Silvicultural Specialist Report

FEIS Flagtail Fire Restoration Project

Affected Environment and Environmental Consequences

Forest Vegetation

Malheur National Forest
Blue Mountain Ranger District

Grant County, Oregon

/s/ Eric L. Wunz — 12/18/2003
Eric L. Wunz, Certified Silviculturist — Date

Affected Environment

Forest Vegetation

Introduction

The forest vegetation burned by the Flagtail Fire forms a diverse pattern created by soil types, aspect, elevation, moisture and temperature regimes, natural disturbances, and past management activities. The fire burned across approximately 7120 acres of the Malheur National Forest, of which about 6180 acres was forested. About 3150 acres of the fire resulted in total mortality, about 2400 acres of the fire resulted in 60-90% mortality, and about 460 acres of the fire resulted in 30-60% mortality. In the areas where the fire did not kill all of the trees, the surviving trees are in a mosaic or underburn pattern with patches of differing percentages of tree survival. Only about 170 acres that were forested did not burn, mostly in riparian areas or previously harvested and reforested areas.

Regulatory Framework

The National Forest Management Act (NFMA) requires that harvested lands be reforested within 5 years. The Forest Service has established a policy that this requirement is applied to salvage as well as to "green" timber sales. In addition, where no salvage is done, deforested lands should be reforested as quickly as practicable (Regional Forester letter 11/19/2002).

The Malheur NF Land and Resource Management Plan provides Forest-wide management goals and objectives. The applicable standards for the forest vegetation portion of this analysis are:

- Maintain stand vigor through the uses of integrated pest management such as stocking level control and species composition in order to minimize losses due to insects and diseases.
- While favoring high quality natural regeneration, consider the effectiveness of various regeneration methods and prescribe the best site-specific method. Satisfactory stocking of any regenerated stand will be expected to occur within 5 years after harvest.
- Use seed collected from phenotypically superior trees from the same seed zone and elevation band for growing planting stock.
- Manage to maintain or re-establish ponderosa pine on sites where ponderosa pine is subclimax.

The Regional Foresters Forest Plan Amendment #2 gives additional direction for timber sales. Since the all of the alternatives do not propose harvesting live trees (except for

incidental amounts) this project is not subject to the ecosystem standard (HRV) but still must apply the riparian and wildlife standards. The applicable wildlife standards for the forest vegetation portion of this analysis are:

- If late and old structure (LOS) is below HRV, there should be no net loss of LOS. The ICBEMP terminology used in this document is old forest single-stratum or old forest multi-strata rather than LOS.
- Manipulate vegetation that is not LOS so that it moves towards LOS. Where open, parklike stands occurred historically, encourage the development of large diameter trees with an open canopy structure.

Analysis Area

The project area is defined as the National Forest lands within the perimeter of the Flagtail Fire. In some cases, the analysis area includes both surrounding private and Federal forestland up to 5 miles outside the fire boundary to adequately discuss cumulative effects (such as insect spread to stands outside the fire area).

Analysis Methods

Data about the Flagtail area was gathered with a variety of methods. Beginning while the fire was still uncontrolled, district resource specialists who were on the ground advising the suppression forces on appropriate firefighting tactics were also gathering information on the fire effects. After the fire was controlled the silviculturist examined most of the timber stands and mapped the fire severity to the forest vegetation using aerial photographs flown after the fire. The stands were then stratified and formal stand exams were taken on a portion of each stratum.

All acres in this section are approximate and are generally rounded off to the nearest 10 acres. Structural stage percentages are shown to the nearest percent, since some are at very low levels, but they are not intended to indicate a degree of precision closer than 5%.

Biophysical Environments

Specific plant species tend to be found together in a characteristic set of ecological conditions. The unit of classification based on the probable, or projected, climax plant community type is termed the Plant Association", and may be used to describe and classify sets of ecological conditions. The Plant Associations found within the Flagtail planning area are documented in *Plant Associations of the Blue and Ochoco Mountains* (Johnson and Clausnitzer, 1992). For purposes of classification and analysis, plant associations may be grouped into areas with like temperature/moisture and fire disturbance regimes called Plant Association Groups (PAGs).

Stand Development

In order to compare the alternatives, the growth of the naturally reforested stands and planted stands is tracked into the future to show the time to produce old forest structures. The goal of this analysis is to compare the alternatives in a consistent manner; the growth projections do not necessarily predict the actual growth expected to occur, as they do not take into account all factors that could affect tree growth. To be consistent, several assumptions have been made to simplify the analysis. Stand density management by periodic thinning and underburning is likely to occur into the future and is assumed to take place. No large-scale disturbances such as stand replacement fire or insect infestations are included.

Stand establishment has been estimated to take 5 years if planted, natural reforestation would take 10 to 20 years if within the seed fall zone (within 800' of live trees) or 20-50 years if outside the seed fall zone. Growth was then projected to be 1.5"DBH per decade. To reduce the success of bark beetle attacks, 1.0"DBH per decade is considered the minimum growth rate and a growth rate above 2.0"DBH per decade can indicate an understocked stand. The midpoint of the range (1.5"DBH per decade) was chosen, this is a conservative number based on the general objective to grow stands between 1.0" and 2.0" DBH per decade.

When used in this section, "short-term" means in the next 20 years and "long-term" means over 20 years. Benchmarks were selected at 50, 100, and 150 years to display the structural stage differences between the alternatives at various times in the future. These roughly are the times when stages grow from one to another.

Historical Conditions

Many of the forests in the West have been altered from their historical condition since Euro-American settlement. This has occurred as a result of fire suppression, logging, cattle grazing, and other activities. There is an increasing realization that the forests of the Blue Mountains evolved with the fire, insects, and other periodic disturbances that occur here and that the historical condition was often more resilient and sustainable than the present condition.

In particular, the Hot Dry and Warm Dry biophysical environments were typically composed of large ponderosa pine and western larch at fairly wide spacing and there was little conifer undergrowth. Periodic low intensity ground fires kept the fuel loads at low levels and killed conifer regeneration and kept the trees thinned. The low levels of ground fuels and the lack of fuel ladders from the ground to the tree crowns reduced the amount of crown fires and the widely spaced crowns did not allow crown fires to spread for long distances. With the wide spacing the trees grew at sufficient growth rates to allow them to better resist bark beetles.

The historical percentages for Historical Range of Variability for Structural Stages are from Powell, 1998, which was derived from several diverse sources, including the regional and area ecologists. Although developed specifically for the Umatilla N. F., the

Plant Association Groups are the same for all of the Blue Mountains thus the historical ranges are applicable throughout the three forests.

The vegetation has evolved with the periodic disturbances of the region and is adapted to surviving them. The desired condition is to move the forest towards the historical condition for each biophysical environment. This will reduce the risk of uncharacteristically severe fire and restore ecological structure, function, and processes to the forest.

Cumulative Effects

The list of actions in Appendix J was used to analyze the Cumulative Effects. Each one was considered to see if any of them, in combination with the actions proposed for the Flagtail Fire Recovery Project, had a measurable effect. Those that did were discussed further in the Cumulative Effect sections that follow each topic.

General Affected Environment

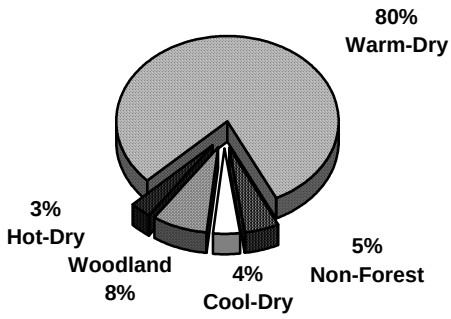
Biophysical Environments

The Plant Association Groups (PAG) that occur in the Flagtail Fire area are:

Dry Forest		
Hot Dry PAG	240 acres	3%
Warm Dry PAG	5660 acres	80%
Cold Forest		
Cool Dry PAG	280 acres	4%
Total Forested Area	**6180 acres**	**87%**
Woodland (Juniper)		
Hot Dry PAG	450 acres	6%
Hot Moist PAG	140 acres	2%
Total Woodlands	**590 acres**	**8%**
Non Forest PAGs	**350 acres**	**5%**
Total Area in Flagtail Project Area	**7120 acres**	

Note: All acres are approximate and are generally rounded off to the nearest 10 acres.

Figure FV - I: Percent of Project Area by Plant Association Group



The following sections describe the biophysical environments found in the project area, and the past (pre-fire) and potential vegetation of those environments. The existing vegetation has been greatly modified by the Flagtail Fire that occurred in July 2002. Many stands were killed or damaged, bringing them far from the desired condition described in Chapter 1 for each biophysical environment.

Woodland (Juniper) Plant Association Groups

Historically, these dry sites were occupied by widely scattered western juniper and ponderosa pine. Fire exclusion in the last century has allowed juniper and sagebrush to greatly increase their coverage and for ponderosa pine to encroach into former pine savannahs and to form overstocked stands. These associations cover approximately 590 acres (8%) of the project area.

The Woodland PAGs are a Fire Regime I (frequent, low intensity, non-stand replacement fire) that burned in a mosaic pattern due to the sparse and patchy vegetation. The fires killed the sagebrush and juniper, and thinned out the ponderosa pine trees, effectively maintaining open grasslands and pine savannahs.

Pre-Fire Stand Conditions

Western juniper stocking was at a greater density than it would have been under the natural fire regime, reducing the amount of open grasslands and forage. The scattered open grown ponderosa pine was being overcrowded by juniper and young ponderosa pine and was declining in vigor. Formerly open grasslands had become dominated by sagebrush.

Post-Fire Stand Conditions

The sagebrush dominated portions of these PAGs burned in a mosaic pattern depending on vegetation patterns and fire behavior. The stands that contained stands of juniper or ponderosa pine generally burned with high mortality due to the lack of fire tolerance by juniper and the overstocked conditions in the encroaching pine trees. There were a few juniper or ponderosa pine patches that did not burn due to their isolated locations.

Hot-Dry Plant Association Group

The lower elevations (3,000-4,500 feet) on south and west facing slopes generally contain plant associations of the hot-dry plant association group. These associations cover approximately 240 acres (3%) of the project area. The driest sites were occupied by scattered western juniper and ponderosa pine. Slightly more moist areas supported nearly pure stands of ponderosa pine. These associations contained primarily ponderosa pine, as well as occasional Douglas-fir, western juniper, and groups of quaking aspen entering the stands from adjacent wetter areas.

The Hot Dry PAG is a Fire Regime I (frequent, low intensity, non-stand replacement fire). Trees typically grow in small even aged clumps ¼ to 1 acre in size in stands generally dominated by larger ponderosa pine and few understory trees and shrubs. Tree density is somewhat low, resulting in open stands and good growing room that maintains tree vigor. Mortality from fire is light and patchy; rarely is the whole stand killed. Natural reforestation of small patches is often good, but the large seed does not disperse very widely with the wind. Ponderosa pine seed crops are infrequent, occurring 3 to 8 years apart.

Pre-Fire Stand Conditions

Many of these stands were harvested and the advance natural regeneration is now 60-80 years ago. Since then, the majority of them were precommercial thinned (removing excess trees less than 7" in diameter). Though some stands were commercially thinned in the last 20 years, many of these stands were growing at twice the density than they would have under the natural fire regime. This contributed to the intensity of the Flagtail Fire and to increased mortality. Bark beetles and dwarf mistletoe were at higher levels than would be expected under historical conditions, weakening or killing trees and adding to the fuel loads.

Post-Fire Stand Conditions

Approximately 230 acres burned with differing intensity in the Hot Dry plant association group. About half of the stands burned with high severity (90-100% mortality), and another third burned with (60-90% mortality). Nearly all of the trees were killed in the high fire intensity areas. In the moderate and low intensity fire areas there was variable mortality and many of the surviving trees were damaged.

Warm-Dry Plant Association Group

The mid-elevations (4,500-5,500 feet) on south slopes and north and east facing slopes at lower elevations generally contain plant associations grouped in the warm-dry plant association group. These areas contain plant associations with seral ponderosa pine and climax Douglas-fir or grand fir and cover approximately 5660 acres (80%) of the project area. Western larch was a component in many of these stands, as well as incidental amounts of lodgepole pine.

Generally, the Warm Dry PAG is a Fire Regime I and are as described for the hot-dry biophysical environment, with a slightly longer return interval and more patches of mortality scattered through the stands.

Pre-Fire Stand Conditions
Many stands were partial harvested starting about 60 years ago. More recently, partial removal and limited regeneration harvest occurred in some stands. In general, fire exclusion and harvest of mature seral species trees led to an increase in Douglas-fir and grand fir species, an increase in fuel levels, and greater stand densities. These conditions led to higher fire intensity and greater tree mortality. Bark beetles and dwarf mistletoe were at higher levels than would be expected under historical conditions, weakening or killing trees and adding to the fuel loads.

Post-Fire Stand Conditions
As with the hot dry stands, about half of the warm dry stands burned with high severity (90-100% mortality), and another third burned with (60-90% mortality). Approximately 5080 acres burned with high to moderate intensity in the Warm Dry plant association group. Many of the Douglas-fir and grand fir found in these stands were killed by fire. A few of the larger, thicker-barked Douglas-fir and grand fir may survive; many of the large ponderosa pine are not expected to survive due to the deep bark scale piles at the base of the trees, especially those with poor crown ratios. The deep litter piles around the bases of the ponderosa pine burned or smoldered for long periods of time killing the cambium.

Cool-Dry Plant Association Group

These areas contain lodgepole pine plant associations and cover about 280 acres (4%) of the project area. They occur throughout the upper elevations and in the colder basins and areas of flat topography that form frost pockets. These associations mostly contain dense, even aged lodgepole pine stands, with minor components of ponderosa pine, western larch, grand fir, and Engelmann spruce.

The lodgepole pine associations are generally a Fire Regime III (moderate frequency, mosaic pattern). Often the patches that burn are high severity, stand replacement fire. Trees grow close together and form dense stands subject to stagnation and bark beetle attacks that often result in high mortality. Stands burn with great vigor due to the heavy fuel loads, usually resulting in complete mortality.

Pre-Fire Stand Conditions
In the last 20 years, regeneration harvests have taken place within some of these areas. Tree density was high in younger stands, but older stands were becoming more open due to high mortality rates from disease and insect infestations (mountain pine beetle in lodgepole and spruce budworm and fir engraver in grand fir), which created an abundance of standing and downed fuel. Most stands burned with high to moderate severity, which was within the historical fire regime.

Post-Fire Stand Conditions
In the Cool Dry plant association group, approximately 260 acres burned with moderate to high intensity. In a few areas creeping ground fire burned in a mosaic, leaving some islands untouched. Lodgepole are not expected to live because of bole scorch due to their very thin bark. Smaller diameter grand fir and Douglas-fir are also not expected to survive. Though most trees in this area are not fire tolerant species, some may survive because they sustained very little scorch or were missed by the fire.

Table FV-I displays the amount of each Plant Association Group that burned and the severity to the trees. The predictions of mortality were determined following the recommendations in "**Factors Affecting Survival of Fire Injured Trees: A Rating System for Determining Relative Probability of Survival of Conifers in the Blue Mountain and Wallowa Mountains**", Scott, et al., 2002.

Table FV - I: Burn SeverityAcres by Plant Association Group

Plant Association Group	No Burn	Acres Burned	Low Severity (30-60% mortality)	Moderate Severity (60-90% mortality)	High Severity (90-100% mortality)
Hot Dry	10	230	20	90	120
Warm Dry	140	5520	440	2210	2870
Cool Dry	20	260	-	100	160
TOTAL (Forested Areas)	**170**	**6010**	**460**	**2400**	**3150**

Note: Much of the Woodland PAGs burned in a mosaic pattern with variable mortality.

Living Trees

Areas of living trees are found around the fire perimeter and in the southwest portion of the fire where the fire was not wind driven and slowed and burned with less intensity. Some are also scattered throughout the fire, usually in areas of low fuels, flat topography, lower stand density, and in stands of fire tolerant species. These factors contributed to reduce the local fire intensity.

Within the fire perimeter, approximately 3150 acres (51%) of forested areas burned with high severity to the vegetation, killing virtually all trees in those stands. There is no stand structure remaining except charred boles. Standing snags and downed logs were largely consumed.

Approximately 2400 acres (39%) of the forested area burned with moderate severity to the vegetation, some western larch and ponderosa pine are expected to survive, while the balance of trees in these stands will die of basal, root, or crown scorch. Stand structure remains in the scattered large overstory trees, but stands will be very open. Many snags and downed logs were consumed.

Approximately 460 acres (7%) of forested acres burned with low severity to the vegetation. These stands are generally second growth ponderosa pine stands with the appearance of an underburn. However, mortality is generally between 30 and 60% of the stand due to basal scorching caused by a long-lasting smoldering type of ground fire.

About 170 acres (3%) of the forested area did not burn, mostly in riparian areas.

Live, fire-injured trees already weakened by overcrowding, disease, or insects may die within the next two or three years. The effects of secondary insect attacks on fire-injured trees are expected to be variable. Some localized mortality is likely, particularly bark beetles in fire damaged Douglas-fir 15”dbh or larger, and low vigor ponderosa pine trees.

Pattern of Surviving Trees

In the Jack Creek subwatershed, the northern portions burned with high intensity wind driven crown fire, resulting in near total mortality. The eastern portion burned with less intensity, it was mostly a backing ground fire here. In some areas along the –011 and –017 roads portions of the fire line were burned out during fire suppression efforts to reinforce the fire line. The mortality in this area was less, ranging from 30 to 90%. In the southern portion fire intensity was mostly ground fire with some pockets of crown fire, which resulted in variable mortality. Along the ridge that divides the Jack Creek and Snow Creek subwatersheds, crown fire was prevalent, resulting in total mortality in many areas.

In the Snow Creek subwatershed, the northern and central portions burned with high intensity wind driven crown fire resulting in near total mortality. In the southern portion fire intensity was variable, mostly ground fire with some pockets of crown fire, which resulted in mortality from 30-90%. The western and southern portions along the fire line were burned out to secure the line during suppression efforts.

In the Hog Creek subwatershed very little area burned, the fire started on the east side of this subwatershed and was pushed by winds to the east and north. In one area to the south of the fire origin, the fire jumped the fire line and backed down off the ridge. Fire intensity was generally moderate with some hot spots, resulting in variable mortality levels.

In the Keller Creek subwatershed, fire intensity was moderate, with mortality ranging from 30-90%, depending on species distribution.

Table FV - II displays the amount of each subwatershed that burned and the severity to the trees.

Table FV - II: Subwatershed Acres Burned

Subwatershed	Total SWS Acres	SWS Acres Within Flagtail Fire	Forested Acres Burned	Low Severity (30-60% mortality)	Moderate Severity (60-90% mortality)	High Severity (90-100% mortality)
Jack Ck. 60507	10230	3090 (30%)	2470	430	1100	940
Snow Ck. 60509	6280	3350 (53%)	3010	-	960	2050
Hog Ck 60511	5940	260 (4%)	290	10	180	100
Keller Ck. 60515	7830	420 (5%)	240	20	160	60
TOTAL	**30270**	**7120 (24%)**	**6010**	**460**	**2400**	**3150**

Insects and Disease In Live Trees

Some of the remaining live trees have been fire damaged and are at greater risk to die within the next two or three years from drought, disease, and insects. Some localized mortality is likely, particularly bark beetles in fire damaged Douglas-fir 15”dbh or larger, and low vigor ponderosa pine trees. Live trees are found in stands that burned with low or moderate severity, about 2860 acres, and in areas that did not burn, which total 170 acres.

Ponderosa pine

Insects can be expected to attack trees weakened by the fire or growing in a weakened condition prior to the fire. Ips beetles colonize freshly killed trees and, if the populations build up to epidemic levels, can spill over into remaining live trees. Western and mountain pine beetles attack weakened trees and can also spread into nearby stands. Damaged trees often undergo drought stress that can cause a reduction of pitch pressure, which is their defense against bark beetles. Annual volume of mortality to bark beetles in the three years following a fire rises 300-1,400 percent from pre-fire levels.

Don Scott, Lia Spiegel, and Craig Schmitt, Blue Mtn. Zone Entomologists and Pathologist for the Forest Service, visited the Flagtail Fire and concluded that ponderosa pine with less than 20% remaining live crown ratio are highly susceptible to later mortality. Trees that had poor vigor prior to the fire are at great risk, with 30% or less live crown ratio. Bole scorch level is a significant factor; especially older trees with mounds of bark scales around the base that burn for a long time and partially girdle the trees.

Turpentine beetles were found in the base of ponderosa pine trees within a month of the Flagtail Fire, but are not expected to kill remaining live trees. Dwarf mistletoe in ponderosa pine will continue to weaken trees that survived the fire. Mistletoe increased the flammability of individual trees and increasing tree mortality and reducing the overall incidence of mistletoe in the area.

Douglas-fir
Douglas-fir bark beetles are expected to spread widely and attack fire-injured trees, eventually killing most trees with intermediate or heavy fire damage. Studies have shown that Douglas-fir bark beetle infest 80-90 percent of Douglas-fir with greater than 20 percent crown scorch. Don Scott, Blue Mtn. Zone Entomologist for the Forest Service, predicts beetle activity in Douglas-fir trees greater than 15"dbh that sustained moderate to severe fire damage. Dwarf mistletoe in Douglas-fir will continue to weaken trees that survived the fire. Mistletoe can be a serious disease of Douglas-fir, forming large brooms which reduce growth and eventually weaken the tree. Mistletoe increased the flammability of individual trees and increasing the amount of mortality to the infected trees, which will greatly reduce the overall incidence of mistletoe in Douglas-fir.

Western larch
There are few insect or disease problems in western larch. Mistletoe is the one exception and can cause decline and eventual mortality due to the mistletoe infected branches becoming so heavy they break off, stripping the branches off of the bole of the tree. Mistletoe also increases the fire mortality of the infected trees, which usually results in an overall reduction in the incidence of mistletoe with periodic burning.

Grand fir
Grand fir is host to many insect and disease pests. Spruce budworm attacks will likely be reduced due to the lack of host trees, a more open and thus warmer environment, and the lack of a multi-story forest structure. Fir engraver is not as aggressive as the Douglas-fir bark beetle, but can cause mortality to true fir trees with heavy damage. Grand fir infected with heart rots or root rots are more likely to succumb if weakened by fire damage. Fire scars on trees not killed by the fire will be entry points for disease and insects, which can cause future damage and mortality.

Lodgepole pine
Most of these stands burned completely and will have no insect or disease problems, other than root diseases that could infect new tree roots. The main pathogen is bark beetles in stagnated lodgepole pine stands.

Shade

Shade at any one time generally covers 30-70 percent of the ground in conifer stands. In the intensely burned areas, shade has been reduced to between 5 and 20 percent. This has increased the amount of solar radiation reaching the ground; the resulting higher temperatures have changed the microclimate for plants. Vegetation that is well adapted

to warmer temperatures and full sunlight will benefit compared to vegetation that grows in shade and desiccates rapidly. This will favor ponderosa pine, western larch, and lodgepole pine establishment over grand fir and Douglas-fir. In addition, the amount of ground vegetation and shrubs will increase compared to that which existed under the closed forest conditions prior to the fire.

The shade that crosses the forest floor as the shadows of trees follow the position of the sun through the day cover a much greater portion of the ground that the numbers shown above. This transient shade has been shown to be adequate to reduce drought stress in tree seedlings.

Stand Structural Stages

The structural stage classifications used here are consistent with the terms and methods used in the Interior Columbia Basin Ecosystem Management Project. Information on pre-fire stand structures and biophysical environments were derived from the Upper Silvies Watershed Assessment. Additional stand delineation refinement was done in the Fall of 2002 as part of the Malheur NF aerial photograph interpretation contract.

The structural stages used are:

SI – stand initiation
SEOC – stem exclusion open canopy
SECC – stem exclusion closed canopy
UR – understory reinitiation
YFSS – young forest single story (not an ICBEMP stage, used here to identify the difference between smaller sized SEOC stands and those that are 15"DBH or larger)
YFMS – young forest multi-story
OFSS – old forest single story
OFMS – old forest multi-story.

The objective of the proposed activities is to only salvage dead trees and will not have any further change on the existing post-fire structural stages. Therefore, Regional Forester's Forest Plan Amendment #2 does not require an analysis for structure stages. (This revised interim direction applies all timber sales except salvage sales, etc.) The existing and historic range of structural stages is displayed for informational purposes only.

Future structural stages are shown in the Environmental Consequences section to show the effects of the lag between planting and natural reforestation has on future forest stage development and other resources, such as future wildlife habitat and the gap between snag fall down and the time to grow new large diameter trees.

Table FV - III shows the range of structural stages believed to have existed before settlement by Euro-Americans. Information is derived from Powell, 1998, Umatilla National Forest, who did an analysis in cooperation with the Blue Mountain Area Ecologist and Malheur, Umatilla, and Wallowa-Whitman National Forest Silviculturists.

Table FV - III: Historic Range of Structural Stages in Blue Mtns.

PAG	SI	SEOC	SECC	UR	YFMS	OFSS	OFMS
Hot-Dry	5-15%	5-20%	0-5%	0-5%	5-10%	20-70%	5-15%
Warm-Dry	5-15%	5-20%	1-10%	1-10%	5-25%	15-55%	5-20%
Cool-Moist	1-10%	0-5%	5-25%	5-25%	40-60%	0-5%	10-30%
Cool-Dry	5-30%	0-5%	5-35%	5-20%	5-20%	1-10%	1-20%

The following assumptions were used to assess the current condition:

- Burned areas with more than 90% tree mortality are now in the Stand Initiation structural stage
- Areas that burned with 60-90% tree mortality area considered to be Understory Reinitiation
- Areas that were previously Old Forest Multi Strata or Young Forest Multi Strata that burned with 30 to 60% tree mortality are considered to be Understory Reinitiation
- Areas that were previously Stem Exclusion Open Canopy that burned with 30 to 60% tree mortality are considered to still be Stem Exclusion Open Canopy.

Table FV - IV shows the current condition (post-fire) of the stand structures on National Forest lands in each biophysical environment within the Flagtail Fire perimeter.

Table FV - IV: Stand Structural Stages, Flagtail Fire Project Area

PAG	SI	SEOC	SECC	UR	YFMS	OFSS	OFMS
Hot-Dry	35%	45%	-	19%	1%	-	-
Warm-Dry	54%	9%	-	36%	.5%	-	.5%
Cool-Dry	77%	1%	-	20%	2%	-	-

Tables FV - V, FV - VI, FV - VII and FV - VIII show the current condition of stand structures in each subwatershed after the Flagtail Fire. The subwatershed areas include the whole subwatershed, including both burned and unburned areas.

Table FV - V: Jack Creek (60507)

PAG	SI	SEOC	SECC	UR	YFMS	OFSS	OFMS
Hot-Dry	4%	69%		8%	18%		
Warm-Dry	27%	26%	9%	23%	6%		9%
Cool-Dry	60%			40%			

Table FV - VI: Snow Creek (60509)

PAG	SI	SEOC	SECC	UR	YFMS	OFSS	OFMS
Hot-Dry	12%	57%		31%			
Warm-Dry	49%	10%		27%	11%		3%
Cool-Dry	85%			13%	2%		

Table FV - VII: Hog Creek (60511)

PAG	SI	SEOC	SECC	UR	YFMS	OFSS	OFMS
Hot-Dry		100%	%	%	%	%	%
Warm-Dry	3%	11%		4%	59%		23%
Cool-Dry	3%	14%			83%		

Table FV - VIII: Keller Creek (60515)

PAG	SI	SEOC	SECC	UR	YFMS	OFSS	OFMS
Hot-Dry		26%		17%	57%		
Warm-Dry	16%	36%	1%	20%	2%		25%
Cool-Moist					59%		41%
Cool-Dry					100%		

Environmental Consequences

Forest Vegetation

Introduction

The effects of the Flagtail Fire on the vegetation were discussed in the Affected Environment section. This section evaluates the effects of the proposed salvage, fuel treatment, and reforestation activities proposed in each alternative on existing and future characteristics and patterns of tree vegetation.

> *Note: All acres in this section are approximate and are generally rounded off to the nearest 10 acres.*

Table FV - IX Acres of Salvage Harvest by Forested Plant Association Groups

	Woodland (Juniper)	Hot, Dry	Warm, Dry	Cool, dry	Total
Flagtail Fire Total Acres	590	240	5660	280	**6770**
Alternative 1 (No Action)	0	0	0	0	**0**
Alternative 2 (Proposed Action)	0*	710	3520	120	**4350**
Alternative 3 (Increased Snags)	0*	550	2270	50	**2870**
Alternative 4 (Plant Only)	0	0	0	0	**0**
Alternative 5 (Historic Snag #s)	0*	640	3030	70	**3740**

*Woodlands within harvest units are inclusions within the other PAGs and are not planned for salvage.

Living Trees

Insects and Disease In Live Trees

Direct and Indirect Effects

Effects Common to All Alternatives (incl. No Action)

Live trees are found primarily on approximately 2860 acres in stands that burned with low or moderate severity, in the 170 acres that did not burn, and in the forested areas surrounding the Flagtail Fire. Many of the remaining live trees have been fire damaged and are at greater risk to subsequent loss from drought, disease, and insects.

Dead trees can provide habitat for insect buildups that can then cause additional mortality in nearby live trees. There can be a big brood of insects the first season after a fire that then falls off as the source of freshly killed trees diminishes. The second and succeeding years generally have lesser insect outbreaks. Immediate salvaging (before the next summer) of infested trees prior to the insects dispersal to nearby live trees can reduce the risk of additional mortality.

Due to the length of time to analyze the fire area and prepare this NEPA document, it is not possible to salvage trees this summer. However, salvaging trees after the first season may result in a small decrease of insect activity and mortality in surrounding live trees in the succeeding years. Alternative 2, which leaves the least number of dead and dying trees, has a slightly lower risk for additional mortality. Alternative 3 leaves approximately 50% more of the dead and dying trees, 1470 acres not salvaged and more snags [13 snags per acre], compared to Alt. 2 and this would place the remaining live trees at proportionately more risk. Alternative 4 is essentially the same risk as No Action, as insects generally prefer the larger trees that would be left. Alternative 5 leaves approximately 25% more of the dead and dying trees, 605 acres not salvaged and more snags [2.39, 7 or 13 snags per acre], compared to Alt. 2 and this would place the risk to the remaining live trees between Al. 2 and Alt. 3.

Cumulative Effects

Rapid salvage of fire killed trees on private lands and the roadside hazard trees on the National Forest that were removed under a CE prepared for that project will have a slight beneficial effect on reducing insect population buildups and spread into the remaining live trees in and near the Flagtail fire. These trees were mostly removed during the fall of 2002 and winter of 2003 before any movement of insects could happen this next spring and summer. The total number of trees removed is less than 1% of the number of fire-killed trees, so the total beneficial benefit is very slight.

Fire Hazard to Live Trees

Direct and Indirect Effects

Effects of No Action

Under this alternative, no salvage would take place. The lack of dead tree salvage will result in an increased fire hazard to the remaining live trees as the dead trees fall down over the next few years. The high fuel loadings would result in any fire after 10 years from now being a high intensity fire that could kill most of the natural regeneration and many of the remaining live trees.

Effects Common to All Action Alternatives

In all alternatives, trees expected to survive the fire are to be left, except for safety concerns and as necessary to facilitate harvest systems. The alternatives that harvest more snags reduce the future fire hazard more than the alternatives that harvest less. Alternative 2 harvests the greatest number of dead trees and reduces the future fire hazard

to the remaining live trees the most. Alternatives 3 and 5 harvest a smaller portion of the area that Alternative 2 harvests, and also leave higher numbers of snags for wildlife so they have a future fire hazard higher than Alternatives 2 but substantially lower than Alternatives 1 and 4. Alternative 4 treats the small fuels (<8 inches) but does not harvest any commercial sized dead trees. The future fire hazard in the flashy small fuels is reduced, but the fire intensity due to the large fuels that will remain is similar to the No Action alternative.

Cumulative Effects

The salvage of fire-killed timber on private lands is mostly complete and has reduced the fuels levels to safe amounts. Other projects to be accomplished under CE documents include riparian fuel treatments that further reduce the fire hazard.

Shade and Microclimate

Direct and Indirect Effects

Effects of No Action

Under this alternative, no salvage or reforestation would take place. Existing shade would remain at current levels. It would gradually decrease in the short term as the dead trees fall. The microclimate of the burned landscape will exhibit greater extremes in temperature, wind, and moisture than pre-fire conditions. Standing dead and downed trees will buffer this environment somewhat, as will the re-growth of shrubs and ground vegetation. However, conifer forest capable of providing shade and cover will not return for several decades longer than the Action Alternatives.

Effects Common to All Action Alternatives

Salvaging will decrease shade to approximately 4-10 % in the most intensely burned areas. The amount of shade will vary slightly by alternative, as the amount of material retained for snags will vary by alternative. More rapid reforestation by planting with the action alternatives will result in a quicker return to more shade and cover than the No Action alternative. Artificial shade is not needed for successful reforestation, stocking surveys done in planted fire-killed strands show no significant difference between areas that were salvaged and not salvaged.

Cumulative Effects

The reduction of noncommercial sized fuels in riparian areas will further decrease shade and cover in the short run, but the reforestation of riparian areas will speed the return to forested conditions.

Reforestation

Approximately 6010 acres of forestland burned in the Flagtail Fire. About 460 acres burned with low mortality and are adequately stocked. About 5550 acres burned with moderate or high severity, of which 580 acres is Woodlands (juniper), leaving 4970 acres to be reforested. Approximately 380 acres were planted in Spring 2003 under another NEPA document, leaving 4590 acres to be documented in this EIS. Approximately 300 acres are expected to reforest naturally, the remaining 4290 acres will need to be planted to meet reforestation objectives.

Following are discussions of areas planned for natural recovery and where planting is recommended in the Action alternatives.

Natural Recovery Areas

Direct and Indirect Effects

Effects Common to All Alternatives (Incl. No Action)

Under all alternatives, planting will not take place in forested areas that still have adequate stocking of live trees; in lodgepole pine stands; and in woodland (juniper) areas.

Forested Areas that have Adequate Stocking

Forested areas that burned with low intensity often have substantial numbers of live trees remaining. With their continued survival, the number of live trees is sufficient to meet management objectives on the site without artificial reforestation.

Small patches of trees, less than an acre or two, have been killed within these stands of live trees. Natural reforestation of these small patches is expected to be successful because there are abundant remaining seed sources, a mineral soil seedbed in many spots, and a brief lapse in vegetative competition. Though ponderosa pine seed is large and does not disperse well with the wind, seed crops are fairly frequent and successful reforestation can be expected in 10 years within 800 feet of seed trees.

Approximately 460 acres burned with low intensity; ground vegetation in these areas will increase in diversity due to small-scale variations in the burn intensity and its effects on the vegetation. The species have fire adaptations and are expected to increase in the years following the fire: Other species will decrease. In general, bunch grasses and non-sprouting shrubs will decrease, while sprouting shrubs and sod-forming grasses will increase.

Sufficient ponderosa pine, and western larch trees larger than 12 inches in diameter are expected to survive in these areas to meet the minimum desired stocking. Smaller trees and many of the western juniper and Douglas-fir have been killed. The remaining live trees will probably have short-term decreases in growth, depending on the level of damage they sustained. Stand conditions will be more open, and within a decade, growth will probably increase due to the decreased competition from fire-killed trees.

Lodgepole Stands
Complete regeneration of lodgepole areas that burned with high intensity is very likely within several years due to availability of seed sources and exposure of a seedbed. Vegetative competition could delay seedling establishment. Lodgepole pine, western larch, and ponderosa pine are the species most likely to regenerate. Lodgepole pine and western larch produce abundant lightweight seed that is easily dispersed and exhibit rapid juvenile growth, thus they are likely to dominate early succession.

Woodland (Juniper) Plant Association Groups
Sparsely forested or non-forested areas will not be reforested as they naturally had a low stocking of conifers. Typical was savannah conditions with widely scattered large ponderosa pine and grasslands that were maintained by frequent low intensity fires. Scattered conifer trees, mostly ponderosa pine, would be expected to be able to become established in micro-sites that the fire has made suitable for seed germination. Establishment and survival are expected to be low, resulting in the desired savannah conditions that were historically typical for this biophysical environment. Anticipated future prescribed burning would limit establishment of juniper or sagebrush on these sites, increasing the extent of grasslands.

Planting Areas

Direct and Indirect Effects

Effects of No Action (Natural Reforestation)
Approximately 4590 acres remain in need of reforestation. There are approximately 1440 acres that are in need of reforestation that contain living trees, and the 800' seed dispersal band around live trees contains another 1900 acres. The total area expected to naturally reforest within 2 decades totals 3340 acres (about 73% of the area to be reforested).

Natural reforestation depends on many factors. These include: existing seed "banked" in the soil and duff layer, seed dispersal from nearby trees, cone serotiny, seed viability, germination, and seedling survival and growth. All these factors are greatly affected by the Flagtail Fire. Buried seeds remain in the soil for a short time. Most reach conditions suitable for germination the spring after dispersal or are soon eaten by animals. In areas with high tree mortality, virtually the entire duff layer was consumed, killing any seed in the soil. It is possible that some very limited protected areas could contain viable seed, but in very small quantities.

Seed dispersal depends on location and distribution of seed sources (live trees, buried seed, or serotinous cones), seed production of those sources, and dispersal by gravity and wind. In the Flagtail Fire the areas of high tree mortality generally have gaps of 4,000-8,000 feet between live trees (seed sources).

Serotinous cones store seeds up to 30 years in cone scales held shut by resin. Lodgepole pine is the only species in the project area known to have cone serotiny; however, lodgepole pine serotiny is uncommon in the Pacific Northwest. Only scattered small

populations or individuals with cone serotiny are known in northeastern Oregon. It is possible that some seed may remain in partially serotinous lodgepole pine cones, but it would be in small quantities and of very limited distribution. Nevertheless, lodgepole pine is a prolific seeder after fire and monitoring of other fires has shown that lodgepole sites rarely need planting on the Malheur NF unless other species are desired.

Seed production of the remaining live trees will affect natural regeneration. Some seed is produced nearly every year on nearly every site, but small seed crops have low viability and very high predation by animals and insects. Large seed crops are needed for significant levels of natural regeneration. These occur periodically, depending on tree species, climatic conditions, and unknown factors. Partial girdling of the bole can increase seed production. For this reason, there may be an increase in cone production of live trees in the project area that had partial bole scorch.

Minimum seed-bearing age of conifer species in the project area is 12-20 years, there are 2-10 years between large seed crops, and seed dispersal distance is 400-800 feet, tapering off at longer distances. All these factors influence the rate of natural reforestation.

Germination depends on qualities of the seed, as well as microclimatic conditions of the seedbed. The quality of the seedbed is a primary factor in natural regeneration. Mineral soil is the best seedbed for most species. Moist, shaded conditions and coarse textured soil or small depressions improve germination by retaining moisture. In the project area, seedbed conditions are expected to be good to excellent for the next 2-3 years, as burning of seedbeds generally improves germination. However, hot, dry conditions may limit germination and seedling survival. Within five years, grass, forbs, and shrubs are expected to have occupied the non-forested areas to the point that mineral soil contact will be limited. Seed must survive the great likelihood of consumption by animals, insects, and fungi to germinate.

Given the conditions for seed dispersal and seedling survival, rates of natural regeneration will vary considerably. Spatial analysis of seed dispersal around surviving trees was used to predict rates of natural reforestation. Stands that contain live trees are located in and around the perimeter of the fire. This includes, 170 acres that did not burn, 460 acres of low severity, and 2400 acres of moderate severity within the fire. Seed fall is greatest under live trees and tapers off with increasing distance. Beyond 800’ seed fall is generally too light to achieve adequate natural reforestation. Therefore, the seed dispersal zone is considered to be the areas in the 800’ band around stands of live trees and the stands of live trees themselves.

The area beyond the 800’ seed dispersal zone of high mortality totals 1250 acres (about 27% of the area to be reforested) and is expected to naturally reforest within 2 to 5 decades. This would be accomplished by gradual seed dispersal by strong winds and animals, and by seed from second-generation seed crops from trees that are growing up in the original seed dispersal zones. Ground vegetation will be very dense and seedling establishment will be more difficult due to the vegetative competition. These areas may not be fully stocked with 100 trees per acre for up to fifty years.

The need to fully reforest the project area will not be met through the No Action alternative, as it will take up to 50 years longer. This would directly, indirectly, and cumulatively affect future vegetation patterns across the landscape, affecting many ecosystem functions and resource values.

Effects Common to all Action Alternatives

Approximately 4290 acres is proposed for planting, and 300 acres by natural reforestation, in all of the action alternatives. The units in Alternative 2 that were dropped between the Draft and Final EIS are to be reforested by planting; as are the areas not salvaged in Alt. 3, 4, or 5.

In 2003 approximately 380 acres deforested by the Flagtail Fire were planted with tree seedlings that were already being grown in the nursery. This includes about 190 acres of forested riparian areas and 190 acres of south facing uplands that are planned for helicopter yarding. These were analyzed in the 2003 Planting CE, a separate NEPA decision document.

In 2004 another 200 acres of trees already being grown in the nursery are anticipated to be available for planting in the Flagtail Fire area. Seed will be sown in the springs of 2003 and 2004 to grow seedlings to plant approximately 2160 acres each year in 2005 and 2006.

Table FV - X displays the number of acres to be planted in each of the 4 years after the fire.

Table FV - X Planned Reforestation by Year

Year	Riparian Planting Acres	Upland Planting Acres
2003	190* (documented in 2003 Planting CE)	190* (documented in 2003 Planting CE)
2004	0	200*
2005	0	2045
2006	0	2045
Total	**0** (documented in this EIS)	**4290** (documented in this EIS)

* Planting in 2003 and 2004 is with trees sown in the nursery before the Flagtail Fire. Bare root seedlings normally take 2 years to grow in nursery beds before outplanting.

Survival of planted trees is expected to be sufficient to stock these areas. Natural regeneration will supplement planted trees in those areas where it occurs, and will be the only reforestation method in some areas, such as lodgepole stands.

Species, Stock Type, and Spacing

In all action alternatives, pre-planting surveys would be done to assess site-specific conditions of each planting area. The surveys will identify the site specific conditions described below for following the recommendations to select the appropriate species, stock type, spacing, planting method, and seedling protection for each area.

Conifer species appropriate to each site will be planted.

- Ponderosa pine is to be planted on Hot Dry sites
- A mix of ponderosa pine, Douglas-fir, and western larch on Warm Dry sites
- Western larch, western white pine, and lodgepole pine in the Cool Dry sites

Most of the seedlings will be two-year old bare-root stock. On dry, rocky areas, one-year old container grown ponderosa pine may be planted. Seedlings will be grown from seed collected within the seed zone that includes the Flagtail Fire, from the elevation band appropriate for the site. Genetic diversity will be higher in planted areas than those that naturally regenerate from the limited number of live trees that remain.

Spacing will be:

- 15' x 15' in units in the Hot Dry PAG
- 13' x 13' in units in the Warm Dry PAG
- 11' x 11' in units in the Cool Dry PAG

These spacings are designed to allow the trees room to grow without needing precommercial thinning to maintain adequate growth rates. This is wider than normal spacing, and will allow for more natural ground and shrub vegetation to become established. The desired stocking levels in 5 years is to be 150 trees per acre on Hot Dry sites and 180 trees per acre on Warm Dry and Cool Dry sites. Non-reforested areas up to one acre in size are permissible, to provide diversity and wildlife forage. Some planting before salvage logging is planned for this project, primarily in helicopter logged units, and has been successful in the past on the Summit and Reed Fires.

Seedling Survival
Seedling survival is sampled, at a minimum, on the first and third year after planting by sampling every acre of planted area.

Seedling mortality on the district is primarily due to drought stress, competing vegetation that exacerbates drought stress, pocket gopher damage, and big game and livestock damage. Seedling survival averages 65 percent for the Malheur N. F. Planting spacing takes this into account in order to achieve fully stocked stands into the future. Failure of planted areas on the Blue Mountain Ranger District is less than 5%.

Reforestation survival in this project area is expected to be close to the 65 percent average if planting is accomplished within 4 years. If it is delayed beyond then, animal damage and competing vegetation may become a problem and animal damage protection measures and control of competing vegetation may be necessary to achieve adequate survival.

Monitoring
All areas planned for tree planting will be examined prior to planting. Exams will assess levels of competing vegetation, pocket gopher activity, and other environmental conditions. Seedling species and stock type will be prescribed as well as site preparation, planting, and protection methods. Any changes from methods prescribed in this document will require additional NEPA analysis.

Planted areas will be monitored for seedling survival, growth, and damaging agents. Stocking surveys will occur periodically until planting areas are certified adequately stocked and "free to grow". Deficient areas will be replanted to at least minimum stocking. Protection measures may be implemented to increase tree survival.

Cumulative Effects

There are approximately 380 acres that will be planted in the project area in 2003, utilizing available tree seedlings. These were analyzed in a CE signed in 2003 and involve 190 acres in riparian areas and 190 upland acres judged to benefit from prompt planting with conifers to reduce the need for competing vegetation control.

The nearby private lands that were deforested by the Flagtail fire will need to be reforested to meet the Oregon Forest Practices Act requirements.

Competing Vegetation

Natural revegetation by native species is an important process in the recovery of the fire area. Early seral and fire adapted species will respond to the open conditions and rapidly regenerate, providing valuable ground cover. Several species, though a natural part of the post-fire recovery, have the potential to respond so aggressively that they compete for site resources resulting in reduced growth and survival of forest trees.

Competition between vegetation for site resources can result in reduced growth and survival of forest trees. It is often the most important factor limiting conifer regeneration in the Inland Northwest. Seral shrubs and forbs have the ability to rapidly occupy open sites caused by fire or other disturbances. They seed in or sprout from roots to quickly occupy the site and their rapid growth rates develop crown volumes that far exceed that of young conifers. Snowbrush ceanothus, pinegrass, and elk sedge are seral plants that have the capacity to rapidly colonize burned sites and they can provide serious competition to tree seedlings.

The effect of the fire has been to greatly reduce the ground vegetative competition, especially in areas that burned severely and killed the grass roots. The vegetation coverage will increase for the next several years as grass and other ground vegetation resprouts and seeds in. Planting within 4 years of the fire is expected to allow the tree seedlings to become established before the ground vegetation becomes a serious competitor.

Thresholds for Competing Vegetation and Site Preparation
Treatment is often necessary if the threshold levels displayed in Table 3 are exceeded for all or a portion of the unit. Based on experience reforesting other burned areas on the Malheur NF, it is not expected that these thresholds will be exceeded in the Flagtail Fire. While they may be exceeded in some portions of the areas needing reforestation, the effect will be to create more structural diversity and wildlife forage than if all of the ground was reforested.

Table FV - XI Treatment Thresholds by Plant Association Groups

	Hot-Dry	Warm Dry	Cool-Dry
Slash (woody debris)	15 tons/acre	20 tons/acre	30-40 tons/acre
Pinegrass and Sedges	20% ground cover	30% ground cover	30% ground cover
Snowbrush Ceanothus	30% ground cover	30% ground cover	30% ground cover
Soil Compaction	20% of area	20% of area	20% of area

The above thresholds may be exceeded in small areas that do not exceed 2 acres in size and do not cover more than 10% of the total area.

Treatment Strategies
The Vegetation Management Plan emphasizes Prevention as the preferred method for managing competing and unwanted vegetation, followed, in order, by Early Treatment, Maintenance, and Correction.

Prevention
This is the preferred strategy. Prevention means to detect or ameliorate conditions that cause or favor competing or unwanted vegetation, but does not directly treat competing or unwanted vegetation. Use of natural controls that prevent competing and unwanted vegetation from reaching damage threshold levels is a key concept with this strategy.

Early Treatment
This means initiating action to control vegetation before the damage threshold is reached. Control in the early development stages is usually easier and can require fewer treatments.

Maintenance
This maintains the current condition, which is below the damage threshold, but can be expected to periodically exceed the threshold.

Correction
This is action taken after a damage threshold has been exceeded.

Direct and Indirect Effects

Effects of No Action

In this alternative, no additional planting would occur thus there would be no site preparation and no control of competing vegetation. Since no manual, mechanical, or herbicide control methods are planned, there would be no health or safety risks to forest workers or the public.

Effects of the Action Alternatives on Vegetation

In the Action Alternatives, the Flagtail Fire Recovery Project would plant approximately 4290 acres. By using the prevention strategy of planting within the next three years, no areas are expected to be over the threshold for corrective action to reduce competing sod grasses or ceanothus, thus no vegetative control treatments are prescribed.

Pinegrass and sedges

Pinegrass and sedges are expected to re-sprout on moderately and lightly burned areas. Growth and spread can be rapid since the roots are already established and other vegetation has been reduced. These sod-forming grasses provide excellent erosion control, and are important early and late season forage for deer and elk. However, they compete very effectively for moisture in the upper soil layers and can adversely impact both growth and survival of tree seedlings.

On intensely burned sites, grass roots will have been killed. Re-establishment of grasses will be much slower and will cover a smaller proportion of the ground area compared to less intensely burned areas.

Grasses compete very effectively for moisture in the upper soil layers and adversely impact both growth and survival of tree seedlings. Studies have shown that survival rates of tree seedlings are reduced to between 35-60 percent when grasses are not controlled, compared to survival rates of 60-80 percent when 50-70 percent of the grass is controlled. To achieve 60 percent survival of seedlings, grass had to be reduced to 40 percent of the previous coverage.

On severely burned sites, grass roots will have been killed. Re-establishment of grasses will be slower and have less coverage than less severely burned areas. The thresholds for grasses are less likely to be exceeded. Planting by 2006 (***prevention strategy***) is expected to be adequate to reforest severely burned areas. Areas that burned with moderate severity, and that occur on south or west aspects may come closer to exceeding the 30% ground coverage threshold, however, most of these areas had fairly dense overstories that reduced the amount of ground coverage before the fire. It will take several years for the grasses to become established to the point where they exceed the treatment thresholds. Therefore, these sites are not expected to need treatment for sod forming grass competition.

Snowbrush Ceanothus

Strongly associated with intense fire disturbances, snowbrush ceanothus can form dense, extensive, nearly impenetrable stands. These stands often last for 10-75 years, until

conifers overtop them. However, in dry or open sites, or where conifer regeneration is delayed, they may persist as a permanent component of the shrub layer. As they senesce, the large, flammable stands can contribute to the extent and intensity of wildfires, perpetuating a cycle of fire and regeneration. Snowbrush ceanothus can be an important browse species for deer and elk, especially in the winter. The seeds are food for small mammals, birds, and insects. Stands of ceanothus provide cover habitat for small mammals and birds as well. Ceanothus can fix atmospheric nitrogen, making it available for plant use in the soil.

Snowbrush ceanothus produces many small seeds that can remain dormant in the forest floor for 200-300 years. They require high temperatures to scarify the seed so that it germinates; giving them the ability to colonize even severely burned areas. Snowbrush ceanothus also re-sprouts vigorously from the root crown, giving it the ability to reoccupy moderately or lightly burned areas. Once snowbrush ceanothus becomes established, it is a serious competitor of young trees. It can overtop even rapidly growing seedlings, growing five feet tall within five years after disturbance. Despite the ability of snowbrush ceanothus to fix nitrogen, shading and competition for nutrients and water reduces conifer tree growth, negating any fertilizing benefits when coverage exceeds 30 percent.

All areas proposed for planting in the Flagtail Fire were analyzed to predict levels of competing vegetation. The greatest potential for establishment of ceanothus is in the grand fir/pinegrass and grand fir/elk sedge plant associations on south and west slopes in areas that experienced high intensity burning. Units were analyzed by their biophysical environment, aspect, and burn severity. No areas with a high potential to exceed the competition thresholds for snowbrush ceanothus are anticipated in the Flagtail Fire area. Planting by 2006 (***prevention strategy***) will be used to reduce the likelihood that ceanothus will seriously compete with the planted seedlings and reduce survival to unacceptable levels.

Subsoiling

Subsoiling is not planned for vegetation control; however it may be used to reduce existing soil compaction on approximately 100 to 150 acres of tractor yarded harvest units and on the 26 acres to be used as helicopter landings. It can be effective in reducing vegetative competition by breaking up the sod mat and reducing the amount of grass coverage. Subsoiled areas have a high likelihood of achieving the purpose and need to reforest the project area. Subsoiling is usually limited to only areas where the soil is compacted. Depending on the extent of soil compaction, the amount of the unit subsoiled is usually 20 to 50% of the total area. Subsoiling exposes and mixes soil, but experience has shown that there is little soil erosion due to increased infiltration rates and limiting subsoiling to slopes less than 30 percent. Exposed soil may increase the risk of noxious weed infestation. Forbs and grasses cover exposed soil within several years, so the introduction of noxious weeds by seed is limited to a short time period. The ground surface is altered with the formation of humps and furrows that last for several years, affecting the visual appearance and creating microclimates for vegetation growth.

Manual and Herbicide Control Methods

No manual or herbicide control methods are planned for control of either sod or ceanothus. There may be some nonforested areas within units, but it is expected to be in small, dispersed areas that total less than 10% of the area. Total future timber production will be less, but stand structural diversity will be increased and there will be more forage produced in the openings for wildlife and cattle. Reforestation success is expected to be similar to the historical average 65 percent survival rate after 5 years on the Malheur National Forest. This rate of reforestation would fully meet the purpose and need to reforest the project area.

Since no manual, mechanical, or herbicide control methods are planned, there would be no health or safety risks to forest workers or the public.

Cumulative Effects

No vegetation control treatments are planned for the Federal lands that are reforested, including the 380 acres to be planted in the spring of 2003 under a separate CE document; therefore there will be no additional cumulative effect from this project.

Animal Damage

Animal damage control is sometimes needed for prompt reforestation of burned areas to meet management objectives. Planting by 2006 (***prevention strategy***) is planned to reduce the need for animal damage control. As stated in the competing vegetation section, small nonforested areas (up to 2 acres in size) and totaling less than 10% of the area are acceptable. These areas can provide increased structural diversity and forage for wildlife and grazing animals. There would be small losses in the amount of timber produced.

Direct and Indirect Effects

Effects of No Action

In this alternative, no additional planting would occur thus there would be no site preparation or control of damaging animals. Since no manual, mechanical, or herbicide control methods are planned, there would be no health or safety risks to forest workers or the public..

Effects of the Action Alternatives

Big Game and Livestock Damage

Damage caused by deer, elk, and cattle in plantations usually consists of browsing on the top and upper branches, causing mortality, deformity, or growth losses in young trees. This is usually the most severe the first few years after a unit is planted, gradually tapering off as the trees become established. One-year old container stock is particularly susceptible to browsing the year of planting. In localized areas, especially near water sources or salting areas, cattle can cause trampling damage to seedlings. Because cattle grazing will be eliminated from the project area until vegetation recovers, damage from livestock will not occur during much of the seedling establishment period.

Big game browsing damage is expected to be moderate to low in the first years following the fire. The lack of forage and cover throughout much of the fire may reduce big game use of the area. Where deer and elk are present, planted container stock may sustain damage because other food sources are limited. As vegetation recovers, bringing in more deer and elk, browse damage may increase, but it is not expected to reach levels that require seedling protection, therefore protection from browsing animals is not proposed in any action alternative.

Porcupine Damage Control

Porcupines damage or kill young trees by clipping them or feeding on their bark. Damage usually occurs in conifer stands between 5-30 years old. On the Malheur NF, planted trees 2-15 years old have had severe localized porcupine damage and mortality in areas up to several acres in size. Preferred habitat is conifer forests with large roost trees and rock outcrops or large logs as dens.

The extent and severity of the fire has reduced preferred porcupine habitat to the few areas with tree survival. Seedling damage and mortality is not expected to be over thresholds, except in very limited areas, in the next five years. Therefore, it is not expected to impede progress toward reforesting burned stands. For this reason, porcupine damage control is not proposed in any action alternative.

Pocket Gopher Damage Control

Most pocket gophers probably survived the Flagtail Fire in their underground burrows. Because they cache vegetation in their burrows, some will survive the winter following the fire, when forage is absent. During the initial period of revegetation, the food base will be very limited and most gophers will relocate or starve. The population will slowly recover as grass and forbs increase, and animals return from adjacent intact habitat. Gopher populations are not expected to recover until two or three growing seasons following the fire, and it may take longer for them to repopulate the fire interior. With prompt planting it is anticipated that treatment thresholds will not be exceeded; therefore pocket gopher control is not proposed in any action alternative.

Since none of the types of animal damage are expected to exceed treatment thresholds, reforestation goals should be met. Planting within the next three years is expected to meet the purpose and need for reforesting the project area and the stocking certification requirements established in NFMA. There may be localized damage that results in non-forested openings of an acre or two, but if any occur, the openings will provide increased structural diversity and increased forage for wildlife and cattle grazing. There may be some loss of timber production if openings are greater than ¼ acre, but the cost savings of not doing animal damage control offsets the timber loss.

Replanting is not anticipated to be necessary, but may be utilized if tree survival is less than desired. Costs would probably be higher because forbs, grasses, and shrubs would be established and could compete with the newly planted seedlings for water and nutrients. Additional vegetation control for sod forming grasses or snowbrush ceanothus may be necessary. Pocket gopher populations could be re-established and require control.

Since no manual, mechanical, or herbicide control methods are planned, there would be no health or safety risks to forest workers or the public.

Cumulative Effects

No animal control treatments are planned for the Federal lands that are reforested, including the 380 acres to be planted in the spring of 2003 under a separate CE document; therefore there will be no cumulative effects.

Forest Stand Resiliency and Future Management

Woodland (Juniper) Plant Association Groups

Direct and Indirect Effects

Effects of All Alternatives

Woodlands may occur as inclusions within Hot Dry or Warm Dry stands. In none of the alternatives are Woodlands to be salvaged or have fuel treatment. With natural reforestation, juniper and ponderosa pine would gradually seed in across the burned areas. Reforestation would be somewhat sporadic; patches of young trees would be a part of the landscape for the next century. Re-introduction of low intensity fire in the future would maintain these areas in a savannah condition with few juniper or sagebrush and scattered large open grown ponderosa pine.

Fire Hazard

Trees that naturally regenerate could withstand low intensity fire in about 30-40 years, allowing the reintroduction of the historical fire regime. With periodic prescribed underburning, stem density and encroachment will be reduced compared with before fire conditions. The future stand structure and composition will be closer to what existed before the beginning of this century, widely spaced open grown ponderosa pine and few junipers or sagebrush.

Insects and Disease

Not salvaging fire-killed timber in the Woodlands will have little effect on the buildup of insect populations since salvage would not take place until over a year after the fire.

Hot Dry & Warm Dry Plant Association Groups

Direct and Indirect Effects

Effects of No Action

No salvage of tree stems or yarding of tops would occur to reduce future fuel levels. As the fire killed trees fall the ground fuels would increase above historical levels for the Hot Dry and Warm Dry plant association groups. High fuel levels would preclude reintroduction of the low-severity, high frequency fire regime until the woody material decays, and any wildfires could kill the young natural regeneration that becomes established.

Natural reforestation would be somewhat sporadic; patches of young trees would be a part of the landscape for the next century. Ponderosa pine would be the main species, with lesser amounts of Douglas-fir and western larch. With the increased fuel loads, even low intensity fire would be a danger to these young trees until they reach 5 to 7"DBH and thirty feet or more in height and during dry periods stand replacement fire is very likely.

Effects of the Action Alternatives

Fire Hazard

Salvage of dead timber and reforestation of burned areas with seral species will allow re-establishment of the historical stand conditions and allow the use of fire to resume its natural role in the landscape sooner than if left to occur naturally. The Hot Dry stands would be planted with ponderosa pine and the Warm Dry stands with a mix of ponderosa pine, western larch, and Douglas-fir. These stands could withstand low intensity fire in about 20-30 years, allowing the reintroduction of the historical fire regime. Future stand structure and composition will be closer to what existed before the beginning of this century. Stands of fire-tolerant trees at lower densities and with reduced fuel loadings will be suitable for periodic underburning. As a result, future wildfires will not be as severe or as large in the project area.

In Alternative 2 approximately 4230 acres would be salvaged (91%) of the burned Hot Dry and Warm Dry forest stands. This would reduce fuels in the stands where it would be the heaviest in the future, and break the continuity of fuel profiles across the landscape.

In Alternative 3 approximately 2820 acres would be salvaged (61%) of the burned Hot Dry and Warm Dry forest stands. This would reduce fuels in the stands where it would be the heaviest in the future, and break the continuity of fuel profiles across the landscape. Non-salvaged areas would still have high future fuel loads precluding periodic underburning in the future and will remain at risk for high severity wildfires.

In Alternative 4 no acres would be salvaged. This would not reduce the heavy fuels in the stands in the future, nor break the continuity of fuel profiles across the landscape. There would be treatment of the unmerchantable sized fuels that would reduce the lighter fuels. All large snags would be left in this alternative, except for hazard trees along roads. As the standing dead trees fall during the next 30 years the fire hazard will increase, risking high severity wildfire and precluding prescribed fire.

In Alternative 5 approximately 3670 acres would be salvaged (79%) of the burned Hot Dry and Warm Dry forest stands. This would reduce fuels in the stands where it would be the heaviest in the future, and break the continuity of fuel profiles across the landscape. Non-salvaged areas would still have high future fuel loads precluding periodic underburning in the future and will remain at risk for high severity wildfires.

Insects and Disease

The salvage of fire-killed timber with this project will have little effect on the buildup of insect populations since it will not take place until over a year after the fire. This would

allow populations to build up and disperse to nearby live trees before the salvage operation. Reforesting with seral species such as ponderosa pine will have a positive effect in the future as they are more resistant to insect and diseases that other species that may naturally seed in the fire.

Cumulative Effects

The primary cumulative effect of salvaging nearby private land is the reduction of future fuel loads to more historical amounts. This will reduce the chance of wildfire moving from private lands onto the National Forest and will allow for periodic prescribed burning to occur that would maintain these lands in a more resilient condition. The salvaging will also help to reduce potential insect buildups, since most of the private lands have already been salvaged. The State Forestry Practices Act requires reforestation of the private lands that are deforested. Planting with seral species such as ponderosa pine will improved resistance to fire, insects, and disease. The salvage of hazard trees along roads and at the Bear Valley Work Center are not expected to have much effect, as the relative size of those projects is so small compared to this analysis.

Cool Dry Plant Association Group

Direct and Indirect Effects

Effects of No Action

No salvage or yarding of tops would occur to reduce future fuel levels. Fuels would increase above historical range, fueling fires of greater size and intensity than historically would have occurred, and could kill young trees that become established.

Of the 280 acres of cool, dry type within the fire, about 160 acres have 90 to 100% tree mortality, about 100 acres have 60 to 90% mortality, and about 20 acres were not burned. Without planting, many of these acres would probably naturally reforest within 15 years, as lodgepole pine and western larch are prolific seeders with relatively light seed that disseminates well. Natural reforestation would occur in this plant association group sooner than others in the fire.

Most of these acres would probably naturally reforest within 5 to 10 years, as lodgepole pine and western larch are prolific seeders with relatively light seed that disseminates well. Natural reforestation would occur in this plant association group sooner than others in the fire.

Effects of the Action Alternatives

Fire Hazard

The historical fire regime is a higher intensity stand replacement fire at longer intervals. Some stands will be left to reforest naturally, while some will be reforested by planting to increase the species diversity with a mix of Douglas-fir, western larch, western white pine, and lodgepole pine. The primary effect of the salvage will to break the continuity of future fuel levels across the landscape, reducing the size of future fires.

In Alternative 2 approximately 120 acres would be salvaged of the burned Cool Dry forest stands. This would reduce fuels in the stands where it would be the heaviest in the future, and break the continuity of fuel profiles across the landscape. The target snag average is 2.39 of the largest snags/acre.

In Alternative 3 approximately 50 acres would be salvaged of the burned Cool Dry forest stands. This would reduce fuels in the stands where it would be the heaviest in the future, and break the continuity of fuel profiles across the landscape. The target snag average is 13 snags/acre (2.5 snags 21"+ DBH, 7 snags 14 to 20.9" DBH, and 3.5 snags 10 to 13.9" DBH).

In Alternative 4 no acres would be salvaged. This would not reduce fuels in the stands where it would be the heaviest in the future, nor break the continuity of fuel profiles across the landscape. There would be treatment of the unmerchantable sized fuels to reduce the light fuel loads. All snags would be left in this alternative, except for hazard trees along roads.

In Alternative 5 approximately 70 acres would be salvaged of the burned Cool Dry forest stands. This would reduce fuels in the stands where it would be the heaviest in the future, and break the continuity of fuel profiles across the landscape. The target snag level varies from 2.39 snags/acre to 7 snags/acre (2.5 snags 21"+ DBH, 2.5 snags 14 to 20.9" DBH, and 2 snags 10 to 13.9" DBH) and 13 snags/acre (2.5 snags 21"+ DBH, 7 snags 14 to 20.9" DBH, and 3.5 snags 10 to 13.9" DBH).

Insects and Disease
The salvage of fire-killed timber will have little effect on the buildup of insect populations since it will not take place until over a year after the fire. Reforesting with seral species such as western larch will have a positive effect in the future as they are more resistant to insect and diseases that other species that may naturally seed in the fire.

Cumulative Effects

There is little Cool Dry forest on private lands, so there are not expected to be any cumulative effects from any activities that may occur.

Stand Structural Stages

Future structural stages are predicted based on average growth for a Warm Dry PAG site in the project under a scenario of natural regeneration and planting. Thinning and periodic prescribed underburning are assumed for both scenarios to maintain stand densities within the usual ranges for managed stands. An average growth rate of 1.5"DBH per decade was used to approximate the 1.0" to 2.0"DBH range usually prescribed for good growth and resiliency to insects. For simplicity, no regeneration harvests, wildfire, insect attacks, or other stand disturbing agents were considered. For this reason, these projections may be optimistic since forest disturbances are always possible that would set

back structural stage development. The main objective of this analysis is to compare the alternatives, not to attempt to predict precisely when a certain structural stage will be actually be reached.

Stands with high mortality are modeled as single story stands starting as SI (stand initiation), growing into SEOC (stem exclusion open canopy) in 50 years, YFSS (young forest single-strata – an unofficial structure that is similar to OFSS, old forest single-strata, but has trees >15") in 100 years, and into OFSS (old forest single-strata) in 150 years. Stands with low mortality are modeled also as single story stands that grow from SEOC into OFSS in 50 years.

Stands with moderate mortality are modeled starting as UR (understory reinitiation), growing into YFMS (young forest multi-strata) in 50 years, and into OFMS (old forest multi-strata) in 150 years. The reason these stands are modeled as multi-strata structure is that the overstory is not sufficient to fully stock the stand, so it is desirable to retain and grow a second story throughout the life of the stand.

Stands with low mortality are modeled starting as SEOC and growing into OFSS in 50 years. They then are maintained at stage by thinning and underburning.

Direct and Indirect Effects

There will be no direct effects to the **current (post fire) structural stages** with any of the action alternatives since few live trees are to be harvested. The **future stand structural stages** in the burned landscape will be different with No Action than under the Action alternatives. This is largely as a result of the longer period necessary for natural regeneration to reforest the burned areas outside of the seed dispersal zone.

Effects of No Action

The approximately 3340 acres within the seed dispersal zone are expected to reforest naturally within 20 years. The seed dispersal zone has 1440 acres with some live trees and 1900 acres within 800' of live trees. On the other 1250 acres (20% of the deforested area) that are located farther from seed sources it is estimated that it would take 20 to 50 years for trees to become established and start to grow. Therefore, development of structural stages would be delayed due the lag in reforestation both in the seed dispersal zone and outside of it.

Currently the post-fire structural stage distributions are 54% stand initiation, 9% stem exclusion open canopy, 36% understory reinitiation, .5% young forest multi-strata, and .5% old forest multi-strata.

50 Years

The 3340 acres of SI stands that are within the seed dispersal zone will reforest naturally and grow to about 5" DBH and into the SEOC stage. The 1250 acres (20%) reforesting

naturally that are not in the seed dispersal zone will still be in the SI stage. The 9% that is SEOC will grow into the OFSS stage. The 36% that is UR will grow into YFMS and the .5% YFMS will grow into OFMS.

100 Years
The 20% of the area that is not in the seed dispersal zone will grow from the SI stage to about 5" DBH and into SEOC. The 34% that was SEOC at 50 years will grow to about 12.5" DBH and into the YFSS stage, and the 36% that was YFMS would remain in that stage at this time.

150 Years
The 20% of the area that is not in the seed dispersal zone will grow from the SEOC to 15" DBH and into the YFSS stage. The 34% that was YFSS at 100 years will grow to about 20" DBH and into the OFSS stage, and the 36% that was YFMS would grow into OFMS.

In general, with natural regeneration many acres will remain in the stand initiation structural stage for a long period; this will create a greater array of age classes over time, and delay the development of old forest structural stages in the future.

Table FV - XII shows the difference at 50, 100, and 150 years from now. The No Action alternative has 9% OFSS in 50 years growing to 43% in 150 years. See the graphs on page 23 for a visual comparison of the No Action and Action alternatives at 50, 100, and 150 years.

Table FV - XII Future Structural Stages for No Action

	SI	SEOC	SECC	UR	YFSS	YFMS	OFSS	OFMS
Existing	54%	9%		36%		0.5%		0.5%
50 Years	20%	34%				36%	9%	1%
100 Years		20%			34%	36%	9%	1%
150 Years					20%		43%	37%

Effects Common to All Action Alternatives
Under all action alternatives, burned areas are planned for reforestation within five years. All of the action alternatives have the same amount of reforestation by planting, with nearly identical rates of structural development. The reduction of the regeneration lag will yield a 20% increase of old forest structural stages compared with the No Action.

50 Years
All areas are to be planted, therefore the SI stands will be reforested quickly and grow to about 7.5" DBH and into the SEOC stage. The 9% that is SEOC will grow into the OFSS (old forest single-strata) stage. The 36% that is UR will grow into YFMS (young forest multi-strata) and the .5% YFMS will grow into OFMS (old forest multi-strata).

100 Years

The 54% that was SEOC at 50 years will grow to about 15" DBH and into the YFSS stage, and the 36% that was YFMS would remain at that stage.

150 Years
The 54% that was YFSS at 100 years will grow to about 22" DBH and into the OFSS stage, and the 36% that was YFMS would grow into OFMS.

Table FV – XIII shows the difference at 50, 100, and 150 years from now. The Action alternatives have 9% OFSS in 50 years, increasing to 63% in 150 years. See the graphs on page 23 for a visual comparison of the No Action and Action alternatives at 50, 100, and 150 years.

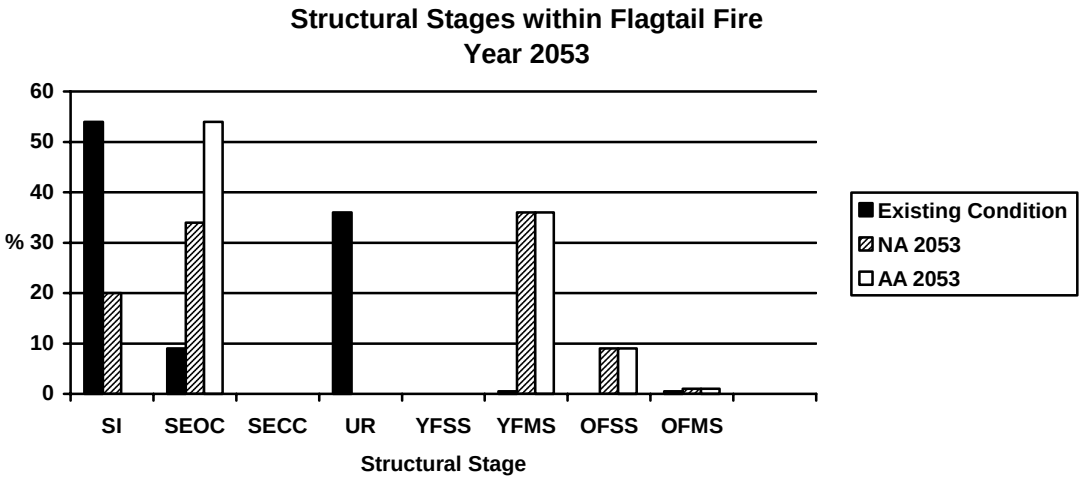
Table FV - XIII Future Structural Stages for Action Alternatives

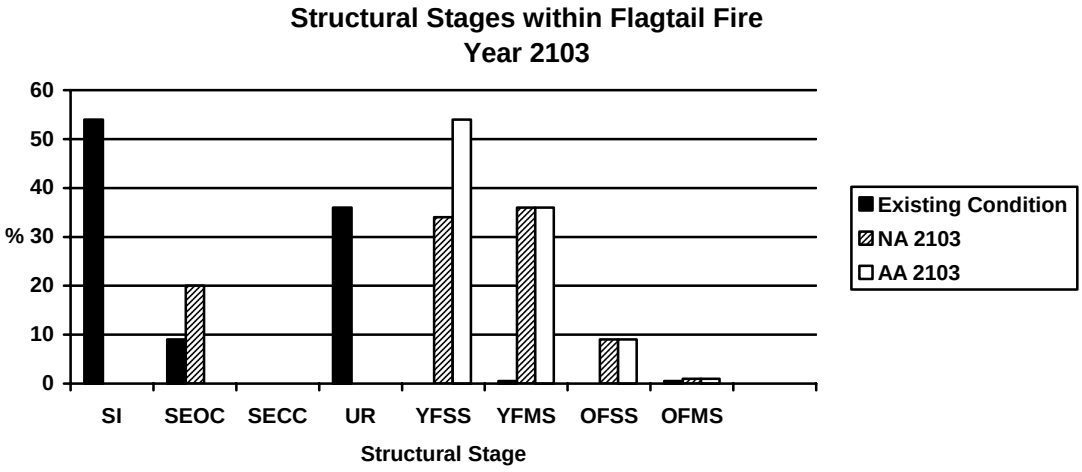
	SI	SEOC	SECC	UR	YFSS	YFMS	OFSS	OFMS
Existing	54%	9%		36%		0.5%		0.5%
50 Years		54%				36%	9%	1%
100 Years					54%	36%	9%	1%
150 Years							63%	37%

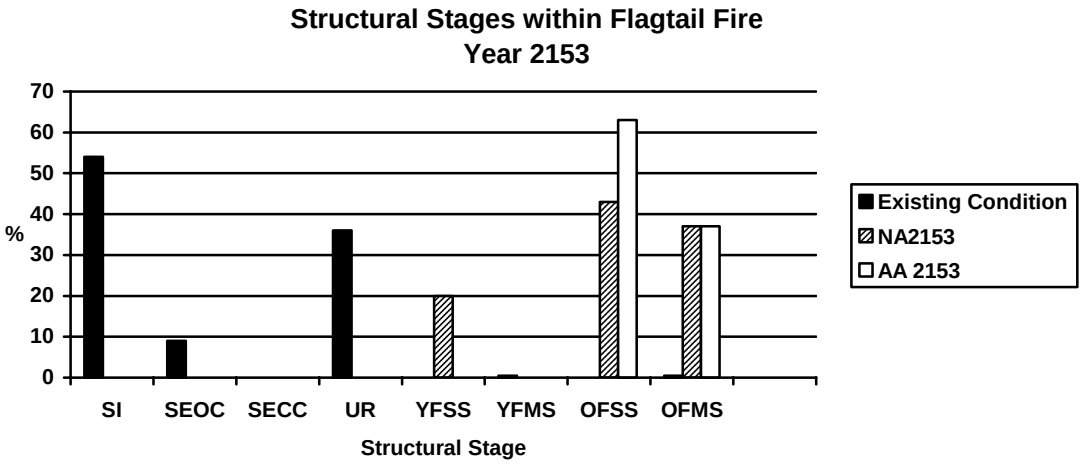
Cumulative Effects

Reforestation of private lands is expected to be fairly rapid as many burned portions are required to be planted under the Oregon Forest Practices Act. These lands would grow into SEOC in the next 50 years, but under the present market forces, cannot be expected to reach large size classes before they are harvested. Therefore, it is not expected that the amount of old forest in the area will increase in the future on private lands.

The following graphs compare the predicted stand structural stage composition of forested areas of the fire 50 years (year 2053), 100 years (year 2103), and 150 years (year 2153) into the future for the No Action and the Action alternatives. The graphs are a compilation of structural stages across all plant association groups showing the percentage of forested acres in each of the structural stages – stand initiation, stem exclusion open canopy, stem exclusion closed canopy, understory reinitiation, young forest multiple story, old forest single story, and old forest multiple story.







NA = No Action, AA = Action Alternatives

Beschta Report on Wildfire and Salvage Logging

The 1995 report by Beschta, et al. made a number of recommendations for salvage logging. They advocate a naturalistic approach and specifically for vegetation recovery they recommend that natural regeneration of both ground vegetation and trees with no pesticides, herbicides, or fertilizers be used.

Following is a summary of these topics, for more information refer to the previous sections.

Natural regeneration of ground vegetation
This document does not plan on seeding burned over lands to reestablish ground vegetation, nor was it advocated by the Burned Area Emergency Rehabilitation (BAER) plan that was implemented immediately after the fire.

Natural regeneration of trees
Planting is recommended in the Action alternatives due to the desire to reestablish tree vegetation sooner than is expected if left to natural regeneration. There would be a reforestation lag of up to 2 decades on the 4300 acres within the seed dispersal zone and up to 5 decades in the other 1250 acres past the seed dispersal zone. A detailed analysis of the differences in the time to establish trees is presented in the Reforestation section of this report.

No pesticides, herbicides, or fertilizers be used
No herbicides, pesticides, or fertilizers are to be used in the reforestation effort, the need for their use was studied and a decision was made they were not necessary for establishment of the new forest.

Consistency with Regulations and Direction

NFMA (Regional Forester's Letter of Nov. 19, 2002)

The No Action Alternative does not meet direction to reforest areas as soon as possible. The Action Alternatives all meet the direction that salvaged areas are reforested within 5 years and that other deforested areas be reforested as soon as possible.

Forest Plan

The No Action Alternative does not meet the Forest Plan direction to establish ponderosa pine (and other early seral species) in appropriate sites to increase fire, insect, and disease resiliency. The Action Alternatives all meet the direction to minimize losses due to insects and disease by establishing ponderosa pine and western larch where they are appropriate within 5 years after harvest. Both natural regeneration and planting are utilized to reforest the burned areas and seed used to grow the seedlings is collected from superior trees within the seed zone and elevation band.

Regional Forester Forest Plan Amendment #2 (Eastside Screens)

All alternatives meet the direction to not decrease old forest structural stages, since live trees are not harvested (except for incidental green trees cut for road and landing construction and for safety). The Action alternatives better meet the objective to shorten the time to grow additional old forest structural stages, since planting will establish trees 10 to 40 years sooner, giving them an advantage over the natural regeneration.

Irreversible and Irretrievable Commitments of Resources

Irreversible Commitments

There are no anticipated long-term irreversible commitments of the forest vegetation since it is renewable as long as the soil productivity is maintained. There may be short-term losses of growth related to soil compaction, but compaction is to be kept below 20% of the forest area, and the growth reduction on compacted ground is about 15%. This would result in a total maximum growth loss of approximately 3% of the growth potential until the compaction gradually diminished (in about 50 years).

Irretrievable Commitments

There are irretrievable commitments of the growth of forest vegetation for about 5 years because of the new landings and roads that are built for the salvage operation. They are to be rehabilitated after use, but there will be a lag in reforestation and growth since the sites are impacted more heavily than the surrounding forestland

Bibliography

Scott, D.W., C.L. Schmitt and L.H. Spiegel, “Factors Affecting Survival of Fire Injured Trees: A Rating System for Determining Relative Probability of Survival of Conifers in the Blue and Wallowa Mountains”, BMPMSC-03-01, USDA Forest Service, Pacific Northwest Region, Blue Mountains Pest Management Service Center, Nov. 25, 2002.

Regional Forester Letter, “Reforestation Requirements Following Salvage Sales”, File Code 2470/2430, USDA Forest Service, Pacific Northwest Region, Nov. 19, 2002

Johnson, C.G. and R.R. Clausnitzer, “Plant Associations of the Blue and Ochoco Mountains”, R6-ERW-TP-036-92, USDA Forest Service, Pacific Northwest Region, 1992

Powell, David C., “Historical Range of Variability for Forest Structure Classes”, Umatilla National Forest, Dec. 1998.

Appendix A – Detailed Unit Information

The Exam Strata field contains the following information:

Predominant Species:
- Pine
- Mixed Conifer
- Mixed Conifer (moist - more Grand Fir)
- Mixed Conifer (dry - more Douglas-Fir)
- Lodgepole

Tree Size:
- Small
- Medium
- Large

Mortality Level:
- 90-100%
- 60-90%
- 30-60%
- 0-30%
- 0%

Exam Strata

A – Pine/Small/30-60%
B – Pine/Small/60-90%
C – Pine/Small/90-100%
D – Pine/Medium/60-90%
E – Pine/Medium/90-100%
F – Mixed Conifer/Small/60-100%
G – Mixed Conifer/Medium/60-100%
H – Mixed Conifer/Mixed Sizes/60-100%
I – Mixed Conifer (DF)/Medium/60-100%
J – Mixed Conifer (DF)/Medium/90-100%
K – Mixed Conifer (GF)/Medium/0-30%
L – Mixed Conifer (GF)/Medium/60-90%
M – Lodgepole Pine/Small/90-100%
N – Plantation/Small/0%