by the loss of these trees as potential commercial products and by the change in forest structure and species composition that may occur.

In the Wedge Canyon Fire, about 10,500 acres of private and state lands are within 5 miles. Though it is not know exactly how many acres of beetle susceptible spruce or Douglas-fir occur on these lands, it is a certainty that at least some amount does exist. It is likely that if conditions for beetles remain favorable, populations may build within the Robert or Wedge fire areas, and beetles will eventually spread onto these lands, causing varying levels of mortality in the larger diameter spruce and Douglas-fir. On State lands, managers are required by law to administer the lands to produce the largest measure of reasonable and legitimate return over the long run (Section 77-1-202, Montana Codes Annotated). Loss of larger diameter trees impacts the economic value of the lands. Also, other resource values that may be at risk given a beetle epidemic (such as old growth and stream stability) are important to state land managers. These values are important to many private land owners as well. In addition, the aesthetic value of individual trees may be of high importance to private land owners, with loss of even a few trees considered highly undesirable.

Alternative 2 (Proposed Action)

Timber resources

The Proposed Action would salvage burned and beetle infested timber from about 2,732 acres within the Robert Fire that is physically and economically feasible to salvage. These acres are “gross loggable acres” and do not include reductions for snag requirements (discussed later). Table 39 shows the acres proposed for harvest by logging system and Forest Plan Management Area. Approximately 22 million board feet (estimated net volume) of timber would be harvested. Acreages within the fire not considered for salvage were primarily areas previously harvested, on unsuitable ground, small diameter unmerchantable timber, or areas too far from a road to make helicopter yarding possible or economically feasible, riparian habitat conservation areas, and grizzly bear core habitat. Volumes and acreages given in this report are estimates based on available information. This is not final cruised volume, or traversed acres. Field verifications for logging systems and estimated volumes, as well as snag habitat quality and quantity will be conducted in the summer of 2004. Some variation in the final unit shape, size will result from field validations. It is not expected that acreages or volumes would increase from these estimates. Some units may be eliminated due to lack of adequate volume to warrant salvage. It is likely that some areas will be reduced in size when final RHCAs are identified, and final snag density requirements are applied to each unit.

Table 39. Gross Acres by Forest Plan Management Area and Logging System (Salvage Areas Only)

Fire Area	Management Area	Helicopter	Cable	Tractor	Grand Total
Wedge	MA11			0	0
	MA15	787	215	1,258	2,260
	MA2A	73			73
	MA2B	56		2	58
	MA3	190	3	3	196
	MA7		23	100	123
Wedge Total		1,108	243	1,380	2,732

GIS processing and rounding result in some seemingly inaccurate totals and subtotals. This "error" is negligible Acres proposed for salvage in INFISH buffers are not included in MA12.

The proposed action was designed to salvage fire-killed timber while leaving snags and woody debris sufficient to maintain ecological processes that protect ecosystem function and provide habitat for wildlife, and excluded activities in all but a few acres riparian habitat conservation areas (RHCA).

Snag management guidelines for the project result in a reduction to the gross acres shown above. Application of the guidelines with retention of leave patches within salvage units results in an overall reduction in proposed acres of about 505 or ~18 percent, for net acres harvested of about 2,227. Refer to Wildlife section for a description of the snag management guidelines.

The proposed action would salvage timber from 87 distinct harvest units. Units vary in size from one to 341 acres. This alternative would salvage only dead trees and trees most likely to die because of fire injury or beetle-infestation (refer to Post-Fire Mortality Guidelines in Appendix B). In units requiring a skyline yarding system, some live trees may have to be cut to access portions of the unit. Individual live trees may need to be designated for cutting to develop safe log landing areas, or for other safety considerations. The intent of the project is to avoid removal of any trees likely to survive the effects of the fire, but realistically, some green trees will be removed to accomplish the larger salvage objectives safely and efficiently. Timber salvage is appropriate in all of the proposed units within the project area. Table 39 (above) breaks out the acres planned by logging system. Harvest operations are expected to take two years. If harvest operations extend to the third year, significant loss of the value of timber products is expected due to deterioration. Deterioration will be greatest in spruce, subalpine fir, and lodgepole pine trees less than 15" dbh. Should harvest extend into the third year, an estimated 30 to 60 percent of the volume not yet harvested would be affected by cracking. This varies greatly by species (USDA 2000).

The National Forest Management Act requires that openings created in the forest by even-aged silviculture shall be less than 40 acres except in areas harvested as a result of natural catastrophic conditions such as fire, insect and disease or windstorm (36 CFR 219.27,d,iii). The Wedge Fire satisfies the "catastrophic" condition. Salvage units in high fire severity areas would result in even-aged stands because the fire caused 100 percent mortality and all new trees would be one age. Units in low severity fire areas would result in two age classes because residual green trees would provide one age class and newly regenerated trees would be a distinctly younger age. Moderate severity fire areas would result in a mixture of both, because delayed mortality to trees is expected in many areas that presently display green crowns but have fatal root and/or bole scorch.

Post-salvage slash treatments are planned in units harvested with ground-based logging systems (tractor logging). This would consist of whole-tree yarding. Un-merchantable tops and limbs would be yarded to the log landings. Slash accumulates at log landings, and is a routine, normal part of the logging operation. Landing slash will be burned to reduce those concentrations.

Forest Structure, composition, old growth

Natural successional development (i.e., no planting after salvage) would occur on 19,313 acres (90%) of the approximately 21,526 acres of the Wedge Fire. Even where seedlings are planted, growing space will still be available for herbs and grasses to become established. Long-term site productivity will not be adversely affected due to the abundance of coarse woody debris prescribed for all units. The removal of dead trees from salvage units would not inhibit natural successional development; however, summer logging of ground-based units might reduce the number of seedlings that establish from the residual on-site seed sources. There are 1,381 acres proposed for ground-based logging, and 550 acres of that would be planted with varying combinations of white pine, larch, Douglas-fir, or spruce. The balance of the acres proposed for natural regeneration in ground-based units are adjacent to seed walls, were serotinous lodgepole pine stands at that time of the fire, or would have islands of residual live trees left to provide a seed source for regeneration. Some of the ground-based units would be harvested in winter, causing much less damage to new seedlings. Much less damage to new seedlings would also be expected with helicopter and cable yarding methods.

Table 40 displays the acreages of structure classes affected by the proposal across the landscape. It is important to note that the fire was the disturbance that initiated a new pioneer or early seral stage of succession. Most stands that had been functioning as late seral received enough mortality that they are now in early succession (grass-forb), or seedling, stage. The proposed action affects succession to the extent that planting conifers in harvested and in unharvested areas hastens the forest regeneration process. Planting seedlings does not inhibit or prevent natural regeneration. Salvage treatments do not change the successional stage, because only dead and dying trees are proposed for harvest (as has been addressed in Appendix B Post-fire mortality guidelines, it is acknowledged that there may be some trees that are removed that would otherwise live, and some trees that are left that may die).

The potential for blowdown of remaining green trees in harvest units is greater because the areas are more open and less trees and canopy are left for wind protection. The edge created by harvest will contribute to blowdown, but will be mitigated somewhat by residual standing snags and unmerchantable trees. Potential for blowdown is a function of species, diameter, landtypes/soils, elevation, soil moisture, wind patterns and crown density. Deep-rooted species are western larch and Douglas-fir. Shallow –rooted species include spruce, subalpine fir and lodgepole pine. Dense stands of trees that have developed together mutually protect and support each other and do not have roots and boles to withstand exposure to wind if opened drastically. Residual live trees may develop windfirmness over time. Predicting when residual trees would blow down with or without harvest is difficult, but residual trees in harvest units can be expected to come down sooner than those in unmanaged stands because of increased exposure to wind. As stated earlier, research (Harrington 1996, Lyon 1977) has shown that most fire-killed trees are on the ground within ten to twenty years regardless of adjacency to salvaged trees, so blowdown patterns are not greatly influenced over the long term. The fire itself created conditions conducive to blowdown of live trees. The additional effect caused by the removal of dead trees from harvest units is judged to be a minor one.

In stands with low to moderate fire severity, the distribution of mortality is highly variable. Consequently, harvest of dead trees would leave stands with irregular forest structures. Gaps or patches of openings would be interspersed with live green trees from sapling, pole, and mature size classes. A mixture of live green trees of all sizes, small-diameter dead trees, and large-diameter snags would represent the residual structure. Residual canopy cover would be greater than in stands with high fire severity.

Some green trees may be damaged (bark skinning) during harvest operations. Skid trails and skyline corridors would be located to minimize damage to green trees. Residual cone-bearing trees will provide a seed source for natural regeneration in these less intensely burned stands. Areas that experienced ground fire may provide site preparation and the germination substrate for natural regeneration.

The potential for blowdown within harvest units in less intensely burned stands is relatively less than in the more intensely burned stands. Stands will be opened up through the removal of dead trees, but green trees are more root-firm and likely to stand. This is not to say blowdown would not happen. As mentioned earlier, elevation, wind patterns, landtypes, and species contribute to the potential for windfall. In addition, open stands with mature trees with full crowns intercept wind better than burned crowns. In time, green trees would develop windfirmness, improving their ability to stand. Delayed mortality can be anticipated after harvest activities due to cumulative stress caused by the fire and climatic conditions. The trees affected by delayed mortality would contribute to future blowdown and long-term coarse woody debris recruitment.

Direct and indirect effects of the proposed action on vegetation diversity and ecological processes will be evaluated through quantifying the amount of various communities and their characteristics (structure and fire severity classes) across the landscape. The analysis will focus on the condition of the forest communities, burned or unburned, that would result from the proposed activities and the effect they will have on future forests. It is important to remember that remnants of the pre-fire condition are present in the vertical arrangement of the burned vegetation (structure).

The importance or relevance of examining structure, especially with regard to burned forest, lies in the precept that ecosystem function is a consequence of structure. If the burned landscape is to function to the extent that burned landscapes have in the past, then a substantial representation of the burn should remain undisturbed. The degree to which the proposed action provides a fully functioning ecosystem is a measure of how well overall ecological integrity might be maintained. The amount of structural class disturbed by the fire and left untreated are the legacy acres.

Although this post-fire harvest affects snag structure, it does not affect the successional structural class. The vegetative structure (size) classes assigned are based on living trees, and the salvage is intended to remove only a portion of the dead and dying trees within the burned area. Amounts of structural class affected by alternative are shown in the tables following. Varying amounts and distributions of structure are left as legacies across the landscape. Smaller diameter trees and unmerchantable trees, and snag retention requirements will leave ten to 25 percent of the unit undisturbed inside otherwise harvestable areas (project file).

Table 40. Forest Structural Stages (Acres) in Wedge Canyon Fire Area, and Those Included in Salvage Harvest Units.

Structure Stage	Wedge Fire Area Acres	Acres included in Salvage Harvest Units	Percent of post-fire Structure treated by Salvage Harvest
Grass-forb	15,268	1,639	11
Harvested, Non-stocked	143	0	0
Immature, sawtimber, all species	1,054	91	9
Immature pole, non-lodgepole pine	102	2	2
Mature, sawtimber, all species	1,531	349	23
Overmature-older forest	537	170	32
Poles- lodgepole pine	838	33	1
Poles- mixed	1,333	81	6
Sapling	1,893	33	2
Seedling	233	11	5
Shrub-hardwood	330	19	6

(This table includes only national forest acres in the fire perimeter).

Old Growth

Prior to the fire, several old growth inventories had been conducted, using various methods. If any method identified a stand as old growth, it was included in this analysis. Definition of old growth was based on Western Montana Zone Definitions for Old Growth (Green et al, 1992) and includes considerations based on tree age, size, stand structure, downed logs, etc. The combined result of the inventories shows that 1339 acres were inventoried as old growth prior to the fire. The structure (ladder fuel, fuel loads, high stem and crown densities, etc) and composition (species often susceptible to fire damage) of these stands, combined with burning conditions during the fire (temperatures, dry fuels, wind, low humidity) combined to create a fire that changed most of these old growth stands to earlier successional stages. Fire changed the characteristics of the stands such that if they were inventoried now, they would not exhibit old growth characteristics sufficient to qualify as old growth as per established definitions. Many of the sites that carried old growth stands will now host grass, forb, shrub and seedling stages (stand initiation) of succession. In estimating the amount of old growth remaining after the fires, it was assumed that old growth stands that burned at high severity are no longer old growth. Stands that burned at low severity continue to contain elements of structure and function attributable to old growth forests. Because the range of conditions found in stands burned at moderate severity is wide, it was assumed that about half of the old growth stands burned at moderate severity retained some old growth characteristics and half were assumed to have changed to early successional stages, and would not contain old growth characteristics. Table 41 displays inventoried old growth, burn severities and the amount of old growth that remains.

Table 41.Old Growth Acres by Burn Severity, Pre- and Post-fire

Old growth Acres Pre-fire	Burn Severity	Post-Fire Old Growth
807	High	0
103	Low	103
428	Moderate	214
Total: 1,339		**317**

It is clear that the fires had a considerable impact on the amount of old growth in the burned area. Old growth, like all forest conditions, in ephemeral. All forest stands develop through developmental stages. At some point (or several points) along the developmental sequence, ecological disturbances re-direct stand development. In this area, the fire converted about 75 percent of the inventoried old growth to younger successional stages, leaving about 317 acres to continue to function as old growth. The Proposed Action includes harvest units in areas that had been old growth. Table 42 displays (pre-fire) inventoried old growth area acres, burn severity, and acre proposed for salvage harvest in those areas.

Table 42. Pre-fire Old Growth, Fire Severity, and Estimated Post-fire Old Growth (acres) Inside Savage Units

Old growth Acres Pre-fire that are inside proposed harvest units	Burn Severity	Post-Fire Old Growth Estimate
325	High	0
10	Low	10
290	Moderate	145
Total: 625		**155**

From Table 42 we see that the low severity burned old growth, which most likely continues to function as old growth, includes a total of ten acres inside harvest units. The ten acres is not in one single patch, but is represented as small areas within several units (2 acres in unit 109, 3 acres in unit 111, 3 acres in unit 117, one acre in unit 145, and one acre in unit 157). Two thoughts suggest a conclusion that low severity burned old growth is not negatively affected by the Wedge Propose Action. Burn severity mapping was done with remotely sensed data, and was done at a gross scale. This small (10 acres) amount of old growth, distributed as it is over several units, could simply be mistyped at this scale. Field verification will determine whether these areas are in fact functioning old growth or not. If they are, they will be avoided during project implementation.

Old growth burned at high severity is no longer old growth as per the definitions, and therefore there would be no affect if salvaged logged.

The moderately burned old growth planned for salvage (gross acres 290) assumes that about half no longer has old growth characteristics. In the remaining half (145 acres), several considerations lead to a conclusion that old growth will not be seriously affected by the proposed action. Considering the project area as a whole, the fire reduced old growth by 75 percent. Moderate severity fire burned 428 acres of inventoried old growth, changing some to early successional stages, and some retained some old growth characteristics. Of those, the proposed action salvages from 290 acres. Of those, it is estimated that half (145 acres) no longer act as old growth, and half (145 acres) may continue to contain old growth characteristics. In those 145 acres, the proposed action only removes dead or dying trees and leaves snag habitat according to the snag guidelines. The guidelines assign the highest emphasis to pre-fire old growth stands, recognizing that those areas are important, and require leaving more dead trees here than under any other condition. Those requirements, along with design features that leave all live trees assure the retention of many of the old growth characteristics in these areas, if they exist at all. Even if mapping is inaccurate, other project requirements (snags, leave trees, coarse woody debris retention, etc) will result in the retention of most old growth elements that currently exist. Ground truthing this summer will determine whether portions of these moderately burned areas are still live, functioning old growth stands, and if so, they will not be included in the final salvage proposal.

Fire Severity

Another component of the situation that provides a measure of the effects of the proposed action is the number of untreated acres in each fire severity class, where no disturbance would occur from salvage activities.

Table 43 discloses the number of acres in each burn severity class where harvesting is proposed (project file) and the percent of national forest system land left unharvested. At least 87 percent of the fire area would be left as legacy (Perry and Amaranthus 1997).

Table 43. Percent of Burned Acres Not Harvested

Legacy Area (Acres)			
Fire Severity	Burned Acres	Salvage Harvest Acres	% of Area Not Harvested
High	10,795	1,659	85
Moderate	5,481	934	83
Low	5,177	140	97
Unburned	73	0	100
Total	21,526	2,733	87

*** includes 206 acres that were not classified during the vegetation burn severity identification process.**

Harvest System

As shown in Table 44, the helicopter and tractor systems make up the largest share of logging method acres, cable systems were used where it was feasible. In the Wedge Fire, most of the areas planned for tractor logging are required to be completed during winter periods when snow or frozen ground protects soil and vegetation. Hand falling and helicopter yarding has the least soil impacts, but is by far the most expensive method. No heavy equipment would be on the ground, nor would trees be dragged across the soil in helicopter units. However, more dead trees may be felled for safety than would be felled in conjunction with other logging systems.

Table 44. Harvest system (acres) by Burn Severity

Burn Severity	Helicopter	Cable	Tractor
High	606	128	925
Moderate	411	107	416
Low	92	8	40
Total	1,108	243	1,381

Reforestation

Where seed sources are available, germination of lodgepole pine, larch, and Douglas-fir have a high potential for success if adequate cone crops exist due to the ash seedbed created by the fire (Miller 2000, Schmidt *et al*. 1976). Regeneration surveys will monitor this process. If natural regeneration is inadequate to meet stocking guidelines, planting would augment seedling stocking in identified areas. Conifer seedlings are planned to be planted on approximately 555 acres inside harvest units, and 1,657 acres outside of harvest units. Natural regeneration is prescribed on 2,177 acres of treated units. Regeneration surveys subsequent to salvage would be performed to determine the success of natural regeneration as well as the planting. A variety of conifer species would be planted to add to the diversity of the early successional vegetative community. Refer to Table 45 for a summary of planed artificial reforestation. Planting introduces diversity in what otherwise might develop into an overstocked monoculture of lodgepole pine. Future managers may then have options and a useable resource for wood fiber if they choose, as expressed in the National Forest Management Act (NFMA).

Regeneration success on the nearby Little Wolf Fire of 1994 has been very high. All harvest units (1,175 acres) included in the fire salvage in Little Wolf have been certified as fully stocked (project record Moose fire). Early surveys of areas planted in 2002 and 2003 in the Moose Fire indicate good survival in many areas, despite drought conditions.

Prompt reforestation would minimize the time that burned stands are unstocked and unproductive from a timber management standpoint. Skidding from the logging operations in both ground-based and cable systems provides at least some of the necessary site preparation for reforestation. Regeneration activities are predicted to provide fully stocked stands within five years. Regeneration indices for past harvest and planting in the area watersheds show a high rate of success. Species diversity would be improved through reforestation. Natural regeneration would be monitored and augmented with planting in the event of poor cone crops. The following table displays the number of acres of planting and natural regeneration proposed.

Table 45. Tree Planting Acres and Species or Species Mixes

Species, or Species Mix	Acre planting inside harvest units	Acres planting outside harvest units
Douglas-fir		292
Larch	403	724
Larch and Engelmann spruce		0
Larch, spruce and shrubs		108

Whitebark pine	150	533
Western white pine, spruce, larch and shrubs		

Seedlings planted on national forest system lands usually (the exception is rust-resistant white pine) come from seed sources native to the site, and are native species found on the habitat types being planted (Beschta et al. 1994). This would be the case on this project as well.

Road reclamation for grizzly bear security (Forest Plan requirements) would require planters and thinners to walk long distances to access some units, increasing unit costs.

Spruce Beetle and Douglas-fir bark beetles

Monitoring for bark beetle population increases and their locations are planned for the summer and fall of 2004. The results of monitoring will assist in refining activities, locations, and methods of treatments directed at reducing the mortality that can result from bark beetles. Even though some areas appear likely for treatments, some refinement of those plans will be needed when we have learned more about where beetles are increasing.

Timing of salvage and other treatments

Timing of beetle treatments is an important factor in the development and implementation of an effective bark beetle management plan. When using pheromone baited beetle funnel traps, placing them in selected locations in a timely manner normally does not pose a problem. Use of trap trees or baited trees also requires timely felling or baiting of the trees in late fall or early spring, before beetle flight. These trees must be removed or otherwise treated before the new generation of beetles emerges.

Timeliness of salvage efforts sometimes combined with removal of trap or baited trees, can be more difficult to achieve, because of the intensive and complex planning, preparation and implementation that is required. The window of opportunity for salvage of trees infested with spruce beetle is manageable, however, since spruce beetles in this area normally remain within the same tree for the duration of their two-year life cycle. It should be possible to complete proposed salvage efforts in the acres infested with spruce beetle within two years (by the spring of 2007), before the majority of adult beetles emerge. With Douglas-fir beetle, the window of opportunity is smaller, as the adult beetles will emerge and spread to surrounding trees one year after infestation (in the spring/summer of 2005) and control efforts aimed at removal of infested trees must be completed before the beetles emerge.

Treatment Methods

Bark beetle management using salvage, pheromone-baited beetle funnel traps, pherome-baited repellant strips (“MCH” strips)and trap trees are the methods employed to address concerns with the beetle population buildup. The proposed action includes about 7 sites for combinations of funnel traps and trap trees for managing spruce beetle, applying traps in and near about 331 acres of beetle susceptible spruce stands. Best estimates at this time would involve the placement of about 50-80 clusters of funnel traps (3 traps per cluster) in selected locations, nearly all within the riparian areas. Funnel traps may also be employed for management of Douglas-fir bark beetles. These traps would be located in or near areas of highest infestation, which is likely to be on southern aspects in the upper Whale Creek and Hornet Wedge drainages, and possible in portions of Tepee Creek drainage. In addition, use of MCH strips (a “repellant” pheromone) may be employed in limited situations, where live, beetle susceptible Douglas-fir still exist and are considered of high value to protect. MCH has proven very effective in preventing bark beetle infestation.

In areas outside riparian zones, trap trees for both spruce and Douglas-fir bark beetles can be used if they are located inside or adjacent to harvest units. Standard timber sale contract provisions make this method very effective at removing infested trap trees. Site specific treatment areas for pheremone-based methods and trap trees will be confirmed by the beetle monitoring scheduled for summer and fall of 2004, and continuing into 2005 and 2006.

Spruce and Douglas-fir bark beetles, as with many insects, rely on chemicals known as pheromones to communicate with one another. The funnel traps contain an "aggregate" pheromone, the attractant chemicals naturally released by unmated female bark beetles after locating a suitable breeding site. It attracts both males and females to a tree, and in the natural system has the function of stimulating mass attacks, which allow beetles to concentrate on a scattered resource or overcome the natural defenses of a live tree. The intent of the trapping is to draw in and capture as many of the adult beetles as possible emerging from the burned trees in 2005 and 2006 and beyond, if necessary, before they have a chance to spread, attack and kill live spruce trees in areas in and around the site of infestation (Gibson 2002a). With selective placement of adequate numbers of traps, the majority of the emerging beetles on a particular infested site can be captured, which could well be many hundreds of thousands of beetles. This will aid in preventing these beetles from spreading out further from the area of infestation.

Funnel traps have been used to successfully "trap out" small, isolated populations of beetles in the past (Gibson 2002a).

Trap trees may be deployed under specific circumstances. This involves felling one to several live spruce or Douglas-fir, thereby creating ideal beetle habitat that attracts beetles as well or better than baited funnel traps. When the trap trees are attacked and fully occupied, they can be removed (if properly located), or the beetles can be destroyed before adults emerge, by burning or de-barking. A disadvantage with this method over funnel trapping is that otherwise healthy trees are sacrificed to lure beetles. In some situations this may be an acceptable alternative to loosing larger numbers of trees that the beetles themselves select, rather than managers.

Direct and Indirect Effects

The proposed action will result in salvage harvest within 811 acres of moderate and high spruce beetle susceptibility areas (about 32% of the susceptible area and 445 acres of moderate and high Douglas-fir beetle susceptible areas (about 45% of the susceptible area). Infested trees, even though they may appear green, are designated for removal as they are assumed to be dying. (see mortality guidelines in the appendix). This will reduce the available spruce beetle habitat by about 811 acres and Douglas-fir beetle habitat by about 445 acres. The spruce beetle infested trees would be salvaged from all these areas before adult beetles emerge in the spring of 2005 or 2006. Some of the Douglas-fir beetle infested trees would be removed from the area before adults emerge in the spring/summer of 2005, if logging occurs in the winter of 2004/2005.. However, due to the short time frame before beetle emergence, the large number of salvage acres, and logging systems that are difficult to carry out in the winter (i.e. helicopter) it will probably not be possible to remove all beetle infested trees prior to summer 2005.

This integrated approach to spruce and Douglas-fir beetle management within the fire area should prove effective at lowering potential beetle populations to the degree that it removes a portion of the bark beetle habitat through salvage and trap tree removal, and captures some portion of the beetle population in pheremone baited traps. However, there would still be substantial amount of beetle habitat within the fire areas, and under favorable conditions, the potential for beetle population buildup still exists. Beetle populations are influenced by many variables (temperature, moisture, snow depths, predatory insects and birds, and suitable habitat), any of which may either cause an increase or decrease in population level. We are only able to influence the habitat available, and to a lesser degree have a direct influence on population levels through trapping of beetles. There would likely be some amount of mortality in remaining live spruce and Douglas-fir within the fire area, because the salvage, trap trees, and pheromone-based treatments are not expected to capture all emerging beetles. Some undetected areas of infested Douglas-fir and spruce within the fire will remain. If population levels increase in the fire area, varying levels of mortality of larger Douglas-fir and spruce in areas outside the fire area is likely to occur over the next few years. Because some reduction to beetle population levels is expected with implementation of the proposed action, effects to resource values and private/state land holdings as discussed under Alternative 1 would be lessened. Monitoring of bark beetle population levelsover the next few years will be used to continually fine-tune our assessment. This proposal takes reasonable actions to stem outbreaks of both spruce and Douglas-fir beetle. It cannot assure success, but it takes reasonable steps to reduce the available habitat, and to capture or divert emerging adult beetles before they can attack live, healthy spruce trees.

3.2.5 Cumulative Effects

Robert Fire

Timber management has taken place in the Robert Fire area since 1946, including precommercial thinning and reforestation. Approximately 50% percent of the fire area on NFS lands has been treated (includes the range of light partial cuts to clearcuts, and some acres may have had more than one treatment). The most recent timber activity occurred in 1993.

The accidental introduction of blister rust seriously affected species composition on many sites by killing white pine and whitebark pine.

Personal use firewood cutting, Christmas tree harvesting, post and poles, and bough collection are historical uses of the area, and have been for many years. They are expected to resume in the future, when closures are lifted.

Fire suppression since 1910 has been successful, generally, in suppressing the majority of fire starts while those fires were small. The effective suppression contributed to accumulations of forest fuel, which may have affected fire behavior in the Robert Fire.

Trees adjacent to roads within the Robert Fire area that were identified as a hazard to firefighters and the public were felled during fire suppression actions. Removal of these trees began in the winter following the fire (some removal will occur this summer).

Robert Fire Burned Area Emergency Rehabilitation (BAER) projects on NFS lands during September/October 2003 included grass seeding and hazard tree falling in the Great Northern Flats area.

Private land development has altered, to varying degrees, the forest composition and structures on lands in the vicinity.

Small amount of private land clearing/logging has occurred in areas adjacent to the North Fork Road. In addition, Stoltze Land and Lumber Company has logged their portions of land in the lower reaches of the McGinnis Creek drainage.

Mushroom Harvest – A signed decision authorized commercial and personal mushroom harvesting within the Robert Fire area. Mushroom harvest began in May 2004 and is expected to continue through July. Generally the first year after fires yield the largest mushroom crops and commercial harvesting declines significantly after that. Some harvesting is likely in 2005 and beyond, but it is expected to be light in comparison to 2004.

Special forest product gathering for personal use is likely to occur, such as berry picking, firewood and Christmas tree cutting, evergreen bough and cone collection, particularly in those areas unaffected by the fire.

The closure order for firewood cutting in the fire area currently in effect will be rescinded after harvest activities. Additional signs will be placed in riparian areas prohibiting firewood cutting in these areas (which are also specified in all firewood cutting permits) once the closure order is lifted.

Alternative 1 (No Action)

There are no known cumulative effects to the timber resources involved in this analysis.

A list of all known activities, past, present, and future is provided earlier in this chapter. Few of them have any direct, indirect, or cumulative impact to vegetation in conjunction with the No Action alternative. Short of conversion to agricultural land or a road, forest vegetation will return to all sites that previously supported forested ecosystems. Disturbances to vegetation, such as wind, fire, or flood, or past harvest, are all short-term. Habitat types in northwestern Montana are generally highly productive for vegetative biomass, the climate provides adequate moisture, and seed dispersal from adjacent live trees, shrubs, grasses, bird and animal droppings, and residual seed in the soil will aid in renewal. The soils severely affected by fire will be slower to recover, but will recover in time. Disturbances caused by suppression activities have all undergone rehabilitation and no lasting effects to vegetation are expected. The No Action alternative has no cumulative negative effects on the future development of old growth forest conditions as long as spruce beetles do not develop outbreak populations. The No Action alternative, because it does not attempt to reduce beetle populations, could result in mortality in and reduced coverage of old forest conditions in areas outside the burn perimeter.

Some road closure is a reasonably foreseeable action with the no action alternative. Former roadbeds will slowly colonize and become vegetated. They will recover, but more slowly than other disturbed areas simply due to the fact that by their nature, roads are almost completely compacted.

The no action alternative does not take advantage of the opportunity to reverse the long-standing effects of an introduced pathogen. Resistant seedlings are available for use in replacing this element of the ecosystem. The fire created suitable conditions for reestablishing these species in a small area of the North Fork River basin where they were once well represented. The failure to begin reestablishment while conditions are ripe, adds to the acres in the basin that will continue to contain less than the full compliment of species.

Past regeneration harvesting has removed potential seed sources in the form of overstory larch, Douglas-fir and in some cases spruce and subalpine fir. Some of these large overstory larch or Douglas-fir would likely have survived the Robert Fire. Lack of this seed source has affected the ability of some areas to regenerate adequately after the fire, or to regenerate to desired seral species.

It is unlikely that mushroom harvesting will affect the rate of regeneration within the burned area to any significant degree. Although substantial numbers of people are expected to cover virtually all of the fire, and seedlings will be stepped on, natural regeneration of lodgepole pine and larch is so great, the fire area will probably only have isolated areas if any where regeneration would be affected by this action..

Areas affected by suppression efforts were seeded with non-invasive grass species, mainly annual rye, which should not persist past next growing season, allowing native species to become established.

Alternative 2 (Proposed Action)

The removal of dead trees, in conjunction with the past, present and reasonably foreseeable activities cited in Chapter 3, will not have a substantial impact on the vegetation resource in terms of structure, function, or composition. The fire was the significant disturbance, any salvage activity of dead and imminently dead trees is not going to affect the ability of vegetation to continue to function as it has since the glaciers receded. Artificial regeneration would introduce species diversity in areas that would otherwise be expected to develop into a lodgepole pine monoculture, and it establishes species that have been in decline since the introduction of blister rust. Disturbances caused by suppression activities have all undergone rehabilitation, including revegetation with annual rye (a short-lived annual) and native species; no lasting effects to vegetation are expected. There are no negative cumulative effects to old growth forests in the vicinity. However, a positive cumulative impact to old growth could result if spruce beetle populations are held in check. Areas outside the fire perimeter that contain old growth spruce could continue to function as old growth over wider areas and for longer period than if they are attacked and altered by spruce beetle.

It is unlikely that mushroom harvesting during the spring and summer of 2004 will affect the rate of regeneration with the burned area. Large numbers of people will visit nearly all of the fire. It is not possible to determine the degree of seedling mortality under these conditions. A very minor amount of mushroom harvesting activity can be expected in future years as green plants become established and conditions for the flush of fungi are no longer present.

Road closures and decommissioning have been occurring and will continue to occur. The cumulative effect of this is a continuous reduction in access for both the public and for management activities. Costs for monitoring and managing the vegetation resource can be expected to increase, though the exact amount is difficult to estimate.

According to Perry and Amaranthus (1997), management systems can be devised that sustain productivity and biological diversity. Design criteria for this project includes consideration for soils, woody debris for nutrient cycling, and conifer regeneration, which would ensure that implementing the proposed action would not destroy indigenous biological diversity or soil integrity on this landscape. The action alternative contain plans for the future through regeneration of the forest with a diversity of species, and at a landscape scale. Future managers will have a wide range of options for forest management.

Glacier National Park managers have no plans for actions within the fire area that would alter the natural course of beetle activity. A significant amount of burned area in the Park now is ideal beetle habitat. It is unknown what level of spruce beetle infestation may occur inside Glacier National Park. It safe to assume that some portion of these acres will have high levels of spruce beetle. These acres are likely to contribute to an elevated spruce beetle population in the area once adults emerge in the spring of 2005 and 2006. These areas may be within the fire (in remaining live spruce) or outside fire boundaries. Mortality of spruce on National Forest System Lands and other ownerships may occur as a result. Whether the beetles are able to successfully attack and breed across these acres depends heavily on weather and other conditions being favorable to beetle success. Implementation of the proposed treatments on National Forest System Lands (salvage and trapping) would have little influence on the growth and spread of spruce beetle populations from these acres within Glacier National park.

This salvage action would remove beetle-infested trees. It reduces beetle population in this area and would add cumulatively to the effectiveness of pheromone trapping by decreasing the overall volume of habitat and directly by removing beetles in infested trees.

Past harvesting activity removed significant volumes of spruce. As a result of high mortality in older overstory spruce and the widespread harvest activity, many acres of what were once mature and older spruce forests were converted to young, early seral seedling and sapling forests. As a result, the amount and quality of potential spruce beetle host material has been substantially reduced from pre-1950 conditions in the local area, and the overall vulnerability of the landscape to spruce beetle is lower.

Past harvesting in the lower elevations occurred largely in mature and older stands dominated by larch and Douglas-fir, with spruce and subalpine fir on the more moist aspects and draws. Large diameter trees were removed, resulting in a substantial reduction of potential host trees for spruce beetle. The fire burned over most of these past harvest areas, and if harvesting had not been done, there could potentially be far more forest at high risk to bark beetle infestation than currently exists. This removal has also affected the potential of some areas to regenerate adequately after the fire, due to lack of seed source.

Most units would not have any specified slash treatment after harvest. Unmerchantable trees would remain either standing or felled/pushed/blown down before or during the logging operation. This material poses no hazard for spruce bark beetle, primarily because of its smaller size and in most cases, its deteriorated, burned condition. Various beetles that feed and breed in dead wood would find this material suitable.

An aggressive planting program is proposed. . Species planted will include western larch, , Douglas-fir and western white pine, whitebark pine and Engelmann spruce. All trees are native and adapted to the site. Planting would help increase the diversity of species within the future forest, which increases the resilience of these areas to the potential future effects of insects (including spruce beetles), disease, and fire.

It is difficult to predict at this time to what extent and where beetle treatments farther into the future may occur (i.e. 5 or more years from now). Continuing monitoring of beetle populations and brood survival will provide us with information needed to ascertain whether additional actions to manage beetle populations are needed. If so, the appropriate analysis and assessment of effects would occur before implementation.

Wedge Fire

Timber management has taken place in the Wedge Canyon fire area since 1951, including precommercial thinning and reforestation. Approximately 32% percent of the fire area on NFS lands has been treated (includes the range of light partial cuts to clearcuts, and some acres may have had more than one treatment). The most recent timber sale analysis occurred in the Hornet Wedge Project (Decision Notice was signed in December 1996.)

The accidental introduction of blister rust seriously affected species composition on many sites by killing white pine and whitebark pine.

Personal use firewood cutting, Christmas tree harvesting, post and poles, and bough collection have been occurring for many years and are expected to resume when closures are lifted.

Fire suppression since 1910 has been successful, generally, in suppressing the majority of fire starts while those fires were small. The effective suppression contributed to accumulations of forest fuel, which may have affected fire behavior in the Robert Fire.

Trees adjacent to roads within the Wedge Canyon area that were identified as a hazard to firefighters and the public were felled during fire suppression actions. Removal of these trees began in the winter following the fire (some will occur this summer).

Wedge Canyon Fire Burned Area Emergency Rehabilitation (BAER) projects occurred on NFS lands during September/October 2003: included grass seeding and straw mulching.

Private land development has altered to varying degrees, the forested cover and structure in areas adjacent to National Forest System Lands. Some extensive clearing/logging of private lands particularly in the Teepee Lake area occurred immediately after the fire.

Mushroom Harvest – A signed decision authorized commercial and personal mushroom harvesting within the Wedge Fire area. Mushroom harvest began in May 2004 and is expected to continue through July. Generally the first year after fires yield the largest mushroom crops and commercial harvesting declines significantly after that. Some harvesting is likely in 2005 and beyond, but it is expected to be light in comparison to 2004.

Special forest product gathering for personal use is likely to occur, such as berry picking, firewood and Christmas tree cutting, evergreen bough and cone collection, particularly in those areas unaffected by the fire.

The closure order for firewood cutting in the fire area currently in effect will be rescinded after harvest activities. Additional signs will be placed in riparian areas prohibiting firewood cutting in these areas (which are also specified in all firewood cutting permits) once the closure order is lifted.

Further private land development will reshape forest structure and composition to some degree.

The Montana Department of Natural Resources and Conservation (DNRC) is logging Section 16. They plan to finish soon.

Alternative 1 (No Action)

There are no known cumulative effects to the timber resources involved in this analysis.

A list of all known activities, past, present, and future is provided earlier in this chapter. Few of them have any direct, indirect, or cumulative impact to vegetation in conjunction with the No Action alternative. Short of conversion to agricultural land or a road, forest vegetation will return to all sites that previously supported forested ecosystems. Disturbances to vegetation, such as wind, fire, or flood, or past harvest, are all short-term. Habitat types in northwestern Montana are generally highly productive for vegetative biomass, the climate provides adequate moisture, and seed dispersal from adjacent live trees, shrubs, grasses, bird and animal droppings, and residual seed in the soil will aid in renewal. The soils severely affected by fire will be slower to recover, but will recover in time. Disturbances caused by suppression activities have all undergone rehabilitation and no lasting effects to vegetation are expected. The No Action alternative has no cumulative negative effects on the future development of old growth forest conditions as long as spruce beetles do not develop outbreak populations. The No Action alternative, because it does not attempt to reduce beetle populations, could result in mortality in and reduced coverage of old forest conditions in areas outside the burn perimeter.

Some road closure is a reasonably foreseeable action with the no action alternative. Former roadbeds will slowly colonize and become vegetated. They will recover, but more slowly than other disturbed areas simply due to the fact that by their nature, roads are almost completely compacted.

The no action alternative does take advantage of the opportunity to reverse the long-standing effects of an introduced pathogen. Resistant seedlings are available for use in replacing this element of the ecosystem. The fire created suitable conditions for reestablishing these species in a small area of the North Fork River basin where they were once well represented. The failure to begin reestablishment while conditions are ripe, adds to the acres in the basin that will continue to contain less than the full compliment of species.

Past regeneration harvesting has removed potential seed sources in the form of overstory larch, Douglas-fir and in some cases spruce and subalpine fir. Some of these large overstory larch or Douglas-fir would likely have survived the Wedge Fire. Lack of this seed source has affected the ability of some areas to regenerate adequately after the fire, or to regenerate to desired seral species.

It is unlikely that mushroom harvesting will affect the rate of regeneration within the burned area to any significant degree. Although substantial numbers of people are expected to cover virtually all of the fire, and seedlings will be stepped on, natural regeneration of lodgepole pine and larch is so great, the fire area will probably only have isolated areas if any where regeneration would be affected by this activity.

Areas affected by suppression efforts were seeded with non-invasive grass species, mainly annual rye, which should not persist past next growing season, allowing native species to become established.

Alternative 2 (Proposed Action)

The removal of dead trees, in conjunction with the past, present and reasonably foreseeable activities cited in Chapter 3, will not have a substantial impact on the vegetation resource in terms of structure, function, or composition. The fire was the significant disturbance, any salvage activity of dead and imminently dead trees is not going to affect the ability of vegetation to continue to function as it has since the glaciers receded. Artificial regeneration would introduce species diversity in areas that would otherwise be expected to develop into a lodgepole pine monoculture, and it establishes species that have been in decline since the introduction of blister rust. Disturbances caused by suppression activities have all undergone rehabilitation, including revegetation with annual rye (a short-lived annual) and native species; no lasting effects to vegetation are expected. There are no negative cumulative effects to old growth forests in the vicinity. However, a positive cumulative impact to old growth could result if spruce beetle populations are held in check. Areas outside the fire perimeter that contain old growth spruce could continue to function as old growth over wider areas and for longer period that if they are attacked and altered by spruce beetle.

It is unlikely that mushroom harvesting during the spring and summer of 2004 will affect the rate of regeneration with the burned area. Large numbers of people will visit nearly all of the fire. It is not possible to determine the degree of seedling mortality under these conditions. A very minor amount of mushroom harvesting activity can be expected in future years as green plants become established and conditions for the flush of fungi are no longer present.

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According to Perry and Amaranthus (1997), management systems can be devised that sustain productivity and biological diversity. Design criteria for this project includes consideration for soils, woody debris for nutrient cycling, and conifer regeneration, which would ensure that implementing the proposed action would not destroy indigenous biological diversity or soil integrity on this landscape. The action alternative contains plans for the future through regeneration of the forest with a diversity of species, and at a landscape scale. Future managers will have a wide range of options for forest management.

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3.3 WILDLIFE

3.3.1 Introduction

The Robert and Wedge Post Fire Project area provides habitat for a wide variety of species, including mule deer, white-tailed deer, elk, wolf, lynx, bobcat, mountain lion, striped skunk, long-tailed weasel, grizzly and black bear, coyote, deer mouse, western harvest mouse, pocket gopher, golden mantled ground squirrel, snowshoe hare, mountain cottontail, gray jays, nuthatches, woodpeckers, mountain bluebirds, spruce grouse, hummingbirds, bald eagles, doves, hawks, owls, ravens, various bats, snakes, lizards, and many other species. Distribution and abundance of wildlife populations is largely influenced by spatial arrangement, size, and specific conditions of habitat areas. This list is not all encompassing of all species that occur in the Robert and Wedge Post Fire Project area; rather it is intended to provide a representation of the wildlife in the area.

The wildlife analysis addresses wildlife habitat and wildlife species needs within the Robert and Wedge Post Fire Project area. Wildlife species and habitat will be evaluated in relation to the existing condition, the desired future condition and how the no-action and proposed action alternatives affect specific species and their habitat. The size and the location of the area that will be analyzed will vary by the habitat needs of the wildlife species that is being considered. Habitat characteristics for sensitive species with habitat in the area listed for Region 1 of the Forest Service will be addressed. Sensitive species known to have occurred or to have potential habitat within the vicinity of the Robert and Wedge Post Fire Project area include; wolverine, black-backed woodpecker, fisher, northern goshawk, common loon and boreal toad. Management indicator species (MIS), neotropical migratory birds, and wildlife species of interest in the area will also be addressed.

Unique/special habitats (e.g. riparian areas, ponds, rock outcrops) as well as specific habitat attributes (i.e. snags and down logs) are important to numerous wildlife species. These important habitat components are distributed across the analysis areas and were heavily impacted by the Robert and Wedge Fires. These habitat components will be discussed as they relate to the individual wildlife species addressed in this report.

Field Surveys/Resource Contacts

Post-fire field reviews were done in the fall of 2003 and early spring 2004. Prior to the preparation of this document a review of District and Forest wildlife records, the U.S Fish and Wildlife Service (USFWS) list of Federally Threatened and Endangered species on the Flathead National Forest, the Region 1 Sensitive Species List and the Montana Fish, Wildlife and Parks website was conducted. Field survey data were also utilized from various surveys done within the Robert and Wedge Post Fire Project area and surrounding vicinity.

During project analysis both written and oral information was obtained on a continual basis from Amy Jacobs - Flathead National Forest Tally Lake District Wildlife Biologist, Henry Rivera - Hungry Horse/Glacier View District Wildlife Biologist, Heidi Trechsel - Hungry