Jocko Lakes Fire Salvage Project

Vegetation Report

Prepared by:
Neil McCusker
Silviculturist

for:
Seeley Lake Ranger District
Lolo National Forest

September 2, 2008

Table of Contents

List of Tables

Introduction

This section describes existing vegetation conditions in the Jocko Lakes Fire Salvage project area (project area), and how the Modified Proposed Action and its alternative would affect vegetation and timber resource components. This analysis was completed for consideration in determining whether or not to prepare an Environmental Impact Statement. Specifically it displays the condition and effects on the following components:

- Vegetation species composition, structural stage distribution and general conditions before and after salvage harvest.
- Timber resources, including acres and volume harvested, and acres reforested.

Overview of Issues Addressed

The following bulleted silvicultural issues were identified by the public during scoping. These issues are considered in this analysis under the following headings.

Post Fire Mortality

- Will salvage logging affect the spread of tree diseases and insect infestation?
- Could salvaging inadvertently remove a tree that would live?

Species at Risk

- Will the project affect natural regeneration

Post Fire Response of Native Flora

- Will salvage logging affect plant species that are specialists for early post-fire conditions

Availability of Post Fire Vegetation

- Is burned, un-harvested habitat rare?

Affected Environment

Existing Condition

Vegetation Response Units

The existing conditions of the vegetative resources are organized around the ecological environments depicted by vegetation response units (VRUs). VRUs are combinations of habitat type groups and fire groups that contain plant communities and associated environments that respond similarly to disturbances and have similar ecological functions and environmental conditions. The VRUs do not change within the landscape, what changes, in a predictable fashion, is the composition and structure of plant species in a succession from one stage to another following a disturbance, or during periods of no disturbance. In the following section, each VRU that exists within the project area is addressed in terms of its natural composition, structure and disturbance regime, and then in terms of the existing conditions within this analysis area along with a coarse filter evaluation and identification of rare elements. The percent representation of each VRU within this analysis will not change as it is a characterization of the ecosystem.

VRU 1 - Non-forest, Grass and Rock (30 acres, <1 percent of project area)

These areas include a wide variety of vegetation types and landforms that lack the potential to sustain forests. Approximately 129,000 acres of the Lolo National Forest are in this condition, including rock, scree, grassy openings, and meadows. These sites are found on a variety of landforms but often occupy steep sideslopes, basin headwalls, and grassy bald ridges. They are characterized by their shallow, poorly developed, and often unstable soils. Areas with fine soil development may support sparse, open forest conditions. Non-forest openings at lower elevations are highly susceptible to a variety of noxious weeds including spotted knapweed, diffuse knapweed, sulfur cinquefoil, goatweed, dalmation toadflax, and leafy spurge. Grassy openings on high elevation windward sites may be moisture limited as prevailing winds prevent snow accumulation. On the other extreme, wet meadows are characterized by abundant moisture, deep, fine-textured soils, and herbaceous vegetation.

Fire is an infrequent disturbance agent on most of this VRU because of the light, discontinuous fuels or wet conditions during much of the year. During the late summer and fall after grasses mature and cure, however, the fine fuels on these sites can burn in conjunction with adjacent timber stands. Expected fire behavior and successional patterns in this VRU most closely match Fire Group 0 (Fisher and Bradley, 1987).

VRU 2 - Warm and Dry Lower Slopes (1,030 acres, 14 percent of project area)

These areas are generally found at lower elevations of the forest and southerly to westerly aspects on slopes greater than 20 percent at mid elevations. Approximately 648,000 acres on the Lolo National Forest fit this category. The lower elevations include terrace, low relief dissected foothill, bench, alluvial fan, toeslope, and footslope landforms (Lolo LSI). Midslopes include dissected footslopes and moderate relief mountain slopes. Droughty soil conditions during the late summer and early fall are the result of low precipitation at lower elevations and a combination of shallow soils and high solar incidence at steepened south and west aspects.

Moderately warm and dry sites result from this combination of topographic, climatic, and edaphic variables. The drier habitat types found on the Lolo are in this VRU. This is where we find ponderosa pine, Douglas-fir/rough fescue, Douglas-fir/bluebunch wheatgrass, and the drier Douglas-fir/ninebark and Douglas-fir/pinegrass habitat types. Douglas-fir/twinflower, Douglas-fir/huckleberry, Douglas-fir/snowberry, and the wetter Douglas-fir/ninebark and Douglas-fir/pinegrass habitat types are included in the wetter portion of this range.

The dry habitat types result in open grown stands of ponderosa pine and Douglas-fir. Grass and forb communities occupy the openings between trees. They are highly susceptible to the establishment and spread of noxious weeds such as spotted knapweed, St. Johnswort, and sulfur cinquefoil following ground disturbance to the native plant communities. Moister sites are typically occupied by dense stands of Douglas-fir with little understory vegetation. After disturbance, these sites can produce shrub communities dominated by ninebark, serviceberry, and maple. They too are susceptible to noxious weed invasion after disturbance, but weed coverage is expected to eventually diminish following tree crown closure.

Disturbances influence these vegetation response units somewhat differently on the drier than the wetter sites. In general however, we believe that these ecosystems developed in response to frequent, low intensity fires and forest insects and diseases that influenced individual trees and small acreages.

On the drier sites, fires at 5-25 year intervals, in combination with drier soils would have typically resulted in low fuel accumulations. Low intensity fires maintained a relatively open grass/shrub/tree character and encouraged ponderosa pine regeneration over Douglas-fir as would be expected in Fire Group 4 (Fischer and Bradley, 1987). This type of disturbance resulted in a pattern of vegetation that was typically rather uniform across these parts of the Lolo. In areas where Douglas-fir predominates, scattered root disease is common, while western spruce budworm and Douglas-fir tussock moth are cyclic agents of disturbance. Ponderosa pine is susceptible to mortality by western pine beetle and pine engraver beetles during years of drought.

On moister sites, the time interval between disturbances of various intensities was more variable. Where influenced by adjacent vegetation, some of these burned frequently and were kept in a more open condition. Average fire intervals of 20-60 years, as characterized by fire group 6, would be expected on many sites. Less frequent, more severe fires would tend to occur during dry years in stands where dense, uniform Douglas-fir and ponderosa pine thickets provide heavy fuel accumulations. A typical situation would be for stand-replacement fires to consume areas of heavy fuels and then “drop down” from the canopy to underburn adjacent areas that have less fuel as a result of slightly more xeric conditions or previous fires. Severe or frequent fires would sometimes put these stands in a prolonged grass/forb/shrub condition. The result would be a more irregular landscape with various patch sizes, ages, and structural characteristics. Expected fire behavior and successional patterns in this VRU most closely match Fire Group 6 (Fisher and Bradley, 1987). In addition to the insects mentioned above for the drier sites, root disease and Douglas-fir beetle would be expected to impact larger diameter Douglas-fir stands.

VRU 3 - Moist Midslopes (2,530 acres, 34 percent of project area)

VRU 3 is found on a variety of landforms, including moderate relief mountain slopes, broadly convex ridges, glacial valley trains, glaciated mountain slopes, and undulating uplands. It includes lower elevations on more northerly aspects and drainage bottoms throughout the forest. Soils are generally well developed, productive, and moist or wet much of the year.

This vegetation response unit includes the moist grand fir habitat types and the warmer and moister subalpine fir habitat types such as subalpine fir/queencup beadlily, subalpine fir/twinflower, subalpine fir/bluejoint, and subalpine fir/menziesia. It also includes the western redcedar and western hemlock habitat types. Together, these are the most productive vegetative types on the Lolo National Forest.

The existing vegetation on these sites includes most seral coniferous species such as western larch, ponderosa pine, Douglas-fir, western white pine, and lodgepole pine. These trees occur in a variety of combinations in response to various wildfires over the past several hundred years. In addition, shade tolerant trees including grand fir, subalpine fir, western redcedar, western hemlock, and spruce are common throughout this VRU. Understories can range from sparsely occupied communities under heavily stocked conifer overstories to rich assemblages of shrub/forb communities in recently disturbed or more open forests. Arnicas, violets, beargrass, Sitka alder, redosier dogwood, twinflower, menziesia, thimbleberry, huckleberry, snowberry, grouse whortleberry, devil’s club, Rocky Mountain maple, elk sedge, pacific yew, spirea, serviceberry can be common to abundant on these sites. Brushfields can persist on these sites for many years after multiple high severity disturbances within short time periods.

Both insects and diseases can be major agents of disturbance in this VRU. Bark beetle effects can range from scattered mortality in Douglas-fir to widespread mortality in even-aged lodgepole pine stands. In the absence of stand-replacing wildfire, dwarfmistletoe can have significant

impacts on Douglas-fir, western larch, and lodgepole pine. Moist conditions and less severe fires also favor the development of various stem decays and root diseases which decrease growth and increase mortality in most of the shade tolerant conifers.

Fire-free intervals likely ranged from 25 on the drier sites to 300 years on the moister sites included within this VRU. Although there is a great deal of variety in the amount and continuity of fuels, fuel loadings tend to be higher here than in other VRUs. This is the result of high site productivity that leads to more rapid biomass accumulation, deeper duff, and moister conditions that lead to less frequent stand replacement fires. One result of these conditions is that fire behavior tends to be either insignificant due to moist fuels or severe as a result of prolonged drying conditions. Expected fire behavior and successional patterns in this VRU most closely match Fire Groups 9 and 11 (Fisher and Bradley, 1987).

VRU 4 - Cool/Dry Upper Slopes (3,760 acres, 51 percent of project area)

This VRU includes many of the same landforms as VRU 3. The difference is that VRU 3 is generally higher on the slope, excludes undulating uplands, and includes subalpine ridges, headwalls, and basins.

These sites include habitat types that are often dominated by persistent lodgepole pine. Subalpine fir/beargrass, subalpine fir/grouse whortleberry, subalpine fir/blue huckleberry, subalpine fir/dwarf huckleberry, and mountain hemlock/beargrass types are included. In addition to lodgepole pine, conifer vegetation can also include subalpine fir, Engelmann spruce, mountain hemlock, and Douglas-fir and western larch on some habitat type phases. Understory species include beargrass, pinegrass, arnica, elk sedge, blue huckleberry, grouse whortleberry, dwarf huckleberry, willow, alder, and smooth wood-rush.

Two primary agents of disturbance influence this VRU. One is mountain pine beetle that, though limited by short developmental periods at upper elevations, can kill high percentages of larger diameter lodgepole pine over large acreages and contribute to more severe fire behavior. The other is wildfire, as would be expected in Fire Groups 7 and 8 (Fisher and Bradley 1987) to play two different roles at 20 to 200 year intervals:

In the most dramatic case, stand-replacing fires at relatively large scales which typically killed all or most above-ground vegetation, favoring lodgepole pine after an initial period of shrub and forb dominance. Many snags and large amounts of coarse woody debris were immediately cycled into the developing stand.

Low and mixed severity nonlethal fires were also common in this VRU prior to European settlement of northwest Montana. These fires perpetuated Douglas-fir and lodgepole pine over shade tolerant species, reduced fuels, and created smaller patches of fuels and vegetation at the landscape scale. They also scarred residual trees, providing entry points for stem decay and insect attack. This burn severity was particularly likely on gentle terrain, upper slopes, and variable topography where discontinuous fuels and reduced slope effects led to nonuniform fire spread (Barrett and Arno 1991).

The cool/dry upper slopes VRU covers about fifty one percent of the JFLS project area while the moist midslopes VRU accounts for another thirty four percent. Warm and dry lower slopes make up the remaining fourteen percent with non-forest being a very minor component of the landscape at less than one percent. Table Silv-1 lists the acres of National Forest lands by VRU within the project area.

Table Silv-1. Acres of NF Land by Vegetation Response Units within the Project Area.

Vegetation Response Unit	Project Area Acres (NF Lands)	Project Area Percent (NF Lands)
Non-forest -VRU 1	30	<1%
Warm and Dry Lower Slopes - VRU 2	1,030	14%
Moist Midslopes - VRU 3	2,530	34%
Cool and Dry Upper Slopes - VRU 4	3,760	51%
Total:	**7,350**	**100%**

Acreage figures are estimates. Total FS land within the project area is estimated to be 7,380 acres. Approximately 30 acres are unaccounted for due GIS land ownership edge matching.

Post Fire Mortality

The Jocko Lakes fire burned with varying intensity across the landscape. Fire behavior ranged from creeping and smoldering to group torching to fast moving crown fire. Five mortality classes are used to describe the post-fire vegetation conditions. These classes are described as follows:

Unburned – Mortality rate of 0 percent. Contiguous areas within the fire perimeter that did not experience fire.

Low - Mortality rates of 0-25 percent. Result from low severity fires where typically duff and ground vegetation were lightly burned, many areas of unburned ground vegetation remain throughout the stand, and less than 25 percent of the dominant and co-dominant overstory trees were killed by the wildfire.

Mixed - Mortality rates of 26-75 percent. Result from fires ranging from moderate severity in stands of mostly unburned overstory trees and low-to-moderate duff reduction and mortality in the ground vegetation to moderately high severity fires that can significantly reduce much of the duff, burning the tops of a large portion of the ground vegetation, and killing up to 75 percent of the overstory trees. The result is a mosaic that can include islands of green trees intermixed with scattered clumps of dead and live trees.

High - Mortality rates of 76-90 percent. Result from high severity fire occurring in which the duff and tops of the ground vegetation was nearly all consumed, leaving a quarter or less unburned or lightly burned, and from 75 to 100 percent of the trees were killed. These areas experienced fire intensities that resulted in fire effects ranging from complete crown scorch to consumption of fine twigs and needles on standing trees.

Very High - Mortality rates of greater than 90 percent. Similar fire effects as experienced under high with greater than 90 percent of the trees being killed.

Change in forest structure and species composition as a result of the Jocko Lakes fire is most prevalent in the high and very high mortality classes. Within the project area, these two classes account for approximately 45 percent of the area. Burn severity resulting in tree mortality of 75 percent or greater essentially resets succession to the grass/forb/seedling stage. Approximately 21 percent of the project area experienced mixed mortality while 26 percent was low mortality and 8 percent was unburned. Table Silv-2 shows the project area acres by mortality class within each VRU.

Table Silv-2. Acres of NF Land by Mortality Class and Vegetation Response Units within the Project Area.

Mortality Class	Project Area Acres (NF Lands)				Total Acres	Percent
	VRU1	VRU2	VRU3	VRU4		
Unburned	<10	60	200	300	570	8%
Low (0-25%)	10	280	680	950	1,920	26%
Mixed (26-75%)	<10	180	600	740	1,530	21%
High (76-90%)	<10	40	150	220	420	6%
Very High (>90%)	<10	470	900	1,550	2,910	39%

Fire Damage Caused Mortality

A preponderance of fire-affected stands are mature lodgepole pine. Others are mixed-species—combinations of lodgepole pine, Douglas-fir, and western larch being common. In a few stands we noted a few large-diameter Engelmann spruce and subalpine fir. In most stands we visited, the lodgepole pine component has been killed. Because of its relatively thin bark, few lodgepole pines survive even moderately severe burns. Subalpine fir and Engelmann spruce are also poor survivors of moderately severe burns. Because of their thicker bark, Douglas-fir and western larch are typically much better suited to survive even moderately severe burns (Gibson 2008).

In areas with what appeared to be low-severity ground fires with few foliar effects we observed many of the Douglas-fir had been girdled by fire at the root collar. We surmised that because of a high amount of litter on the forest floor and extremely hot, dry conditions experienced in 2007, ground fires had burned long enough and hot enough to destroy cambial tissue on Douglas-firs at or just below ground level—where bark is much thinner than just a few inches higher on the bole. A few western larch had also died from similar effects; but in general, larch seems better able than Douglas-fir to withstand those somewhat unusual conditions. In the Jocko Fire area, in stands where fire effects appeared to be minor (low to mixed severity burns), except for the destruction of forest litter; many Douglas-fir appear to have been killed by having cambial tissue at the root collar, or on large supporting roots, destroyed (Gibson 2008).

Numerous literature, (Gibson 2008, Hood, et al 2007, Scott 2003, 2002, Reinhardt and Ryan 1989) describe delayed mortality of conifers as a result of fire damage. Though there are currently no absolute predictors of mortality/survivability, trained Forest Service employees will estimate fire-damaged trees with a low probability of tree survival based on visible fire-damage indicators (Scott 2003, 2002) using a decision guide that was developed to determine which fire damaged trees have a low potential for survival. This guide will be used for fire damaged tree harvest selection when green needles are present on fire-damaged trees. It is based on the above observations within the project area (Gibson 2008) and the literature referenced above.

Insect Caused Mortality

While appearing to have few fire effects, fire damaged trees that experienced burn severity sufficient to girdle the bole or root collar—particularly Douglas-fir—will almost certainly attract Douglas-fir beetles (*Dendroctonus pseudotsugae Hopkins*). Although beetle populations are not presently at epidemic levels in the fire area, there were numerous small groups of beetle-killed trees in that general vicinity in 2006 (the area was not flown in 2007 because of the fire). Fire-damaged trees are quite attractive to Douglas-fir beetles; and beetles are very adept at finding

them, colonizing them, and often using them as an epidemic "trigger." Douglas-fir beetle outbreaks are not a foregone conclusion in stand conditions such as those found in the Jocko Fire area—much depends on weather over the next several months and extent of existing beetle populations. But the possibility of an outbreak is great, and the likelihood high (Gibson 2008).

Other stands, comprised of lodgepole pine, are much less likely to serve as the source of bark beetle outbreaks. First, mountain pine beetle (*D. ponderosae Hopkins*) populations are already high on parts of the Seeley Lake Ranger District, and existing beetles are more inclined to stay in stands in which they are presently found, so long as susceptible trees remain. Second, mountain pine beetle populations are only rarely attracted to fire-weakened or damaged lodgepole pine (Gibson 2008).

We observed a few large-diameter Engelmann spruce that had fallen because of fire damage to supporting roots. Those are quite likely to be infested by spruce beetles (*D. rufipennis* [Kirby]); but their numbers were sufficiently few, and the occurrence of mature standing spruce nearby low enough that development of an outbreak seems to be of low probability (Gibson 2008).

Our observations suggest the development of Douglas-fir beetle outbreaks in the Jocko Fire area is likely enough to be a management concern. Threats from other bark beetles are slight. Removing fire-damaged and beetle-infested trees as soon as possible will lessen the chance of a buildup in the Douglas-fir beetle population in the area. In 2008, beetles will quite likely be attracted to those trees severely damaged by fire; and in 2009, to trees within the fire perimeter only moderately affected. In subsequent years beetles will be attracted to older, larger-diameter, but live Douglas-fir nearby. In typical Douglas-fir beetle outbreak development, beetles are inclined to attack the most "susceptible" Douglas-fir first—those that are older than 120 years, greater than about 14 inches dbh, and ones growing in stands of greater stocking that 150 square feet basal area per acre. Often those stands are of "old growth" character and ones in which we would most like to prevent bark beetle depredations (Gibson 2008).

Amman and Cole (1983) and Gibson (personal communication) conclude that finding boring dust in bark crevices, or around the base of an infested tree – and particularly if it is found completely around the tree's circumference – is conclusive evidence that the tree has been infested by a sufficient number of beetles that it cannot survive. Within the PROJECT AREA units, insect attacked green trees that have boring dust completely around the tree's circumference in bark crevices or around the base of boles are considered dead and may be designated for removal by Forest Service personnel.

Successional Stages

Table Silv-3 represents the post-fire successional stages on National Forest lands within the project area. The data is derived from the size class field of TSMRS (Timber Stand Management Record System, FSH 2409.21e R1) and adjusting successional stage by the tree mortality classes (RAVG, 'ba7'). High and very high mortality areas were reclassified as the initial successional stage "grass/forb/seedling". Mixed mortality areas were reclassified as multi-storied to reflect the range of stand replacement burn or overstory mortality intermixed with remaining areas of no-burn or lower severity where the present successional stage did not change. Low fire severity areas with 0-25 percent tree mortality remained unchanged from its current successional stage.

Table Silv-3. Acres of NF Land by Successional Stage within the Project Area.

Successional Stages	Project Area Acres (NF Lands)	Project Area Percent (NF Lands)
Non-forest	30	<1%
Grass/Forb/Seedling	3,350	46%
Brush/Sapling	890	12%
Poletimber	160	2%
Multi-storied	1,810	25%
Mature	1,110	15%

Old Growth Forest

Old growth forest is not part of the affected environment for this proposed salvage project because no salvaging would occur in old growth stands. The following section on the background of old-growth management is provided in an attempt to help clarify the various manners that old-growth has been addressed over the past two and a half decades, or more and to make it clear to the public that old growth was appropriately considered in this project, and how we assured no old growth would be part of the affected environment for this project.

The Lolo Forest Plan defines old growth on page VII-24 and VII-25 as "individual trees or stands of trees that in general are past their maximum rate in terms of the physiological processes expressed as height, diameter and volume growth". The Lolo Forest Plan EIS established the strategy of defining and distributing old growth (i.e., trees, stands, forests, habitat) on the Lolo NF. On page II-61 the EIS states:

> As a strategy for meeting old growth needs, the Forest was segregated into 71 drainages. A minimum of 8 percent old growth was allocated to most of these drainages where wilderness was not available, although this varies to some degree by alternative (Table II-19). This old growth was then distributed by vegetative type within each drainage recognizing the individual needs of various old growth dependent species.

Note that Table II-19 shows 488,884 acres under alternative "d" (the selected Forest Plan alternative) as "Land available in wilderness & roadless areas for old growth-dependent species" or approximately 23 percent of the LNF. In addition, Table II-19, shows 43,854 acres under alternative "d" for "additional lands allocated to provide vegetative and spatial diversity", these are the MA21 allocations. The Lolo Forest Plan shows 41,303 acres of MA21, page III-104. In modeling the outputs and effects of the various Forest Plan alternatives the EIS concludes on Lolo Forest Plan EIS, page IV-37 that:

> In all alternatives, a goal of retaining at least 10 percent of the suitable timber land in old-growth forest at all times was prescribed. The goal was exceeded in all alternatives because other constraints were more limiting, or forested lands not suitable for timber production produce old-growth stands unless catastrophic fire, insects, or diseases kill the trees.

On page IV-10 of the Lolo Forest Plan EIS, old growth is described in much broader context than Thomas et al (1979) or Green et al (1992) as follows:

> A wide variety of nongame wildlife occurs on the Forest and they are dependent upon a wide variety of habitats. Some activities that directly benefit nongame habitat are planned and include retention of specified amounts of slash scattered on the ground, the retention of snags where safety permits, and the assignment of old-age timber stands to old-growth dependent wildlife species.

Management Area 21 (MA21) of the Lolo Forest Plan is described on FEIS page 3-8 as, “a variety of forested lands representing all elevations, aspects, habitat groups, and growing site conditions”. “They are located throughout the Forest in such a way as to evenly distribute old age stands of timber for wildlife species dependent upon old growth for habitat.”

The Lolo NF uses the Region 1 old growth forest type characteristics (Green et al 1992, revised in 2005) to identify and allocate old growth in addition to or in substitution of, old growth stands previously allocated (MA21) in the Forest Plan (April 1986). The current approach of inventory, analysis, and tracking of old growth stands during landscape scale NFMA analysis was adopted by Forest Supervisor letter dated 4/29/94 (2070/1950). The policy provides for implementation of an old growth strategy within the Lolo Forest Plan to conserve biological diversity, including old growth dependent species; retain at least 8 percent of the Forest land in old growth reserves; manage landscapes using ecological principles; and prescribe treatments that consider the range of natural variation, age class distribution and natural processes. Ecosystem Management Areas (EMAs) have served as the analysis area for making old growth allocations. This analysis is not a landscape scale NFMA analysis but rather an analysis of limited purpose and need. Design criteria used in developing the proposed action protects existing old growth stands within this analysis, which reads, “No old growth stands as defined by Green et al. (prior to or following burn), and no MA 21 should be harvested”.

A Forest-wide old-growth analysis using Forest Inventory and Analysis (FIA) data (FIA 2006) provides additional proof that the Lolo NF continues to meet the old-growth strategy of the Forest Plan. The estimated percentage of old-growth (using the more restrictive definition provided by Green et al 1992) on all forested lands on the Lolo NF is 9.5 percent (FIA 2006, with a 90 percent confidence interval of 7.6 percent to 11.4 percent), which is well above the 8 percent strategy (Lolo Forest Plan EIS, page II-61). Using the Lolo Forest Plan definition of old-growth (page VII-24 and 25) the FIA inventory data indicates that at least 14.4 percent of the Lolo NF forestlands are old-growth (i.e., old forest stands as represented by large size and over 160 years old).

All proposed salvage units were assessed to verify that they were not old growth (Green et al. 1992) before the fire.

Species at risk

Natural Regeneration

Two seral (i.e. shade intolerant) conifer species that occur within the project area have been identified as “species at risk” in the Northern Region Overview (1999) primarily as a result of wildfire suppression. Protecting, enhancing, and establishing western larch and ponderosa pine is important to the ecological integrity of forested landscapes and conifer species. Natural regeneration of these species may be deficient in some burned areas for lack of adequate seed fall.

The ponderosa pine and western larch communities are considered most at risk due to: past and potential future loss in the aerial extent of the cover types; significant changes in landscape level

heterogeneity (fragmentation); and significant changes in structure (both density and change in distribution of structural stages) (USDA 1999). Past management practices which removed seral species from the overstory while releasing climax (shade tolerant) species in the understory is one example of a human activity which decreased seral species.

Fire suppression allows fire susceptible climax species to develop at rates beyond the range of natural variation. Past settlement logging cleared large areas that seeded naturally, and were then subjected to fire suppression, further increasing climax species. This is particularly applicable to ponderosa pine and western larch. Past harvests and fire suppression are significant contributors to the decline of ponderosa pine and western larch (USDA 1999).

Within the project area, ponderosa pine has the greatest potential to subsist within VRU 2 and western larch has the greatest potential to subsist in VRU 3 and 4. Table Silv – 4 reflects the acres of VRU 2, 3 and 4 that experienced 75 percent or greater mortality as a result of the Jocko Lakes fire. This is an indication of potential reduction or loss of the species at risk within the project area.

Table Silv-4. VRU 2, 3 and 4 Acres With 75 Percent or Greater Mortality within the Project Area.

VRU	Potential Species At Risk	Total Acres	Acres With 75% or Greater Mortality	Potential Reduction (Percent)
Warm and Dry Lower Slopes - VRU 2	Ponderosa Pine	1,030	510	50%
Moist Midslopes - VRU 3	Western Larch	2,530	1,050	42%
Cool and Dry Upper Slopes - VRU 4	Western Larch	3,760	1,770	47%

Observations by district personnel indicate that cone production in western larch and ponderosa pine were below average in 2007 indicating that natural regeneration potential for these species is low. Most cones of these species were mature when the wildfire occurred, so even where cone bearing trees were killed by the wildfire, viable seed protected within the closed mature cones were disseminated in the late summer/early fall of 2007. Burned forests and plantations of lodgepole pine with serotinous cones have the greatest potential to successfully regenerate naturally due to heat from the fire causing the release of many years of stored seed at once.

Post-Fire Response of Native Flora

Native flora that occur on these landscapes have evolved with wildfire. All burned areas are expected to naturally re-vegetate from surviving or colonizing plants. Survivors are established plants capable of re-growth after wildfire while colonizers establish new plants on burned sites from seeds.

Fire effects on plants can vary significantly among fires and on different areas of the same fire. Fire behavior, duration, pattern of fuel consumption, and the amount of subsurface heating all influence plant injury and mortality, and their subsequent recovery.

Post-fire responses depend upon the characteristics of the plant species on the site, their susceptibility to fire, and the means by which they recover after fire. Plant mortality is often the result of injury to several different parts of the plant, such as crown damage coupled with high cambial mortality. Death may not occur for several years and is often associated with the secondary agents of disease, fungus, or insects (USDA 2000). Data from three large wildfires

show that a high percentage of plant species on site at the time of the fire survive and re-establish on the burned area from on-site plant parts and seeds or fruits (Lyon and Stickney 1974).

A low severity fire (lightly burned, short duration, low ground char) that only consumes some of the surface fuels may kill laterally growing rhizomes or roots near the surface, or stem buds that are not well protected. It has little effect on most buried plant parts and can stimulate significant amounts of post-fire sprouting.

A moderate severity fire (moderately burned, moderate duration, moderate ground char) consumes the litter layer, and partially consumes both large woody debris and the duff layer. It incinerates plant structures in litter and the upper duff layer, such as shallow rhizomes, and may kill buds on portions of upright stems that are beneath the surface, and buds on the upper part of root crowns. Sprouting occurs from buds in deeper duff or soil layers. Moderate severity fires frequently cause the greatest increase in stem numbers of root sprouting species and rhizomatous shrubs.

A high severity fire (heavily burned, long duration, deep ground char) removes the duff layer and most of the large woody debris, particularly rotten material. It can eliminate species with regenerative structures in the duff layer, or at the duff-mineral soil interface, and may lethally heat some plant parts in upper soil layers, particularly where concentrations of heavy fuels or thick duff layers are consumed. Any re-sprouting that does occur on heavily burned micro-sites can only occur from stolons and rhizomes that re-colonize from adjacent areas or from deeply buried plant parts. (USDA 2000) Table Silv–2 summarizes the fire severity by VRU which can be used as an indication of plant community successional status as a result of the Jocko Lakes wildfire when compared to the preceding paragraphs.

Post-fire development of vegetation on burned sites is largely a function of the composition of the survivor component of the initial post-fire community and the conditions of the germination substrate (the surface available for the germination of disseminated seed). The initial community, appearing in the first post-fire growing season, is composed of: 1) re-growth plants (survivors) that originate from plants in the pre-burn forest; and 2) seedlings that colonize the burned surface of the ground. Characteristic “survivors” are shade tolerant under-story species which have growing points (e.g. rootcrown, rhizome, deeper-seated-stem plants, bulbs, or corms) in the mineral soil.

Seeds of colonizers originate from both burned (onsite source) and unburned (offsite source) sites. Residual colonizer plants originate from onsite seed sources already present in the pre-burn forest. Seeds of offsite colonizer plants disperse onto the burn in the first year after the fire from unburned areas. Plants most characteristic of the “residual colonizer” component are shade intolerant, dependent on early post-fire habitats, and have seeds with poor or limited dispersal capability. These often constitute the “surprise” species which exhibit no living plants on a site prior to the fire but appear, often in large numbers, in the initial community. Ground-stored seeds of many residual colonizer species exhibit long-term viability, e.g. *Ceanothus sanguineus* (redstem), *C. velutinus* (snowbush), *Ribes viscosissimum* (sticky currant), *Iliamna rivularis* (wild hollyhock), *Dracocephalum parviflorum* (dragonhead), *Geranium bicknellii* (geranium), and *Phacelia franklinii* (phacelia) (Stickney, 1991).

Offsite colonizers, those with seed from unburned sources, require a seed crop and a dispersal event that occurs while the burned surface is available. Offsite colonizers tend to be shade intolerant and develop best in early post-fire open habitats. Often these are “weedy” and short-lived (annual or biennial) species. Many are representative of the Composite or Sunflower

Family. Some of the more common offsite colonizer species include: *Epilobium angustifolium* (fireweed), *Salix scouleriana* (scoulers willow), *Populus tremuoides* (quaking aspen), *Anaphalis margaritacea* (pearly-everlasting), *Gnaphalium viscosum* (cudweed), and the exotics, *Cirsium vulgare* (bull thistle), and *Lactuca serriola* (prickly lettuce). In addition, all northern Rocky Mountain conifers can function as offsite colonizers (Stickney, 1991). Table Silv-5 depicts the fire life forms of some common understory plant in the survivor component of Northern Rocky Mountain forests.

Table Silv-5. Fire life forms of some common understory plants in the survivor component of Northern Rocky Mountain forests (Stickney, 1991).

Botanical Name	Common Name	Fire Life Form	Fire Susceptibility
Acer glabrum	mountain maple	Rootcrown shrub	Least
Alnus sinuate	sitka alder	Rootcrown shrub	Least
Amelanchier alnifolia	serviceberry	Rootcrown shrub	Least
Arctostaphlylos uva-ursi	kinikinnick	Mat plant	Most
Arnica latifolia	arnica	Rhizome herb	Least
Aster conspicuus	aster	Rhizome herb	Least
Berberis repens	Oregon grape	Rhizome woody plant	Least
Calamagrostis rubescens	pinegrass	Rhizome herb	Least
Ceanothus sanguineus	redstem	Rootcrown shrub	Least
Ceanothus velutinus	snowbrush	Rootcrown shrub	Least
Chimaphila umbellata	prince's pine	Duff rhizome	Most
Clintonia uniflora	queen cup	Duff rhizome	Most
Epilobium angustifolium	fireweed	Rhizome herb	Least
Erythronium grandiflorum	glacier lily	Bulb herb	Least
Holodiscus discolor	oceanspray	Rootcrown shrub	Least
Linnaea borealis	twinflower	Mat plant	Most
Lonicera utahensis	Utah honeysuckle	Low rootcrown shrub	Least
Lupinus argenteus	lupine	Caudex herb	Least
Menziesia ferruginea	fools huckleberry	Rootcrown shrub	Intermediate
Pachistima myrsinites	mountain lover	Low rootcrown shrub	Intermediate
Physocarpus malvaceus	ninebark	Rootcrown shrub	Least
Prunus emarginata	bitter cherry	Rootcrown shrub	Least
Pteridium aquilinum	bracken fern	Deep rhizome herb	Least
Pyrola secunda	wintergreen	Duff rhizome	Most
Ribes viscosissimum	sticky currant	Rootcrown shrub	Least
Rosa gymnocarpa	baldhip rose	Rootcrown shrub	Least
Rubus parviflorus	thimbleberry	Rhizome shrub	Least
Salix scouleriana	Scouler willow	Rootcrown shrub	Least
Sambucus racemosa	black elderberry	Rootcrown shrub	Least
Shepherdia canadensis	russet buffaloberry	Rootcrown shrub	Least
Spirea betulifolia	birchleaf spirea	Rhizome shrub	Least
Symphoricarpos albus	snowberry	Rhizome shrub	Least
Taxus brevifolia	western yew	Coniferous shrub	Most
Thalictrum occidentale	meadowrue	Caudex herb	Intermediate
Trillium ovatum	trillium	Corm herb	Least
Vaccinium globulare	huckleberry	Rhizome shrub	Intermediate
Vaccinium scoparium	whortleberry	Rhizome shrub	Intermediate
Viola orbiculata	roundleaf violet	Duff caudex herb	Most
Xerophyllum tenax	beargrass	Surface rhizome herb	Most

Availability of Post Fire Vegetation

The Jocko Lake fire burned 11,648 acres of National Forest land. The potential area affected by the Jocko Lakes Fire Salvage Project is 1,648 acres, or 14 percent of the total area burned.

Desired Condition

The Forest Plan made land allocations using management areas, each of which emphasizes a particular Desired Future Condition (DFC). Forest Plan goals and standards provide direction for achieving the DFC. The project area includes four mapped management areas.

Additional management direction is provided by the Northern Region Overview (1999), Northern Region Snag Protocol (2000) and The Lolo NF Down Woody Material Guide (2006).

The following narratives summarizes management direction specific to forest vegetation management activities (salvage timber harvest and tree planting).

Forest Plan Direction

Goals:

- Goal #1 – Provide a sustained yield of timber and other outputs at a level that will help support the economic structure of local communities and provide for regional and national needs.
- Goal #2 – Provide habitat for viable populations of all indigenous wildlife species and for increasing populations of big-game animals.
- Goal #4 – Provide a pleasing and healthy environment, including clear air, clean water, and diverse ecosystems.

Standards:

- Standard #18 – All management practices will be designed or modified as necessary to maintain land productivity.
- Standard #56 – Implementation of the principles of integrated pest management will be accomplished through sound silvicultural prescriptions. Silvicultural practices will be designed to consider past, current, and potential impacts from insects and diseases.
- Standard #57 – Biological and vegetative management practices will be utilized to control insect and disease infestation.

Management Area Direction

Management Area 13 (140 acres) - Lakes, lakeside lands, major second-order and larger streams, and the adjoining lands dominated by riparian vegetation; includes floodplains and wetlands; grazing is prohibited and management intent provides for improving water quality standards, aquatic habitats, fishery and recreation values; classified as suitable for timber production on those lands accessible and economically productive; remaining lands are classified as unsuitable for timber production.

Management Area 16 (5,520 acres) - Lands of varying physical environments which are classified as suitable for timber production; management provides for healthy stands of timber and optimizing timber growing potential and sustained timber production.

Standards:

- 19. Provide for regeneration of a mixture of species with the emphasis on maintaining the components of ponderosa pine and western larch commonly found in naturally occurring stands.
- 20. Dead or down trees may be salvaged as constrained by habitat needs for cavity nesting wildlife species.

Management Area 17 (70 acres) - Same as Management Area 16 except that slopes are generally over 60 percent and management is directed at optimizing timber growing potential while maintaining soil productivity on steeper slopes.

Management Area 25 (1,620 acres) – Lands with moderate degree of visual sensitivity, visible from or adjacent to major roads, trails, communities, and other high use areas; classified as suitable for timber production with a visual quality objective of Partial Retention.

Standards:

- 17. Dead or down trees may be salvaged as constrained by habitat needs for cavity nesting wildlife species.

Northern Region Overview

The Northern Region Overview sets priorities for ecosystem restoration and focuses the Forest Service Natural Resource Agenda to the National Forest lands of the Northern Region. For forest vegetation, the overview establishes indicators of risk to the proper functioning conditions of this ecosystem. Risk indicators include: (1) the loss of species composition at the cover type level, (2) the change in landscape level fragmentation, and (3) stand level structure as measured by density and seral stage/size class distribution.

Northern Region Snag Management Protocol

This document provides an optional snag retention standard specific to the Northern Region for National Forests that choose to use it. It also describes a process for the recruitment, protection, and modeling of snag management for forest plan revision. Where local data are available or are considered better than the sources used in this document, Forests have the option to use those data to set their snag retention standards.

The 2006 Down Woody Material Guide, Lolo NF.

The purpose of this paper is to better integrate current knowledge of woody material resource into land management practices on the forest. Specifically, this guide provides updated direction for the Lolo Forest Plan, Appendix N, “Procedures to Implement the Forest’s Snag Standard (#28), pages N-1 through N-3.

Environmental Consequences

Methodology

Current condition data for the potential salvage units was collected during walk thru unit exams in June and July 2008. Current condition for the remainder of the Forest Service lands within the project area was derived from the RAVG raster geospacial digital image produced from Landsat Thematic Mapper imagery, the TSMRS stand data base and pre-fire stand exam data that was collected from 1980 through 2006.

The Forest Vegetation Simulator (FVS) and the Fire and Fuels Extension (FFE) of FVS were used to simulate post-fire conditions including snags and down wood as well post-salvage conditions. FVS is a firmly established tree and stand growth model that is fully supported and maintained by the Forest Service (USDA Forest Service 2008).

Incomplete and Unavailable Information

Stand inventory data was available on 85 of the 168 affected stands proposed for salvage harvest. Data displayed in the effects analysis is an average of those stands that have data.

Additional fire caused tree mortality will occur over time due to tree bole and crown damage and from subsequent bark beetle infestations. This type of mortality is difficult to predict, therefore the post-salvage environment was approximated based on existing fire mortality.

Spatial and Temporal Context for Effects Analysis

The cumulative effects assessment area for the vegetation resource is the project area. The time frame considered is approximately 10 years in the future at which time the majority of the proposed post fire activities would be completed and the vegetation response to the fire stabilized.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

A review of past, present and future activities concluded that: a) past timber sale activities are included in the forests data that was used in this analysis and therefore included in summaries of effects; b) there are no grazing leases on NF lands; c) the condition of past wildfire sites is included in the stand database, and was considered in analyzing direct, indirect and cumulative effects); d) other past activities, present and ongoing activities, foreseeable future activities, as listed, are not considered to have direct or indirect effects on forest vegetation, and are not considered in cumulative effects. e) other foreseeable activities, as listed, except the Jocko Fire reforestation activities (planned to begin in the spring of 2008 under a separate decision), have no direct or indirect effect on forest vegetation and are not considered.

The Jocko Lakes fire reforestation activities have a direct effect on the project area, and are included in the cumulative effects analysis of future species composition.

Alternative 5 – No Action

Direct and Indirect Effects

Alternative 5 would not provide commodity outputs to local communities.

Post Fire Mortality

Alternative 5 provides no direct reduction of Douglas-fir beetle infestation or risk of future infestation of host trees. There is potential for future loss of old growth Douglas-fir trees from bark beetle predation.

Under Alternative 5 Douglas-fir beetle predation potentially provides the beneficial effect of opening up the overstory canopy and allowing natural regeneration of ponderosa pine and western larch where seed sources exist (Hagle et al. 2000). However, Douglas-fir beetle predation does not emulate the effects of historic fire regimes as the beetle kills the larger trees, which are the most fire resistant, and leaves dense saplings in the understory that fire would readily remove.

Alternative 5 would not remove any trees, and therefore, could not inadvertently remove a tree that would have survived.

Species at Risk

The wildfire has reduced the presence of western larch and ponderosa pine by approximately 45 percent from where it could potentially subsist within the project area while creating an environment for their reestablishment. Natural regeneration varies with the condition of the seed source and germination environment. Some areas would regenerate more slowly than others, but ultimately, all previously forested sites are capable of reforesting. Many of the potential ponderosa pine sites would remain understocked or regenerate to Douglas-fir while the potential western larch sites would regenerate to Douglas-fir and lodgepole pine due to below average seed production in western larch and ponderosa pine prior to fire, an average seed crop for Douglas-fir, and many years of seed released from serotinous cones in lodgepole pine.

Alternative 5 would not plant any ponderosa pine or western larch, and therefore would not help the establishment of these at risk species.

Post Fire Response of Native Flora

Alternative 5 would consist of just the native plant response to wildfire effects. This would protect native flora by allowing natural processes to occur unhindered. There would be no change in structural stage distribution as described in the Existing Condition section of this report. Post-fire successional processes would direct the future development of successional stages.

Availability of Post Fire Vegetation

Alternative 5 would have no effect on post fire vegetation or its availability.

Cumulative Effects

In the short term there would be little change from the current condition under Alternative 5. Changes that are expected with no action include: tree planting planned to begin in the spring of 2008 under a separate decision, conifer natural regeneration and stand development within stands that have a green component post-fire.

The approximately 2,000 acres of planting planned to begin in the spring of 2008 under a separate decision will have a positive effect by moving those areas planted from a non-stocked to a stocked condition and by planting western larch and ponderosa which are considered species at risk.

The pre-wildfire bark beetle populations and observed predation of host trees could result in a continued outbreak. The cumulative effects of the eventual outbreak would chiefly relate to the significant mortality of sawtimber-sized host trees and the environmental conditions associated with standing dead trees that ultimately fall to the ground.

The rehabilitation work under BAER and suppression rehabilitation resulted in seeding of non-native seed mixes for erosion control during fireline and safety zone rehabilitation, culvert replacement, etc., over a limited area immediately following the fire. Flora from these non-native seed mixes can quickly occupy these disturbed sites and persist for long periods, typically out competing native flora.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 5 meets Forest Plan standards for old growth, snags, and down woody debris.

Alternative 5 does not comply with:

- Forest Plan Goal #1 – Provide a sustained yield of timber and other outputs at a level that will help support the economic structure of local communities and provide for regional and national needs.
- Management Area 16 standard #19 - Provide for regeneration of a mixture of species with the emphasis on maintaining the components of ponderosa pine and western larch commonly found in naturally occurring stands.

Alternative 3 – Revised Proposed Action

Salvage harvest of merchantable dead trees (no green needles) as well as fire-damaged and insect attacked trees with a low probability of survival would occur on approximately 1,650 acres. All salvage units would be reforested either thru natural regeneration, planting or a combination of both. Currently, it is anticipated that approximately 480 acres would naturally regenerate and 1,170 would require planting. The actual acreage that requires planting would be determined from monitoring natural regeneration over several years following salvage harvests.

Design Features and Mitigation Measures

The following harvest unit and dead leave tree design would be implemented in compliance with the desired condition during the salvage harvest.

Table Silv-6. Design for Dead Leave Trees to be Implemented During Salvage Harvest.

Design	Units
No designated old growth stands would be salvage harvested.	All units
Most dead timber greater than 21inches diameter at breast height (dbh) would be retained. Exceptions: some large lodge pole pine may be salvaged and snags may be felled for safety, temporary road construction, skid trails, corridors, or landings.	All units
For dry sites (VRU 2), retain a minimum of 4 snags per acre greater than or equal 20 inches dbh, or largest available. Select ponderosa pine, western larch and Douglas-fir in order of priority when available.	2-1, 2-5, 2-6, 10-6, 13-1, 22-7, 26-1, 26-2
For moist sites (VRU 3), retain a minimum of 6 snags per acre greater than or equal to 10 inches dbh, with a minimum of 2 snags/acre greater than 20 inches dbh, or largest available. Up to 12 snags per acre would be desirable. Select ponderosa pine, western larch or Douglas-fir in order of priority when available.	2-2, 2-3, 4-1, 4-2, 8-1, 8-2, 10-1, 10-2, 10-3, 10-4, 10-5, 10-7, 10-8, 10-9, 10-10, 10-100, 14-1, 20-1, 20-15, 22-1, 22-3, 22-5, 22-6, 22-22, 26-5, 26-6, 26-7, 28-1, 28-2, 28-4, 29-4, 31-1, 31-3, 31-4, 32-1, 32-2, 32-3, 36-1
For higher elevation moist sites (VRU 4), retain a minimum of 5 of the largest snags /acre, with a desire to have up to 10 per acre.	8-3, 20-2, 20-12, 22-2, 26-4, 28-3, 29-1, 29-2, 34-1, 34-2, 36-2, 36-3

Direct and Indirect Effects

Alternative 3 would provide commodity outputs to local communities. Salvage harvesting a portion of the fire and insect killed trees from approximately 1,650 acres out of the 11,650 acres of National Forests burned by the Jocko Lakes wildfire in 2007, or approximately 14 percent. Roughly half of the standing merchantable volume would be removed from the areas salvaged, or an average of 6.4 thousand board feet per acre (mbf/ac). The total commodity output recovered across the estimated 1,650 acres of salvage would be approximately 10.6 million board feet.

The post-salvage environment was approximated based on fire mortality and compared to traditional silvicultural systems. Units that experienced greater than 90 percent fire mortality are expected to function like a clear cut with reserves, 75 to 90 percent mortality like a seed tree cut with reserves and 50 to 75 percent like a shelterwood seed cut with reserves. These are considered to be even-aged systems and would require natural or artificial (planting) regeneration to restock the units. Those units that experienced less than 50 percent fire mortality would function like an intermediate (thinning) cut. Seventy five percent and greater mortality coincides with the grass/forb/seedling successional stage while 25 to 75 percent mortality coincides with the multi-storied successional stage. Table Silv–7 lists the acres of salvage by the silvicultural system that best approximates the post-salvage environment.

Table Silv-7. Salvage Unit Acres by Post Salvage Environment.

Silvicultural System That Best Approximates the Post-Salvage Environment	Unit Acres
Clear Cut with Reserves(CC)	900
Seed Tree Cut with Reserves (ST)	100
Shelterwood Seed Cut with Reserves (SH)	170
Intermediate – Thinning - Cut (INT)	480

The following table (Silv–8) reflects the average post-salvage conditions across FVS modeled stands within each of the mortality categories discussed above. The overall range of residual live trees per acre is estimated to be 1-4 in the clearcut with reserves, 5-15 in the seed tree with reserves and 16-45 in the shelterwood seed cut with reserves. Dead removal in trees <5 inches dbh is a result of the logging operation and natural fall of burned trees. Dead removal in the other dbh categories is a result of the logging operation, natural fall of burned trees and salvage harvest. The residual live does not include estimates of natural regeneration that has occurred since the wildfire. Beschta (et al. 1995, p.9) recommends leaving all trees greater than 20 inches dbh and generally all live trees. The Jocko Lakes Salvage project would retain all live trees, with the exception of trees in corridors, landings or temporary road locations, and retain all trees greater than 20 inches dbh with the same exceptions.

With the goal of maintaining species and natural recovery processes Beschta et al. also recommends leaving at least 50 percent of standing dead trees in each diameter class. No references or explanations are given for this recommendation. The Forest Service considered this recommendation and the best available science on the number of snags needed in the post fire landscape to provide for wildlife species habitat and soil productivity (see Project file documents M16-1 Wildlife Report and M6-1 Soils Report). One hundred percent of the standing dead would be retained on 10,017 acres or 86 percent of the Jocko Fire on National Forest lands. The retention requirements determined to assure resource needs are met for the Jocko Lakes Fire

Salvage Project are displayed in Table Silv-6. Table Silv-8 shows that these retention requirements would be met or exceeded.

Table Silv-8. Average Post-Salvage Conditions by Mortality Class.

Mortality Category	DBH	Trees Per Acre			
		Pre-Harvest Dead	Dead Removal	Residual Dead	Residual Live
>90%	<5”	800	610	190	0
	5-9”	90	80	20	0
	9-20.9”	100	90	6	1
	>20.9”	4	0	4	<1
75-90%	<5”	800	610	190	0
	5-9”	90	70	20	2
	9-20.9”	90	80	7	8
	>20.9”	4	0	4	1
50-75%	<5”	800	610	190	0
	5-9”	90	70	17	5
	9-20.9”	80	70	8	21
	>20.9”	3	0	3	2

Post Fire Mortality

The Affect of Salvage Logging on the Spread of Insect and Disease

Alternative 3, the Modified Proposed Action, provides very little direct reduction of bark beetle (Douglas-fir beetle, mountain pine beetle, and western pine beetle) infestation or risk of future infestation of host trees. The limited effect would be removal of bark beetle brood in infested trees that meet the definition of dead trees that are harvested and removed from the area prior to beetle emergence in early summer. As in Alternative 5, No Action, there could be future loss of old growth trees (particularly Douglas-fir) from bark beetle predation, though only slightly reduced theoretically as described in the preceding condition.

The beneficial effect described about Alternative 5, above, similarly applies to Alternative 3, i.e. the role bark beetle predation plays in forest succession (Hagle et al. 2000) since such a very small percentage of bark beetle infested trees would be harvested.

Possibility of Removing Trees That Will Survive Fire Effects

Dead trees are defined as trees with no green needles. These include trees that experienced burn severity that completely burned or scorched the tree crown. With trees that burned less severely (trees with green needles remaining) there is some question as to whether they will ultimately

succumb to fire effects, become overwhelmed by bark beetles, or might survive both. Though there are currently no absolute predictors of mortality/survivability, trained Forest Service employees will estimate fire-damaged trees with a low probability of tree survival based on visible fire-damage indicators (Scott 2003, 2002) or conclusive evidence that the tree has been infested by a sufficient number of beetles that it cannot survive (Amman and Cole 1983 and Gibson personal communication). Since these indicators are not absolute, there is a chance that some trees designated for removal could survive the fire effects or bark beetle predation.

Species at Risk

Salvage Logging Affect on Natural Regeneration

Alternative 3 would rely upon natural regeneration to restock salvage units wherever possible. However, in those conditions where salvage harvests results in an environment like even-aged silvicultural systems such as clear cuts, seed tree or shelterwood harvests (see table Silv–7), then artificial regeneration may be used to meet management objectives such as the establishment of ponderosa pine and western larch. The determination of natural regeneration failure can take two to five years. Culturists would assess seed fall, germination, seedling survival and “free to grow” status to determine natural regeneration success. Planting would provide the opportunity to increase the occurrence of the seral species at risk by direct establishment at desired numbers and locations in species mixtures suitable to the environment, including shade tolerant species like Douglas-fir.

Timber harvesting operations could damage conifer regeneration in skid trails and landings while at the same time creating bare soils or reduced duff conditions favorable to seral species seed germination and growth. The estimated 1,650 acres of salvage harvest represents approximately 14 percent of the National Forest lands in the Jocko Lakes wildfire area. Regeneration in the 1,170 acres of salvage harvest units that are functioning as even-age systems (Table Silv-7) would develop under lower slash conditions with fewer fire-killed trees to eventually fall to the ground with the effect of decreasing the threat of stand replacement fire intensity should another wildfire occur in the next hundred years or so.

Reforestation funding could likely be inadequate within the timeframe for successfully establishing conifers in all locations should natural regeneration fail without a salvage sale. Timber sale receipts from this project could be available for reforestation costs through the Knutson-Vandenberg (KV) Act.

In the short-term, this alternative would provide for greater establishment and retention of species at risk conifers than Alternative 5, No Action, by providing tree planting of ponderosa pine and western larch where natural regeneration fails and would provide the possibility of collecting additional reforestation funds through the KV trust fund deposits.

Winter logging operations would result in a very low potential of disturbance to soils, natural conifer regeneration and grasses/forbs/brush (see project record document M6-1 Soils Report).

Skyline (77 acres) and summer tractor logging (21 acres) operations have been designed to minimize soil disturbance. Some natural conifer regeneration would be disturbed by these operations. It is anticipated that where natural regeneration exists and is adequate to restock the unit, these operations would not impede that process.

Residual snags and coarse wood within salvage units would provide adequate microsites for natural regeneration establishment, survival and growth (USDA FS 2006).

Post Fire Response of Native Flora

Alternative 3 would be similar to Alternative 5 in that native plant response to wildfire effects would be the primary process. A resource protection measure for the project states that "Revegetation on disturbed or treated sites will include native plant species as recommended by the USFS-R1 native species policy (USDA-FS 1994). This policy emphasizes the use of locally adapted native plant seed, whenever possible. Native seed or non-persistent, annual grasses will be used. Seeding will be used as a reclamation tool only where resource damage will occur without it. Otherwise, sites will be allowed to re-vegetate naturally from the localized adjacent seed source." (Chapter 2 of EA and project record document M14-1 Botany report).

Within the 14 percent of National Forest lands in the Jocko Lakes wildfire area that is proposed for salvage harvesting, natural processes are not expected to be hindered on a small number of acres that may receive direct seeding of non-native non-persistent, annual grass species for erosion control following actions associated with salvage harvesting and log hauling.

National native plant policy (FSM 2070 effective 02/13/2008) promotes appropriate use and availability of both native and non-native materials for revegetation, rehabilitation, and restoration of native ecosystems in order to: 1) ensure genetically appropriate native plant materials are given primary consideration; 2) restrict use of persistent, non-native, non-invasive plant materials to only those situations when timely reestablishment of a native plant community either through natural regeneration or with the use of native plant materials is not likely to occur; and 3) ensure that development, review and/or approval of revegetation, rehabilitation and restoration prescriptions, including species selection, genetic heritage, growth stage and any needed site preparation, is done by a plant materials specialist who is knowledgeable and trained or certified in the plant community type where the revegetation will occur. The Lolo NF maintains and updates a seed mix guide for re-seeding disturbed sites where native plant response will be slow or inadequate in the short-term for erosion prevention (http://www.fs.fed.us/r1/lolo/resources-natural/soils/seed_guide.pdf). The objectives of the seed guide are to: provide seeding guidelines in the absence of more site-specific or project specific seeding prescriptions; provide seed mix recommendations to quickly re-vegetate disturbed sites to reduce soil erosion, to reduce noxious weed invasion and provide site protection for native species establishment; maintain flexibility for integration of locally collected grass, shrub and forb species into mixes as local seed banks become established to meet project needs; and provide native species and cultivar recommendations that follow current Forest Service policy and direction.

There would be no change in structural stage distribution as described in the Existing Condition section of this report. Post-fire successional processes would direct the future development of successional stages. Planting within salvage units may decrease the time it takes for the planted areas to develop from the grass/forb/seedling stage to the brush/sapling stage.

Availability of Post Fire Vegetation

The Jocko Lakes Fire Salvage would salvage timber from approximately 1,650 acres, 14 percent of all of the National Forest Land burned in the Jocko Lakes fire, correspondingly 86 percent of the area burned in the Jocko Lakes fires would be left to natural processes.

Cumulative Effects

In the short term there would be little change from the current condition under alternative 3. Tree planting planned to begin in the spring of 2008 under a separate decision, conifer natural

regeneration and stand development within stands that have a green component post-fire account for those changes.

The approximately 2,000 acres of planting planned to begin in the spring of 2008 under a separate decision will have a positive effect by moving those areas planted from a non-stocked to a stocked condition and by reestablishing western larch and ponderosa which are considered species at risk.

The pre-wildfire bark beetle populations and observed predation of host trees could result in a continued outbreak. The cumulative effects of the eventual outbreak would chiefly relate to the significant mortality of sawtimber-sized host trees and the environmental conditions associated with standing dead trees that ultimately fall to the ground.

The rehabilitation work under BAER and suppression rehabilitation resulted in seeding of non-native seed mixes for erosion control during fireline and safety zone rehabilitation, culvert replacement, etc., over a limited area immediately following the fire. Flora from these non-native seed mixes can quickly occupy these disturbed sites and persist for long periods, typically out competing native flora.

Availability of Post-Fire Vegetation

Wildfires in a Regional Context

The time period from 2000-2007, 3.5 million acres have burned by wildfire within Forest Service Region 1 (Table Silv-9). On the Lolo NF during this same time period approximately 255,402 acres have burned representing 12.2 percent of the Lolo NF. Given the prediction of warmer and dryer summers the region is likely to experience large fires in the future. In addition bark beetle activity has increased throughout Region 1 during this same time period (Steve Slaughter, Personal Communication). All of these recent large fires and the increased bark beetle have created many acres of snags in recent history. Given the prediction for large fires in the future more acres of snags will be created every year.

Table Silv-9. Acres Burned Within FS Region 1 from 2000-2007.

Region 1 National Forest	Acres Burned 2000-2007	Total Forest Acres	Percent Forest Acres Burned
Beaverhead-Deerlodge NF	126,771	3,391,197	3.7%
Bitterroot NF	410,190	1,594,695	25.7%
Clearwater NF	102,265	1,825,820	5.6%
Custer NF	169,482	1,188,497	14.3%
Dakota Prairie NG	3,089	1,256,427	0.2%
Flathead NF	322,360	2,348,202	13.7%
Gallatin NF	159,570	1,851,801	8.6%
Helena NF	100,729	974,498	10.3%
Idaho Panhandle NF	5,578	2,500,697	0.2%
Kootenai NF	47,822	2,220,156	2.2%
Lewis and Clark NF	142,662	1,863,114	7.7%
Lolo NF	255,402	2,088,380	12.2%
Nez Perce NF	337,813	2,223,901	15.2%
Non-FS	1,264,193	-	-
Grand Total	**3,447,925**	**26,591,578**	**8.6%**

Notes: Non-FS acres includes acres within the FS R1 boundary as well as any contiguous acres outside of FS R1 boundary. The percent of Forest Acres Burned is for R1 Forest Service only. Total R1 FS acres are based on an R1 Forest Service Ownership GIS data set and represent an approximate of those acres.

Over 1 million acres burned during the summer of 2007 just in Region 1 alone. This helps to put the Jocko Lakes Fire into a regional context. Recently an internet site has been developed to display annual post fire analysis process to determine first cut, coarse, vegetation burn severity map within 30 days of containment. The process is called Rapid Assessment of Vegetation Condition after Wildfire (RAVG). This information is available at: http://frdev.ftcol.wo.fs.fed.us/postfirevegcondition/index.php. This site displays spatially all the fires over 1000 acres and fire severities in the region. Note that fire severity groups through RAVG are more general however it gives a good regional perspective of the amount of acres burned and general severities over the entire region.

Un-Harvested Post-Fire Vegetation

Un-harvested post fire vegetation is not rare on the Lolo NF or on the Seeley Ranger District. The Jocko Salvage project would affect a fraction of burned vegetation available and a very small percentage of un-harvested post-fire vegetation.

Table Silv-10. Un-harvested post-fire vegetation on the Seeley Ranger District and the Lolo NF from 1980-2008.

Lolo National Forest (2,088,380 ac)	Acres	Percent of Total
LNF- Total Fire Acres Since 1980	340,505	16% of LNF
Acres Burned since 1980 no harvest pre or post fire	293,896	86%
Acres Burned since 1980 with post-burn harvest	3,464	1%
Acres Burned since 1980 with harvest prior to burn	43,144	13%
Seeley Ranger District (322,591 ac.)		
Seeley RD Total Fire Acres Since 1980	123,289	38% of Seeley RD
Acres Burned since 1980 no harvest pre or post fire	115,351	94%
Acres Burned since 1980 with post-burn harvest	1,074	0.9%
Acres Burned since 1980 with harvest prior to burn	6,863	5.6%

Over 1/3 of the Seeley Ranger District (38 percent) and 16 percent of the Lolo NF has burned since 1980 (Table Silv-10). Only a small percentage of the acres burned since 1980 have had any harvest activity either prior to burning or after burning. Ninety four percent of National Forest lands burned on the Seeley Ranger District since 1980 have had no pre-fire or post-fire harvest (115,351 acres). Eighty six percent of National Forest lands burned since 1980 have had no pre-fire or post-fire harvest (293,896 acres) (project file M19-63).

The Jocko project would salvage dead timber or timber with a low probability of survival from 0.5 percent of all the area burned on the Lolo NF since 1980 and 0.4 percent of all the area burned without any pre or post harvest. It would salvage dead timber, or timber with a low probability of survival, from 1.3 percent of all the area burned on the Seeley Ranger District since 1980 and 1.1 percent of all the area burned without any pre or post harvest. On non-National Forest lands the percentage of post-fire habitat that has been harvested is likely higher then on National Forest land, however, this does not reduce the quantity available on National Forest lands.

A member of the public requested we “Set aside large, continuous areas of previously unlogged, post-fire habitat from post-fire logging proposals. These reserves should comprise a large proportion of post-fire habitat representative of the broad range of burn severities and post-fire structural and compositional characteristics” (Appendix C). They also expressed concern that “…high quality low elevation post-fire habitat is amongst the rarest…”

This analysis shows large continuous areas of previously un-harvested post-fire habitat would be retained (project file M19-67 and M19-68). To consider the structural and compositional characteristics of these areas we looked at the potential natural vegetation type for areas burned and not burned, harvested and not harvested (project file M19-65 and M19-66), and we considered current vegetation types (project file M19-71). Fire severity data would not provide any additional information of value to help put the potential effects of the Jocko project in context, and that data is not readily available. We also considered the question of low elevation post-fire habitat. The proposed project is generally between 4000’ and 5000’ elevation. The Lolo NF has had approximately 97,900 acres burn in this elevation since 1980, or 29 percent of the total area burned. The Seeley Ranger District has had approximately 18,790 acres burn since 1980, or 15 percent of the total area burned. The Jocko Lakes Fire Salvage would affect 7 percent and 1 percent of the area burned at this elevation on the Lolo NF and the Seeley Ranger District respectively.

All of the information considered supports the conclusion that the Jocko salvage would affect a very small percentage of a post-burn vegetation condition that is not rare across the District or Forest. Given warming trends and fuel conditions, the acres of post-burn vegetation may continue to increase.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 3 complies with all direction listed in the Desired Condition section of this report. Alternative 3 meets Forest Plan standards for old growth, snags, and down woody debris. Design criteria specifically avoided salvage harvests within existing old growth stands. Actions on the Lolo NF routinely establish and follow mitigation measures to assure compliance with snag and down woody debris standards identified at Lolo Forest Plan appendix N, and supplemented with the Lolo Down Woody Material Guide. Silvicultural prescriptions and timber sale contract provisions would adhere to these requirements.

Monitoring Recommendations

Post-salvage stocking exams within all salvage units with 50 percent or greater overstory mortality to monitor natural regeneration and planting need.

Post-planting 1st and 3rd year survival exams.

Post-salvage stand exam within all salvage units with less 50 percent overstory mortality.

References (Literature Cited)

Amman, Gene D., and Cole, Walter E. 1983. Mountain Pine Beetle Dynamics in Lodgepole Pine Forests, Part II: Population Dynamics. Gen Tech Rep INT-145. USDA Forest Service, Intermountain Forest and Range Experiment Station. July 1983.

Fischer, William C., Bradley, Anne F. 1987. Fire Ecology of Western Montana Forest Habitat Types. Gen. Tech. Rep. INT-223. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 95 pages.

Gibson, Kenneth E. June 13, 2002. Northern Region Entomologist. Personal communication (email) with Steve Slaughter (Lolo NF Silviculturist) regarding determination of tree mortality from recent insect attacks.

Gibson, K. 2008. Trip Report TR-MFO-08-05: Bark Beetle Potential in the Jocko Fire Area, Seeley Lake Ranger District. June 6, 2008. Unpublished report by USDA Forest Service Forest Healthy Protection entomologist. Available from Seeley Lake Ranger District files.

Green, P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann. 1992. Old Growth Forest Types of the Northern Region. USDA Forest Service, Northern Region, R-1 SES 4/92.

Hagle, Susan K., et al, 2000. Succession Functions of Pathogens and Insects: Ecoregion Sections M332a and M333d in Northern Idaho and Western Montana. Volume 1: Analysis Methods and Volume 2: Results and Conclusions. FHP Report No. 00-10. USDA Forest Service, Cooperative Foresrty-Forest Health Protection, Northern Region. July 2000.

Hood, Sharon M.; C. W. McHugh; K. C. Ryan; E. Reinhardt and S. L. Smith. 2007. Evaluation Of A Post-Fire Tree Mortality Model For Western USA Conifers. In the International Journal of Wildland Fire, 2007, 16, 679-689.

Lolo Forest Plan. USDA Forest Service, Lolo National Forest, Missoula, MT. April 1986.

Lyon, Jack L., and Peter F. Stickney. Early Vegetal Succession Following Large Northern Rocky Mountain Wildfire. In Proc. Montana Tall Timbers Fire Ecology Conference and Fire and Land Management symposium, No 14, 1974:355-375.

Pfister, Robert D., et al, 1977. Forest Habitat Types of Montana. Gen Tech. Rep. INT-34. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 174 pages.

Reinhardt, E. D.; K. C. Ryan. 1989. Estimating Tree Morality Resulting from Prescribed Fire. In: Proceedings, Prescribed Fire in the Intermountain Region. Baumgartner, D. M.; Breuer, D. W.; Zamora, B. A.; Neuenschwender, L. F.; Wakimoto, R. H. (editors). Pullman, WA. Washington State University. 41-44.

Scott, Donald W.; C. L. Schmitt and L. H. Speigel. 2002. Factors Affecting Survival of Fire Injured Trees: A Rating System For Determining relative Probability of Survival of Conifers in the Blue and Wallowa Mountain. USDA Forest Service. Wllowa-Whitman National Forest. Blue Mountains Pest Management Service Center. BMPMSC-03-01. 68 pages.

Scott, Donald W.; C. L. Schmitt and L. H. Speigel. 2003. Factors Affecting Survival of Fire Injured Trees: A Rating System For Determining relative Probability of Survival of Conifers in the Blue and Wallowa Mountain. Amendment 1. USDA Forest Service. Wallowa-Whitman

National Forest. Blue Mountains Pest Management Service Center. BMPMSC-03-01. Amend 1. 6 pages.

Stickney, Peter F. Effects of Fire on Flora: Northern Rocky Mountain Forest Plants. USDA Forest Service, Intermountain Research Station. March 1991.

USDA 1999. Northern Region Overview: Summary. USDA Forest Service, Northern Region, Missoula, MT. 44 pages.

USDA 2000. Wildland Fire in Ecosystems: Effects of Fire on Flora. Gen Tech. Rep RMRS-GTR-42-Volume 2. USDA Forest Service, Rocky Mountain Research Station. December 2000.

U.S. Department of Agriculture, Forest Service. 2008. Northern Idaho/Inland Empire variant of the forest vegetation simulator. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Forest Management Service Center. 51 p.