Draft Environmental Impact Statement

B&B Fire Recovery Project

Sisters Ranger District, Deschutes National Forest
Jefferson and Deschutes Counties, Oregon

United States Department of Agriculture

Forest Service

March 2005

B&B FIRE RECOVERY PROJECT
Draft Environmental Impact Statement
Jefferson County, Oregon

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Abstract: The USDA Forest Service is proposing to harvest fire-killed and damaged trees, reduce fuels, plant trees, remove trees that are hazardous to public safety, and reduce unneeded roads within a portion of the Link, Bear Butte and Booth (B&B) Fire perimeters. This project is located in the Metolius Basin on the Sisters Ranger District in Central Oregon.

The purpose and need for these activities is to: 1) Harvest the fire killed timber resource before it loses all of its economic value; 2) Reduce harvest slash and fuels within salvage units to establish fuel conditions that will help reduce the potential for future high mortality, rapid spreading or large fires; promote the restoration of fire as a component of healthier ecosystems; provide defensible space, reduce risk to existing and developing NRF habitat; and increase suppression effectiveness; 3) Provide for public, administrative and operational safety by removing danger trees along open roads and areas of concentrated use; 4) Reforest desired and historically prevalent or common species (where natural, on-site, seed sources are lacking) within salvage units to aid in the quicker development of desired forest conditions, including large trees to support silvicultural activities within Matrix and late-successional characteristics within LSR; and, 5) Reduce open road densities, particularly within Late-Successional and Riparian Reserves, to help protect and improve late-successional and watershed conditions, and the associated fisheries and wildlife habitat.

Proposed actions include salvage and the associated activities described above on 6803 acres in 142 units within Matrix, Late-Successional Reserves, and Administratively Withdrawn allocations with the Northwest Forest Plan Area. Danger trees would be removed or cut and Defensible Space fuels treatment would be completed on 20 acres in the Round Lake area. Ground based yarding would occur on 5,847 acres, while helicopter yarding would occur on 955 acres. Approximately 29.7 MMBF of timber would be harvested, while fuels reduction and reforestation would occur on 6803 acres. Danger trees would be treated along 146 miles of roads, and 71 miles of roads would be decommissioned or inactivated.

Approximately 5.1 miles of temporary roads may be developed to aid in the access to and removal of trees. Two additional actions would require site-specific amendments to the Deschutes National Forest Land and Resource Management Plan: one to the visual quality

standards and guidelines, to allow short-term visibility of salvage and fuels treatment activities; and another that would allow firewood removal within the Metolius Heritage Area.

Five alternatives, including no action, were fully analyzed to gain an understanding of potential impacts of different strategies for meeting project goals. Alternative 2 is the proposed action. However, the Forest Supervisor may consider some elements from other alternatives for certain areas. As such, readers are encouraged to review all of the alternatives, and comment on elements of the other alternatives that the Forest Service should consider in the final decision.

Review and Comment: Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision-making process. Reviewers should structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

Send Comments to:

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Date Comments Must be Received: **18 April, 2005**

Chapter 1

Purpose and Need

PURPOSE AND NEED FOR ACTION

1.1 Introduction

The Forest Service has prepared this Draft Environmental Impact Statement (DEIS) for the proposed harvest of fire-killed trees, reduction of fuels, planting of trees, removal of trees posing a danger to public safety and reduction of unneeded roads within a portion of the Link and B&B Complex fire perimeters. This DEIS addresses: 1) the proposed action and four additional alternatives – including no action; 2) the major issues associated with the proposal; and 3) the direct, indirect, and cumulative environmental effects that would result from the implementation of the proposed action or any of the alternatives.

1.2 Document Organization

This DEIS has been prepared in compliance with the National Environmental Policy Act (NEPA), the National Forest Management Act (NFMA) and other relevant Federal and State laws and regulations. This document in organized into four chapters:

- *Chapter 1. Purpose and Need for Action*: This chapter includes information on the history of the project proposal, the purpose and need for the project, and the agency's proposal for achieving that purpose and need. This chapter also includes a description of how the Forest Service informed the public of the proposal, how the public responded, and a description of issues relevant to the proposed action.
- *Chapter 2. Proposed Action and Alternatives*: This chapter provides a more detailed description of the agency's proposed action including design criteria, as well as detailed descriptions of alternatives for achieving the stated purpose and need. This chapter also includes a discussion of any mitigation measures associated with the proposal; any monitoring or applicable research studies associated with implementation; and a summary of the environmental effects associated with the proposed action and each alternative.
- *Chapter 3. Affected Environment and Environmental Effects*: This chapter describes the current condition of relevant natural and social resources, and the environmental effects of implementing the proposed action and other alternatives. This chapter is organized by resource with those resources associated with 'Key Issues' identified.
- *Chapter 4. Consultation and Coordination*: This chapter includes: a list of preparers and agencies consulted during the development of this DEIS; a glossary of terms; literature cited; and an index.
- Appendices (A-Z): The appendices provide more detailed information to support the analyses presented in the DEIS. They are not included with the DEIS but are available upon request from the Sisters Ranger District of the Deschutes National Forest.

Additional documentation, including more detailed analyses of project area resources may be found in the project planning record located at the Sisters Ranger District in Sisters, Oregon.

All of the numeric quantifications included in the description and analysis of site conditions and the proposed action and alternatives are approximate. These numbers have been generated from several sources such as electronic sources (i.e. queries of Geographical Information System (GIS) spatial data) and field sources (i.e. field reconnaissance and verification). They do provide an approximate, if not exact, display of effects or trends as described by the Council on Environmental Quality (CEQ) Implementation Regulations (40 CFR 1502.16).

1.3 Background

The Metolius Basin is located in the northern half of the Sisters Ranger District, Deschutes National Forest, and is within Jefferson and Deschutes Counties. It lies approximately 30 miles west of Bend, Oregon and east of the crest of the Cascade Mountains. Virtually all landforms, rocks and soils within the area are a result of volcanic, glacial or major earth movement influence. The area includes the volcanic upper slopes of the Cascade Mountain Range in the upper elevations, the gently sloping plains of glacial outwash in the lower elevations and the hills and ridges of lava that rise above the surrounding outwash plains. The climate is characterized by a major precipitation gradient from west to east, about 65 percent of the annual precipitation falls between October and March with snow in the upper elevations and rain in the lower elevations (USDA 2004c, USDA 1996a).

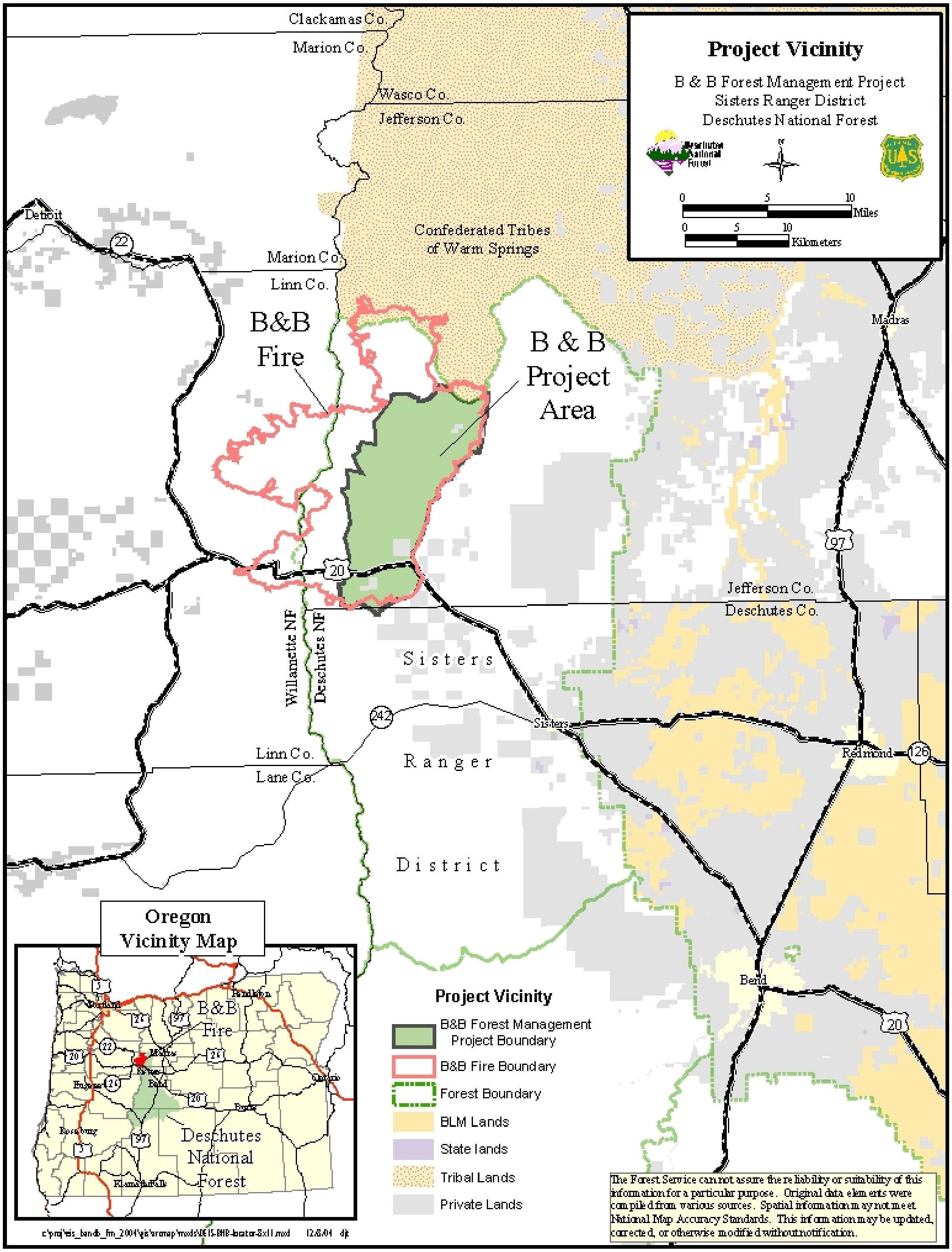
Over the previous century large fires have occurred within the basin. Between 1900 and 2000 fires have affected approximately 17.5 percent of the basin with an average of 3.8 percent of the basin affected within any given ten year period. Fire exclusion over this same period has impacted the historic fire regimes of forests on the east side of the Cascade Mountains - fire return intervals have increased as have fuel loadings and ladder fuels (USDA 1996a). As a result the risk of fires that lead to significant vegetation mortality increases. Large fires which are not typical of the previous century with regard to their spatial extent have occurred within the basin in 2002 and 2003 (Eyerly, Cache Mountain, Link, B&B Fires). These fires have covered approximately 54 percent of the basin in those years for a total of 71.5 percent of the basin having been affected by fire since 1900**.** In 2 years (2002 & 2003) four times as many acres have burned than burned in the previous 100 years (USDA 2004c).

On July 5, 2003, the Link wildfire ignited in the southern portion of the Metolius Basin. This fire burned for 11 days and contained approximately 3589 acres within the burn perimeter. Later in August two separate fires ignited on the afternoon of the 19th – the Bear Butte and Booth. These fires eventually burned together and were managed as one incident – the B&B Complex - which affected approximately 91,902 total acres – the largest fire in the history of the Deschutes National Forest. From its start the B&B Complex fire exhibited multiple days of extreme fire behavior with associated large acreage gains reaching over 90,000 acres in early September. Several days of precipitation, moister conditions and cooler temperatures in mid-September led to containment of this fire, however burning within the interior of the perimeter continued for several more weeks.

The B&B Complex grew quickly and spread rapidly. Extreme fire weather conditions coupled with high fuel loadings as a result of the spruce budworm infestation between 1995 and 2003 (some areas in excess of 50 tons per acre) both contributed to the intensity of the fire. In many areas the forest vegetation was consumed resulting in stand replacement (36 percent), other areas

experienced mixed overstory vegetation mortality or surface vegetation removal as a result of underburning. The northern, southern and western areas of the fire resulted primarily in stand replacement where the central and eastern portion of the fire resulted in mixed mortality or underburn

Map 1-1. B&B Fire Recovery Project Location



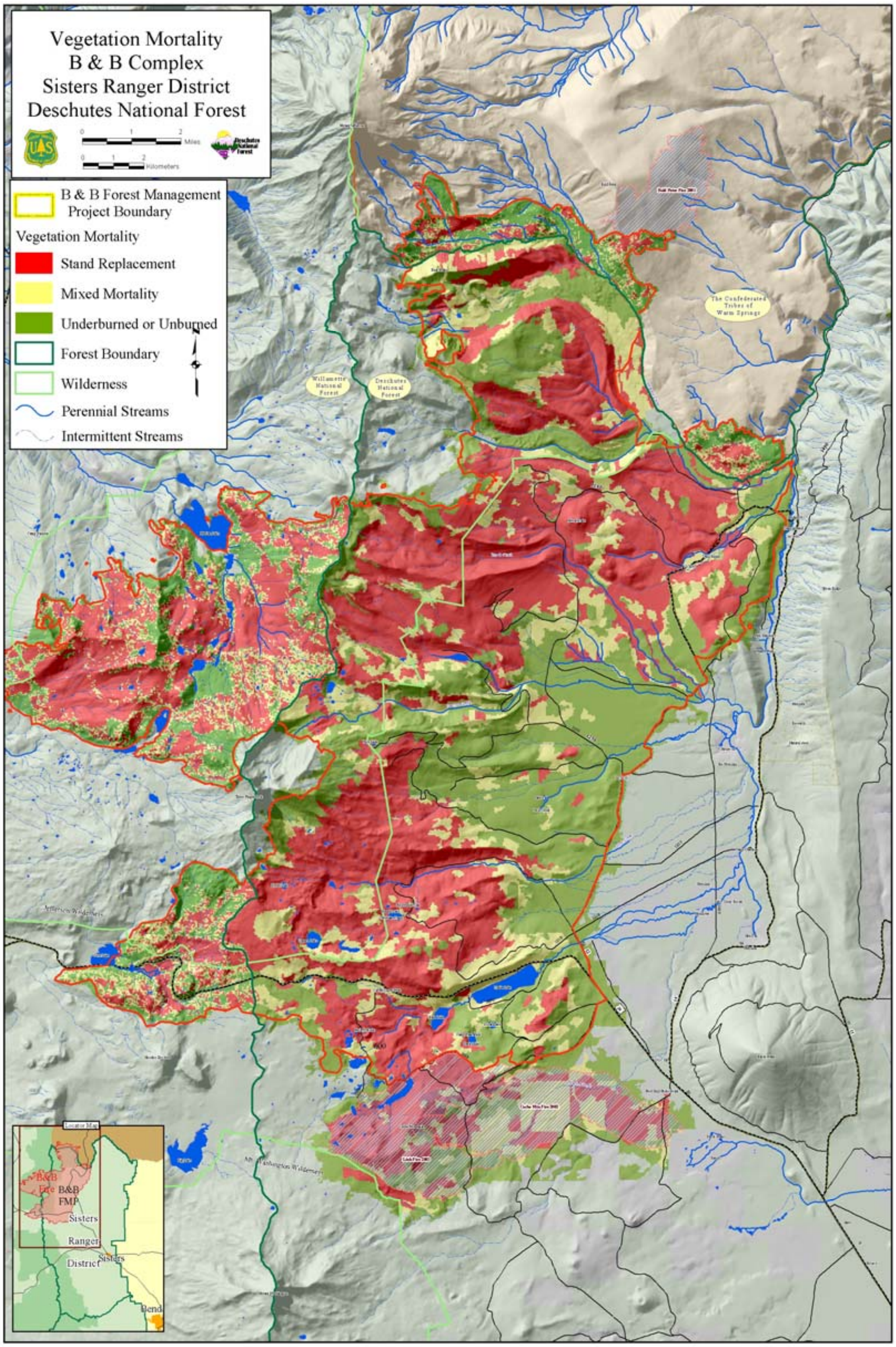
(See Map 1-1). Throughout the fire perimeter pocket areas exist that were unaffected by the fire and remain as remnant patches.

At the end of the 2003 fire season approximately 95,941* (see note in Table 1-1, below) acres of private, state, Confederated Tribes of the Warms Springs Reservation and National Forest Land were included within the perimeters of the Link and B&B Complex fires. A substantial percentage of the fire burned with enough intensity to kill either the majority of trees in a stand or the entire stand (high mortality). Post-fire satellite imagery was analyzed to identify areas of low, moderate, and high mortality burn with regard to overstory vegetation. High mortality burn areas are considered greater than 75 percent mortality and revert to a stand initiation phase; moderate mortality burn areas are considered 25-75 percent mortality; and low mortality areas experienced relatively low tree mortality with 0-25 percent mortality. Within the Deschutes National Forest approximately 33,027 acres burned with high or moderate mortality resulting in mortality of forest stands (stand replacement). Most of the stand replacement areas occurred in the dry mixed conifer stands (nearly 15,173 acres of high/moderate mortality fire). Land ownership within the Link and B&B Complex fire perimeters is broken down by acres and percentage in Table 1-1.

Table 1- 1. Land Ownership within the Link and B&B Complex (Bear and Booth) Fire Areas

OWNERSHIP	ACRES	PERCENTAGE OF FIRE AREA
DESCHUTES NATIONAL FOREST	69,659	74
WILLAMETTE NATIONAL FOREST	19,568	21
CONFEDERATED TRIBES OF WARM SPRINGS	3,803	4
PRIVATE LANDS	1,251	1
TOTAL	**94,281 ***	**100**
Note: * The Metolius Watershed Analysis Update displays 95,941 as the total acreage for both the Link and B&B Complex Fires. Based on the most current information used for analysis in this project the actual total number of acres encompassed by the fires is 94,281 as displayed in this table.		

Map 1-2. Link and B&B Complex Fire Mortality



1.4 Project Location and Area

The project area is located within the burned area perimeter of the Link and B&B Complex fires of 2003. This area is located approximately 15 miles northwest of Sisters, Oregon, on the east slope of the Cascade Mountains, west and northwest of Camp Sherman, Oregon. Oregon Highway 20 bisects the southern project boundary and offers views of the southern extent of these fires (Figures 1-1 and 1-2 show views from Mollies Rock near Corbett Snowpark on Hwy. 20 before and after the fire). The total fire perimeters for the Link and B&B Complex include approximately 94,281 areas. Of this area approximately 69,659 acres within the burn area perimeters are located on the Deschutes National Forest on the Sisters Ranger District. This area includes approximately 27,400 acres of designated Wilderness or Research Natural Areas where activities proposed in this project are excluded. Map 1-3 shows the entire fire perimeters and the designated Wilderness and Research Natural Areas. The remaining area on the Deschutes National Forest constitutes the project area and includes approximately 41,000 acres of Forest Service lands available for management actions and which are described within the Deschutes National Forest Land and Resource Management Plan (LRMP) as amended by the Northwest Forest Plan (NWFP). The project area is included within the Metolius Watershed. The Metolius Watershed is highly valued for its unique character – the Metolius River is spring fed and one of the most stable rivers in the world for its size and supports one of the healthiest Bull Trout populations in the state; the basin is also know for its large ponderosa pine trees and scenic views and is the epicenter of the global population of the Peck's Penstemon wildflower. Elevations in the project area range from 2,600 feet near the Metolius River to 5,280 in the upper watershed, several plant association groups including both wet and dry mixed conifer, ponderosa pine and lodgepole pine associations are found within the project area. Table 1-2 provides the legal description of the project area. Table 1-3 displays fire effects within the project area for several plant association groups (PAG).

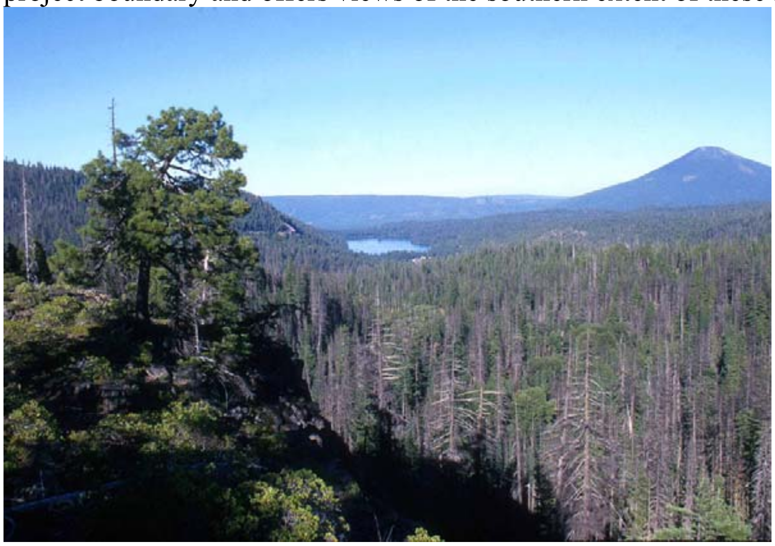


Figure 1-1. Mollies Rock Before Fire

Figure 1-2. Mollies Rock After Fire

Table 1-2. Legal Description of Project Area

Township	Range	Sections *
10 South	8 East	35 & 36
10 South	9 East	31-35
11 South	8 East	1,2,11-16,21-28,33-36
11 South	9 East	2-11,14-22,28-32
12 South	8 East	1-4,9-16,21-29,32-36
12 South	9 East	5,6,7,18,19,30,31
13 South	8 East	2,3
Note: * Sections wholly or partially contained within the project boundary.		

Table 1-3. Fire Effects by Plant Association within the Project Boundary by acres and percentage of the project area

Plant Association	Fire Effects							
	Stand Replacement		Mixed Mortality		Underburned		Unburned	
Dry Mixed Conifer	11,300 ac	28 %	5,000 ac	12 %	7,600 ac	18 %	NA	0 %
Wet Mixed Conifer	4,500 ac	11 %	1800 ac	4 %	4200 ac	10 %	NA	0 %
Ponderosa Pine	700 ac	2 %	500 ac	1 %	2500 ac	6 %	NA	0 %
Lodgepole Pine	300 ac	1 %	200 ac	0 %	300 ac	1 %	NA	0 %
Riparian or Aquatic	300 ac	1 %	NA	0 %	200 ac	1 %	400 ac	1 %

1.5 Desired Future Conditions

There are at least two existing descriptions of desired vegetation conditions for the area burned in the B&B Complex fire. The first is found in the Deschutes Forest Plan preamble for the Metolius Conservation Area Management Allocations (USDA 1990a, p. 4-164), and more specifically, the Metolius Heritage Area standards and guidelines (USDA 1990b). The second is the plant association group (PAG) specific description of desired conditions from the Metolius LSRA (USDA 1996a). While the recent fires have returned many areas to a stand initiation phase these descriptions can still be useful in a general way to define desired future forest stand conditions.

The Metolius Heritage Area description calls for "a unique ecosystem represented by large yellow-belly ponderosa pine and spring fed streams…"; with "peaceful, park-like forests of ponderosa pine and western larch…." ; and "mature and over mature forests having large trees, snags, and dead downed material. Stands with two or more canopy levels will be seen, but will highlight the largest trees in the stands."

The LSRA desired conditions define sustainable forest stands that best provide habitats for wildlife that depend on late-successional and old growth forests. The LSRA provides a range of desired seral class distributions as well as specific desired conditions for each seral class. The general descriptions for each PAG follow (see also Map 1-3):

Ponderosa Pine – (9% of the project area)

Generally homogeneous landscape of scattered large trees, reproduction in even-aged clumps up to several acres in size, scattered grass/shrub/forb openings, 1/10 to ¼ acre in size with a few larger. Stands are denser in riparian bottomlands and other moist ecotones, sparser on steep south facing slopes. Other species present include Douglas-fir and western larch in moist ecotones, juniper and incense cedar in drier ecotones, some lodgepole stands. Understories are primarily shrub and grass. Large snags and down logs are evenly distributed, and only rarely concentrated where openings result from root rot, bark beetle mortality, or localized high intensity fire. Low intensity fire is the primary disturbance agent, with return intervals ranging from 8 to 20 years. Wind throw is locally a factor.(USDA 1996a p. 66)

Dry Mixed Conifer - (60% of the project area)

Landscape is a mosaic of varying textures and seral stages, but predominately containing stands of small medium and large trees. Patch sizes are quite large from 100 to 1000 acres. Ponderosa pine and Douglas-fir are the dominant overstory species with sparse understories of shade-tolerant species. Low intensity fire return intervals range from 15 to 30 years. Low intensity fires maintain primarily early seral species and prevent the dominance of climax species in most stands. Moderate to high intensity fire is the primary stand modifying disturbance agent at varying intervals. Insects and disease also play a role on a smaller scale. Scattered stands exist where disturbance intervals are longer and allow the development of climatic climax conditions (stand characteristics that would develop in the absence of periodic disturbance). These stands are generally older and have a higher density of the largest trees. Northern spotted owl habitat is best provided by the climatic climax stands. (USDA 1996a p. 72)

Wet Mixed Conifer – (26% of the project area)

Landscape is a mosaic of varying textures and seral stages, but predominately containing stands of small, medium and large trees. Patch sizes are quite large, from 100 to 1000 acres. Ponderosa pine and Douglas-fir are the dominant overstory species with sparse understories of shade-tolerant species. Moderate to high intensity fire is the primary stand modifying disturbance agent at varying intervals. Insects and disease also play a role on a smaller scale. (USDA 1996a p. 78)

Lodgepole Pine – (2% of the project area)

Landscape is a mosaic of varying textures and seral stages, but predominantly containing stands of pole and small-sized trees with a few large remnants. Patch sizes are small – no more than 300 to 500 acres, and often as small as 10 to 20 acres. These stands are usually associated with frost pockets, poor soils, or other areas that are not tolerated by other tree species. Ponderosa pine, white fir, spruce, or white pine may be present. Moderate high intensity fire is the primary disturbance agent at relatively regular intervals of around 100 years. Insects and disease also play a role, especially bark beetles in stand replacement.(USDA 1996a p. 85)

Surface Fuel Loading

The Metolius Watershed Analysis Update of 2004 (USDA 2004c) described several objectives for fuels management within the watershed:

- Reintroduce fire at intervals that represent the natural range of variability (NRV)
- Reduce fuels in and around the Wildland Urban Interface (WUI), and other developed areas to provide defensible space and increase suppression effectiveness

- Reduce fuel loadings and crown bulk density so that they more closely approximate natural dead and down woody fuels loads in order that fire can be re-introduced and be used to restore and maintain habitat within the NRV

Specific fuel management areas have been described within the B&B Fire and Fuels Strategy (see Appendix A); these areas include: 1) fire regime areas; 2) Wildland Urban Interface Areas; defensible space areas; and 4) areas adjacent to existing or developing nesting, roosting and foraging habitat (NRF) for northern spotted owls. These areas would support: 1) fuel loads and arrangements that are manageable for both fire control and ecosystem processes; 2) firefighter and public safety especially associated with communities at risk; 3) fuel breaks along roads that are designed to act as an anchor point and a safe location during suppression activities; 4) to protect existing NRF and reduce risk to developing suitable habitat.

The Metolius LSRA also describes the desired amount of surface fuel that should be present within specific PAG's to support healthy forest conditions within the associated fire regime. Table 1-4 displays these desired surface fuel loadings for areas with disturbance (fire climax) and those without disturbance (climatic climax) as a major component of stand development, recommendations from Brown et al and the Sisters Ranger District are also displayed for comparison.

Table 1-4. Desired Conditions for Surface Fuel Loading in Late Succesional Reserves and Matrix Designation Lands

Plant Group Association	Metolius LSRA Tons/Acre	Brown et al. Tons/Acre	Sisters District Fuels Recommendation Tons/Acres
Ponderosa Pine Climatic Climax	10-15	5-20	7-15
Ponderosa Pine Fire Climax	5-10	5-20	7-15
Mixed Conifer Climatic Climax	12-35	10-30	15-25
Mixed Conifer Fire Climax	8-12	10-30	15-25

Down Wood

A variety of species are associated with down wood. Use by species differs in relation to size, decay class, and purpose of use, as well as many other factors. Therefore, by providing for varying densities, sizes, species, and decay classes on the landscape, it will provide for an array of wildlife species. Most available information of wildlife use of downed wood is representative of green stands. No information is available for downed wood in DecAID for post-fire environments and little literature exists for wildlife use of downed wood by wildlife species in post-fire environments. Therefore, we reviewed Brown et al. (2003) to help determine acceptable downed wood levels to realize benefits to wildlife while managing for acceptable fire risk.

Optimum levels of down woody material for providing acceptable risks of fire hazard and fire severity while providing desirable amounts for soil productivity, soil protection, and wildlife needs were calculated for warm, dry forest types and cool, subalpine forest types by Brown et al. (2003). A range of 5 to 20 tons per acre for warm, dry types and 10 to 30 tons per acre for cool types seemed to best meet most resource needs. For wildlife, these optimum levels included both standing and downed coarse woody debris. Levels representing the high end for pre-settlement conditions were found as follows: 5 to 10 tons per acre for warm, dry ponderosa pine and Douglas-fir types, 10 to 20 tons per acre for cool Douglas-fir types, and 8 to 24 tons per acre for cool lodgepole pine and other subalpine types (Brown et al. 2003).

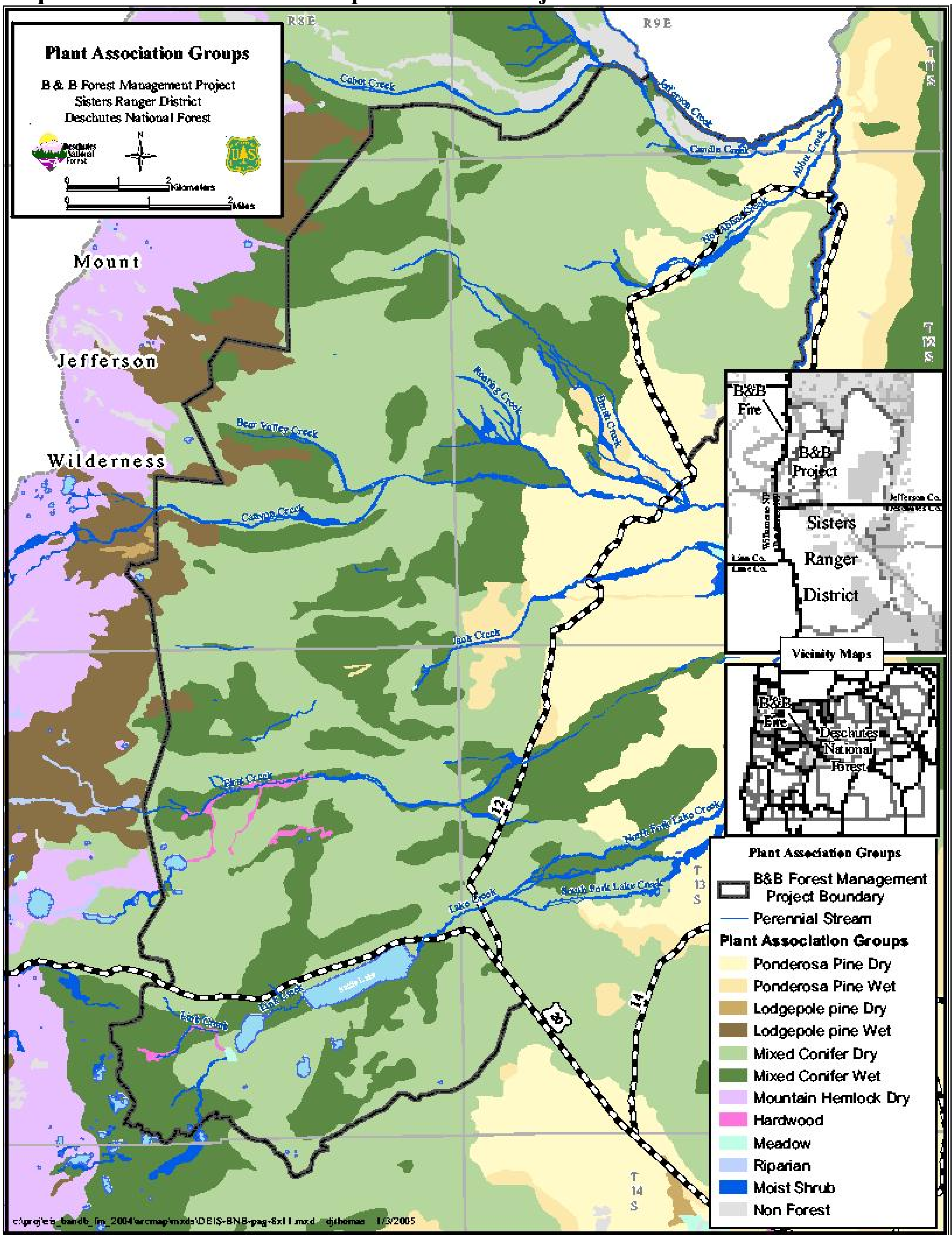
Forest Roads

The Metolius Area Roads Analysis provides a description of the desired roads resource in the project area: a road system that is safe and responsive to public and agency needs and desires, is affordable and efficiently managed, has minimal negative ecological effects on the land, and is in balance with available funding for needed management actions. The Metolius Watershed Analysis Update of 2004 (WA) found low use roads in many areas are becoming unusable due to blow down and shrub growth without being assessed to see if they are hydrologically stable. The WA also recommended that road closures be utilized to reduce road densities within the watershed.

Metolius Watershed

The WA described numerous findings, trends and recommendations within the basin. These are fully described within the Watershed Analysis and are incorporated by reference in this document (USDA 2004c). While this project does not propose to address all of the recommendations from the WA where concerns, trends and actions do overlap specific reference has been made to the WA in this document.

Map 1-3. Plant Association Groups Within the Project Area



1.6 Need for the Proposed Action

The recent wildfires in the Metolius Basin have created large expanses of fire killed vegetation and created many areas that have been returned to a stand initiation phase of development. While fire is a natural part of the forest landscape and disturbance regime, some portions of lower elevation mixed conifer and ponderosa pine forest areas have experienced fires in the past eight years that were outside their natural fire regime, that are uncharacteristic in size and intensity and unprecedented in the fire history of the past 100 years. (USDA 2004c).

There is an expected decrease in fire risk for approximately five years as a result of the reduction of fine fuels and brush in the fire area; however, over the longer term (5-60 years) there is an expected increase in fuel loading as currently dead standing trees topple to the ground (USDA 2004c). As fuels accumulate on the ground there is a greater resistance to future fire suppression efforts and decreased safety to the public and fire suppression personnel. Excessive fuels loads can also complicate or preclude the reintroduction of fire into these landscapes and compromise safety during suppression activity in the event of future fire. The maximum surface fuel loading is predicted to occur approximately 30 years following the fires. The maximum surface fuel loading for areas of stand replacement is estimated to reach between 40 and 70 tons per acre, which is substantially higher than desired conditions described for lands within the late-successional reserve (LSR) or matrix designations (see Table 1-4).

Wildfires have created new landscape patterns which in some ways resemble historic landscape patterns with complex edges, some gradual edges, and live stand remnants and legacies. However, more trees in lower elevation forests are dead than would have likely occurred historically and patch sizes of dead trees are larger than historic patch sizes. There are several large, early seral patches in the areas of: Cache Mountain , Round Lake and Abbot Butte. (USDA 2004c).

The abundance of standing dead and damaged trees in the watershed provides an opportunity to remove commercial wood products while still maintaining the necessary ecosystem components to provide for the viability of other resources such as wildlife. There is a need to recover the value of remaining forest products and timber volume where a stand-replacement event occurred in order to contribute to local and regional economies. In many areas within the LSR and Matrix designations the fire killed more trees than are needed to maintain late-successional conditions (USDA 1994 p. 66). In many places management can promote healthy and productive forest ecosystems for habitat, water and biological diversity in the long-term while balancing short-term economic benefits for communities by providing a supply of wood products.

There is a need to remove standing dead trees that will eventually fall and add to the surface fuel loading. The salvage of standing dead and dying trees and fuel treatments of smaller trees within salvage units would reduce the risk of future increased burn duration and improve the ability to manage future prescribed or wildfire events. Excessive fuel loads can threaten the developing forest stand in the event of future fire, preclude the return to a natural fire regime where natural or prescribed fire can be reintroduced, threaten the safety of future fire suppression efforts as a result of extreme fire behavior.

There is a need to move the conditions within the project area towards future desired vegetation and surface fuel loading conditions following the loss of large expanses of forest vegetation by promoting the development of desired forest vegetation. Desired future conditions for both the Metolius Heritage

Area and Metolius Late-Successional Reserve describe an array of stand conditions with large forest structure as a key component. Reforestation in stand replacement areas coupled with desired surface fuel loadings to reduce the potential for future high mortality fires that are resistant to control can lead to the accelerated development of these desired future conditions.

There is a need to reduce road impacts as well as protect the safety of forest users in the area. The presence of unstable, dead trees along roadsides, trails and other use areas presents a hazard to public safety. The Watershed Analysis also noted miles of roads within the basin that could be closed and thereby decrease sedimentation impacts to the unique Metolius watershed area.

1.7 Purpose of the Proposed Action

The purposes of this project within the B&B Fire Recovery Project Area are to:

- Harvest fire killed timber that has economic value.
- Reduce fuels within salvage units to establish conditions that will help reduce the potential for future high mortality, rapid spreading or large fires; promote the restoration of fire as a component of healthier ecosystems; increase defensible space and suppression effectiveness and reduce risk to existing and developing spotted owl nesting, roosting and foraging (NRF) habitat.
- Improve public, administrative and operational safety by removing danger trees along open roads and areas of concentrated use.
- Reforest desired species (where natural, on-site, seed sources are lacking) within salvage units to aid in the quicker development of desired forest conditions, including large trees to support silvicultural activities within Matrix and late-successional characteristics within LSR.
- Reduce open road densities, particularly within Late-Successional and Riparian Reserves, to help protect and improve late successional and watershed conditions, and the associated fisheries and wildlife habitat.

Harvest fire killed timber that has economic value.	▪ The area is currently characterized by fire-killed and damaged ponderosa pine and mixed conifers which quickly lose commercial value and their suitability for sawtimber as their value rapidly deteriorates after fire mortality. ▪ There is a demand for wood and various wood products throughout the region. Removing fire-killed trees through salvage logging will provide sawtimber and other wood products to the local and regional economies (USDA 1994 A-1). ▪ Salvage of merchantable forest products will help offset the costs of removing fuels in smaller unmerchantible size classes and contribute to reforestation through planting. Consider salvage of burned trees for economic benefit to produce wood products and provide jobs (USDA 2004c)

Indicators: Board feet of commercial volume proposed for harvest.
Acres proposed for salvage and biomass product sales.

Reduce fuels within salvage units to establish conditions that will help reduce the potential for future high mortality, rapid spreading or large fires; promote the restoration of fire as a component of healthier ecosystems; increase defensible space and suppression effectiveness and reduce risk to existing and developing spotted owl nesting, roosting and foraging (NRF) habitat.	▪ Most of the project area was historically a short interval fire adapted ecosystem. Reducing fuels loads in salvage units will set these areas up for the reintroduction of more natural and manageable fire regimes. ▪ As standing dead trees fall, especially trees with intact crowns, and smaller diameter trees and shrubs and other understory species become established, the accumulations of fuels in the project area will substantially increase. The accumulation of surface fuels loadings can result in conditions that support higher intensity and rapidly spreading fire behavior that leads to potentially damaging results to existing forest stands. These conditions represent a substantial departure from historic conditions. These fuels will pose a risk to regenerated forest stands and will limit the use of prescribed fire. Removing a portion of the fuels and dead trees now will facilitate thinning new stands, which in turn accelerates growth and vigor of the trees. ▪ Reduce fuels loads to a level that allows the reintroduction of fire and prescribed fire at the appropriate stages for the vegetation type (USDA 2004c). ▪ The long-term (30+ years) accumulation of fine fuels and forest litter coupled with fuel loads resulting from dead trees that have fallen will result in a higher potential for rapid spread and increased intensity, increased residence time of fire within stands and increased burn severity to soils. The potential for reintroduction of fire in the future would be reduced due to high fuel levels. Removal of dead trees and fuels now can promote the reintroduction of more natural fire frequencies and intensities. ▪ Promote the long –term survival and growth of new conifers by bringing fuel loads to a sustainable level for eastside forests that reduces the likelihood of stand replacement fire in newly regenerated stands, particularly during early stages of stand development (USDA 2004c). ▪ Salvage burned trees to reduce fuels towards historic levels to improve the ability to re-introduce fire and to make fires easier to control in the future (USDA 2004c)

Indicators: Percent of project area where fuel loadings do not exceed 10-35 tons per acre

Improve public, administrative and operational safety by removing danger trees along open roads and areas of concentrated use.	▪ The fires burned over acreages that are important and popular recreation areas on the Deschutes National Forest. The presence of unstable, dead trees along roadsides, trails and other use areas presents a hazard to public health and safety. ▪ It is a forest management goal to provide safe, efficient access for the movement of people and materials involved in the use of the National Forest lands (USDA 1990a p. 4-2) ▪ Human use in the watershed is increasing. There is also an increased risk to visitors and employee safety from falling snags, down trees and falling rock ▪ Reduce risks to public safety in burned areas, salvage to reduce hazards in areas where human safety may be threatened. (USDA 2004c) .

Indicators: Miles of roads treated for public and operational safety hazards
Acres of fuels treatments within defensible space areas

Reforest desired species (where natural, on-site, seed sources are lacking) within salvage units to aid in the quicker development of desired forest conditions, including large trees to support silvicultural activities within Matrix and late-successional characteristics within LSR.	▪ Forest vegetation structure and tree size have been pushed even farther outside the historic range due to fire. This continues a trend of more early seral vegetation and fewer older, large trees over 21 inches in diameter. (USDA 2004c) ▪ Natural regeneration of conifer species after fire is dependent on seed dispersal from remaining live trees. In many areas of mixed mortality fire white fir regeneration is apparent, however, reestablishment of this species will not meet the long term goals of the LSR or Metolius Heritage Areas. In large areas of high mortality – stand replacement fire - adjacent seed sources of desired species will not likely be available. Replanting of the desired species mix will ensure timely establishment of species desirable for long-term objectives. ▪ The restoration rate of late-successional forest habitat can be increased with planting and competition reduction treatments. Since timber production is not an objective of LSR's plant at lower densities to reduce the number of future entries needed to meet long-term management objectives (USDA 2004c). ▪ There are large areas of early seral vegetation due to wildfire created mortality in forest vegetation, increasing the amounts of grass, shrubs and seedlings. ▪ In matrix areas plant at higher tree densities to ensure that objectives for timber production can be met over most acres.

Indicators: Acres of reforestation within the project area by vegetation mortality condition (High, Moderate and Low)

Reduce open road densities, particularly within Late-Successional and Riparian Reserves, to help protect and improve late successional and watershed conditions, and the associated fisheries and wildlife habitat.	▪ The Metolius Basin currently contains approximately 3.7 miles of road per square mile. Roads provide accessibility to forest lands, however, they can serve to fragment wildlife habitat, provide area for invasive weed establishment, affect surface water runoff and increase erosion and sedimentation in streams. Closure and decommissioning of roads can have the opposite effect. ▪ In many areas low use roads are closing themselves due to blow down and shrub growth, without being assessed to see if they are hydrologically stable. ▪ Reduce riparian road miles through inactivation and decommissioning in the Abbot Creek, Candle Creek, Canyon Creek, First Creek and Lower Lake Creek subwatersheds (USDA 2004c). ▪ Continue to reduce road densities toward Forest Plan Standards (USDA 2004c).

Indicators: Miles of roads proposed for inactivation and decommissioning

1.8 Proposed Action Area

In developing a proposed action for this project it was necessary to evaluate the project area acres to identify those acres where actions consistent with the purpose and need can be implemented. While the project area of approximately 41,000 acres is extensive, salvage harvest is not permitted or consistent will all land management direction or resource opportunities and needs that exist within the project boundary. The following description identifies acreages that are not included in the proposed action and rationale as to why these acreages have been excluded from treatment in this project.

Riparian Reserves: Approximately 6,980 acres within the project boundary (~16%) are included in riparian reserves. Within the Metolius watershed approximately 31 percent of the riparian forest areas burned at moderate to high mortality. The Metolius Watershed Analysis which was updated after the wildfires of 2002 and 2003 identified: upland erosion; channel instability and erosion; debris slides in the upper watersheds; and storm runoff stress of the road drainage network as threats to water quality, specifically peak flows, stream temperatures and nutrient increases. Several subwatersheds are at higher risk after the wildfires to sediment deposition into important fish spawning areas, morphological changes to stream channels or temperature increases. This includes Abbot Creek, Candle Creek, Canyon Creek, First Creek and Lower Lake Creek subwatersheds. In order to reduce the potential of these risks to affect the water quality of streams in the Metolius Basin most of the riparian reserves have been excluded from treatment in the proposed action.

Recent Timber Sales and Plantations: Approximately 10,960 acres within the project boundary (~11%) are included within recent timber sales or plantations. In these areas the size and density of timber does not provide an opportunity for salvage recovery and therefore these areas have been excluded from treatment.

Low Mortality Underburned Ponderosa pine and Douglas-fir Stands: Approximately 1,770 acres within the project boundary (~4%) are included in these resource conditions. Based on fire regime and stand characteristics these stands are considered to be within their natural range of variability. These stands typically exhibit more frequent low intensity fire regimes and their characteristics do not necessitate the removal of dead overstory, fuels reduction or reforestation to maintain their integrity; therefore these stands have been excluded from treatment.

Metolius Wild and Scenic River: Approximately 1,770 acres within the project boundary (~4%) are included under this land use designation. In order to protect the scenic quality of this area and reduce further impacts to this resource the areas included as Federal Wild and Scenic Designation on the Metolius River have been excluded from treatment.

Inventoried Roadless Areas: Approximately 1,600 acres within the project boundary (~4%) are included under in this resource condition. These areas generally coincide with fire regime IV forest stands that are considered to be within the natural range of variability and do not necessitate the removal of dead overstory, fuels reduction or reforestation to maintain their integrity. Any salvage activities in these areas could also include the creation of new temporary roads; based on findings in the Metolius Watershed Analysis road closures were identified to reduce resource impacts from roads; therefore additional road creation in roadless areas would be inconsistent with those findings. In order to limit further impacts in the area from roads and to maintain consistency with management directions these areas were excluded from treatment in this project. There are no other areas in addition to the inventoried roadless areas that meet the Forest Service Handbook criteria (FSH 1909.12 Chapter 7.11) for consideration for wilderness designation.

Designated Nesting, Roosting and Foraging Habitat for Northern Spotted Owls: Approximately 1,630 acres within the project boundary (~2%) are included in this resource condition. Due to the loss of northern spotted owl habitat from the recent wildfires all remaining suitable habitat will retained to aid in the recovery of the spotted owls and maintain its critical habitat in the area. In order to protect remaining habitat for this species these areas have been excluded from treatment in this project.

High Elevation Meadow West to Cascade Summit: Approximately 3,600 acres within the project boundary (~3%) are included in this resource and vegetation condition. These areas are unique habitats that do not contain salvageable timber material and are therefore excluded from treatment in this project.

Fire Regime IV Stands: Approximately 800 acres within the project boundary (~2%) are included in this fire regime. These stands typically exhibit stand replacement fire on a longer interval disturbance (i.e. 35-100+ years) regime. Stands within the project area in this fire regime are considered to be within the natural range of variability and do not necessitate the removal of dead overstory, fuels reduction or reforestation to maintain their integrity; in addition these stands are located mostly within inventoried roadless areas; therefore these stands have been excluded from treatment.

Landslide Prone Areas in Canyon and Cabot Drainages: Approximately 500 acres within the project boundary (~1%) are included with unstable soils conditions. These areas tend to be more susceptible to mass erosion and sedimentation risk to downstream areas and are therefore excluded from consideration for treatment in this project.

Nesting Stands (great gray owls, goshawks, bald eagles): Approximately 400 acres within the project boundary (~1%) are included that exhibit nesting use for these species. The recent wildfires have destroyed or impacted many acres of primary habitat for various raptor species. In order to limit further intrusion and disturbance of these species their remaining nest stands within the project area have been excluded from treatment.

Approximately 57 percent (~24,000 acres) of the project area is within the previously described acreages that will not be considered for treatment under the proposed action. It is relevant to note that while these areas have been excluded from treatment in this project they may also be included in other projects and are being managed for other landscape goals and objectives within the basin based on their specific resource condition and attributes.

Of the 43 percent (~18,000 acres) of the project remaining that is consistent with the purpose and need of this project an initial economic viability evaluation was completed. This evaluation utilized aerial photograph interpretation, satellite imagery and stand exam data. Analysis of this data with regard to size of material and density of the stand, coupled with field reconnaissance of portions of the project area, reduced the potential acreage within the project area that is consistent with salvage operations and likely to support a commercial sale to approximately 14,000 acres (~33%). The initial public scoping letter and Federal Register notice of July, 30, 2004 utilized this assessment to describe potential treatment for the proposed action of 10-14,000 acres.

A more detailed economic viability and logging systems analysis in concert with more detailed field review of the area that revealed less economically viable acreage than originally estimated, further refined the potential proposed action to approximately 6000-8000 acres of salvage harvest recovery within the project area.

1.9 Proposed Action Description:

The Sisters Ranger District of the Deschutes National Forest is proposing to salvage harvest approximately 29.7 MMBF, reduce fuels and reforest 6803 acres (~16% of the project area and ~7% of the fire areas) in 142 units within Matrix, Late-Successional Reserve and Administratively Withdrawn land allocations and remove danger trees and excess fuels on 20 acres of high public use areas for a total of 6823 acres treated. Ground based yarding would occur on 5,867 acres while helicopter yarding would occur on 955 acres. Harvest acreage includes salvage harvest, special forest product and firewood areas, risk reduction and harvest in several LSR white fir dominated mixed mortality areas. All soft snags would be retained where they do not present a public health and safety hazard; all existing down wood would be retained across the project area; two of the most likely to persist snags on average per acre would be left in each unit (this recognizes that most likely to persist snags are not necessarily evenly distributed across the landscape); substantial amounts of non-merchantable, most likely smaller size class, trees would remain as snags within the units. In units exceeding 40 acres 15 percent retention patches would be left in clumps. All suitable habitat areas (nesting, roosting and foraging areas (NRF))would be excluded from treatment areas. In units adjacent to existing NRF habitat all units exceeding 20 acres would contain 15 percent retention patches of snags left in clumps.

The proposal includes the removal of harvest created slash and fuels remaining post-harvest would be treated on 6803 acres within salvage units and 20 acres of high public use areas to reduce fuel loads. These additional fuels treatments would move unit conditions towards the desired future fuel characteristics that will restore fire as an ecosystem component and reduce the risk of future uncharacteristic fire. In specific areas where defensible space, riparian reserve and danger tree treatments overlap the areas would be treated to defensible space fuels criteria as described in the Fuels Strategy.

Reforestation of desired tree species could occur on 6,823 acres primarily where stand replacement burn occurred and where desired natural reforestation does not occur. This includes approximately 4,979 acres of reforestation treatments in LSR with a diversity of species including ponderosa pine, Douglas-fir, western larch, and sugar pine.

The proposal includes danger tree removal along 146 miles of roads including commercial utilization along 2.5 miles of Riparian Reserve which overlap fuels defensible space areas in order to decrease the amount of fuels in those areas. Danger tree removal and fuels defensible space treatments would occur within 20 acres of high public use areas around Round Lake. In addition 71 miles of forest roads would be decommissioned or inactivated (see Maps 2-1 and 2-4). These treatments would begin implementation upon issuance of a Record of Decision expected in the summer of 2005.

Development of the proposed action was completed while considering the context of fire effects on the resources and values in the project area. The Deschutes Land and Resource Management Plan has designated several land use allocations within the Metolius Watershed to address the resources of the area (See Section 1.9 Planning Framework). All proposed action described in this project are consistent with guidance provided by those designations and is limited to National Forest System lands within the project area.

The scope of the project and decisions to be made are limited to: commercial salvage harvest, salvage created activity fuels reduction, non-salvage associated fuels reduction, special forest product harvest and sales, reforestation, danger tree removal, road decommissioning and closures, and mitigation and monitoring within the project area. Connected actions to be included in the decision include: temporary road development, treatment of activity fuels created as a result of salvage operations, reforestation of salvage units, danger tree removal and commercial utilization along haul routes and in riparian reserve areas which overlap fuels defensible space areas.

1.10 Laws and Policy

Development of this DEIS follows implementing regulations of the National Forest Management Act (NFMA); Title 36, Code of Federal Regulations, Part 219 (36 CFR 219); Council of Environmental Quality, Title 40; CFR, Parts 1500-1508, National Environmental Policy Act (NEPA).

Many federal and state laws, including the Forest and Rangeland Renewable Resources Act (RPA), Endangered Species Act, Clean Air Act, and Clean Water Act also guide this analysis. The following is a brief explanation of each of these laws and their relation to the current project planning effort.

The American Antiquities Act of 1906

This Act makes it illegal to appropriate, excavate, injure, or destroy any historic, prehistoric ruin or monument, or any object of antiquity, situated on lands owned by the Government of the United States, without permission of the Secretary of the Department of the Agency [Government] having jurisdiction over the lands on which said antiquities are situated.

The National Historic Preservation Act of 1966, as amended

This Act requires Federal agencies to consult with American Indian Tribes, State and local groups before nonrenewable cultural resources, such as archaeological and historic structures, are damaged or destroyed. Section 106 of this Act requires Federal agencies to review the effects project proposals may have on the cultural resources in the Analysis Area.

The Endangered Species Act of 1973, as amended

The purposes of this Act are to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such tests as may be appropriate to achieve the purpose of the treaties and conventions set forth in subsection (a) of this section." The Act also states "It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."

The Migratory Bird Treaty Act of 1918

The purpose of this Act is to establish an international framework for the protection and conservation of migratory birds. The Act makes it illegal, unless permitted by regulations, to "pursue, hunt, take, capture, deliver for shipment, ship, cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, including in this Convention…for the protection of migratory birds…or any part, nest, or egg of any such bird" (16USC 703). The original 1918 statute implemented the 1916 Convention between the United States and Great Britain (for Canada). Later amendments implemented treaties between the Unites States and Mexico, Japan, and the Soviet Union (now Russia).

The National Environmental Policy Act (NEPA) of 1969, as amended

The purposes of this Act are "To declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nations; and to establish a Council on Environmental Quality" (42 U.S.C. Sec. 4321). The law further states "it is the continuing policy of the Federal Government, in cooperation, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the present and future generations of Americans. This law essentially pertains to public participation, environmental analysis, and documentation.

The National Forest Management Act (NFMA) of 1976

This Act guides development and revision of National Forest Land Management Plans and has several sections to it ranging from required reporting that the Secretary must submit annually to Congress to preparation requirements for timber sale contracts. There are several important sections within the act, including Section 1 (purpose and principles), Section 19 (fish and wildlife resources), Section 23 (water and soil resources), and Section 27 (management requirements).

The Clean Water Act, as amended in 1977 and 1982

The primary objective of this Act is to restore and maintain the integrity of the Nation's waters. This objective translates into two fundamental national goals: 1) Eliminate the discharge of pollutants into the nation's waters; and 2) Achieve water quality levels that are fishable and swimmable. This Act establishes a non-degradation policy for all federally proposed projects. Under Section 303(d) of the Clean Water Act, the State has identified water quality-limited water bodies in Oregon. In the Metolius watershed four streams have been listed under section 303(d) for water quality concerns: Lake Creek, First Creek, Canyon Creek and Brush Creek.

The Clean Air Act, as amended in 1990

The purposes of this Act are "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to state and local governments in connection with the development and execution of their air pollution prevention and control programs; and to encourage and assist the development and operation of regional air pollution prevention and control programs."

Multiple-Use Sustained-Yield Act of 1960

The Multiple Use – Sustained Yield Act of 1960 requires the Forest Service to manage National Forest System lands for multiple uses (including timber, recreation, fish and wildlife, range, and watershed). All renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be re-established and grown again if the productivity of the land is not impaired.

Migratory Bird E.O. 13186

On January 10, 2001, President Clinton signed an Executive Order (E.O. 13186) titled "Responsibilities of Federal Agencies to Protect Migratory Birds." This E.O. requires the *"environmental analysis of Federal actions, required by NEPA or other established environmental review processes, evaluates the effects of actions and agency plans on migratory birds, with emphasis on species of concern."*

Natural or Depletable Resource Requirements and Conservation Potential

The B&B Fire Recovery Project has been designed to conform to applicable laws and regulations pertaining to natural or depletable resources, including minerals and energy resources. Regulations of mineral and energy activities on the National Forest, under the U.S. Mining Laws act of 1872 and Mineral Leasing Act of 1920, are shared with the Bureau of Land Management. The demand for access to National Forest System lands for the purpose of mineral and energy exploration and development is expected to increase over time.

Environmental Justice

On February 11, 1994, President Clinton signed Executive Order 12898. This order directs each Federal agency to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. On the same day, the President also signed a memorandum emphasizing the need to consider these types of effects during NEPA analysis. On March 24, 1995, the Department of Agriculture completed an implementation strategy for the executive order. Where Forest Service proposals have the potential to disproportionately and adversely affect minority or low-income populations, these effects must be considered and disclosed (and mitigated to the degree possible) through the NEPA analysis and documentation (see Chapter 3 - Environmental Justice).

Prime Farmland, Rangeland, and Forestland Memorandum

All alternatives are in accordance with the Secretary of Agriculture Memorandum 1827 for prime farmland, rangeland, and forestland. "Prime" forestland is a term used only for non-Federal land, which would not be affected by proposed alternatives. Regardless of the alternative selected, National Forest System lands would be managed with sensitivity to adjacent private and public lands.

Floodplains and Wetlands (E.O. 11988 and 11990)

The purpose of these 1977 orders are to "…avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direst and indirect support of floodplain development…" and similarly "…avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands…"

Wetlands that meet the Jurisdictional Definition (Corps of Engineers) are found in the B&B Fire Recover Project Area. These areas are mapped and avoided during harvest and fuels treatments.

Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (as Amended)

This act directed the Secretary of Agriculture to prepare a Renewable Resources Assessment and updates. These assessments include "an analysis of present and anticipated uses, demand for, and supply of the renewable resources with consideration of the international resource situation, and an emphasis of pertinent supply, demand and price relationships trends." The USDA Forest Service Forest Inventory and Analysis unit provides updates for this assessment.

Forest Order 12962 (aquatic systems and recreational fisheries)

This 1995 order's purpose is to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. It requires federal agencies to evaluate the effects of federally funded actions on aquatic systems and document those effects relative to the purpose of this order.

Executive Order 13112 (invasive species)

This 1999 order requires Federal agencies whose actions may affect the status of invasive species to identify those actions and within budgetary limits, "(i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species… (iii) monitor invasive species populations… (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded;…(vi) promote public education on invasive species… and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species… unless, pursuant to guidelines that it has prescribed, the agency had determined and made public… that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

Executive Order 13287 (preserve America)

This 2003 order's intent is to preserve America's heritage though "actively advancing the protection, enhancement, and contemporary use of the historic properties owned by the Federal Government… The Federal Government shall recognize and manage the historic properties in its ownership as assets that can support department and agency missions while contributing to the vitality and economic well-being of the Nation's communities and fostering a broader appreciation for the development of the United States and its underlying values…"

Consumers, Civil Rights, Minorities, and Women

All Forest Service actions have potential to produce some form of impacts, positive or negative, on the civil rights of individuals or groups, including minorities and women. Analysis of this potential impact is required by Forest Service Manual and Forest Service Handbook direction (see Chapter 3 - Social Economics).

Healthy Forest Initiative and Healthy Forest Restoration Act of 2003

Healthy Forest Initiative (HFI) provides guidance for implementation of the National Fire Plan, provides Categorical Exclusion (CE) authorities for fuels reduction activities and stewardship contract authority. Healthy Forest Restoration Act (HFRA) passed by congress in 2003 to improve the capacity to conduct hazardous fuels reduction projects by providing authorities within Environmental Assessments (EAs) and Environmental Impact Statements (EISs).

1.11 Planning Framework

Development of the DEIS is also consistent with the management guidance and direction provided in various planning documents. These documents and guidance are described briefly in the following section – for more detailed information on how the proposed project applies guidance from these documents see Appendix B.

Northwest Forest Plan

In 1994, the Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan) amended the Deschutes National Forest Land and Resource Management Plan. Some of the project area became Late Successional Reserve under the Northwest Forest Plan (Map 1-2, page 6) this document tiers to the analysis in the Finale Supplemental EIS (FSEIS) on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. The following Land Allocations are described in that FSEIS and occur within the project area (see Map 1-2):

Late Successional Reserve (approximately 23,600 acres, 56% of the project area)

The objective of Late Successional Reserves is to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl (USDA 1994 p. C-9). Standards and guidelines for LSRs include guidelines for salvage, which is defined as "removal of trees from an area following a stand replacement event" (USDA 1994 p. C-13). The Metolius Late Successional Reserve covers approximately 76,000 acres. An LSR Assessment was completed in 1996.

Approximately 30 percent of the Link and B&B Complex fires occurred within the Metolius Late Successional Reserve (LSR) (Map 1-2), located along the northern and western portions of the fire. Approximately 23% of the LSR experienced stand-replacement fire severity. The recent wildfires of 2002 and 2003 have impacted 20 of the 24 northern spotted owl pairs on the district – 11 have been lost, 4 altered, and 2 have dead nest groves.

Past management within the area followed objectives in the Northwest Forest Plan and the Metolius LSR Assessment. The Metolius Late Successional Reserve Assessment identifies desired conditions and management strategy for the LSR designed to protect and enhance a composition of four types of late-successional habitats (USDA 1996a p. 66). The majority of the LSR is made up of mixed conifer plant associations where the dominant climax species are grand/white fir and Douglas-fir (approximately 62 percent), the LSR also includes approximately 32 percent ponderosa pine plant associations. The Metolius LSR Assessment (LSRA) identifies potential natural vegetation conditions for the area and describes specific goals and objectives to achieve in the management of the LSR. (USDA 1996a p. 64-65). Within the fire areas, the late-successional forest habitat was approximately 32 percent mixed conifer and approximately 2 percent ponderosa pine. The overall objectives are to provide a mosaic of fire-climax and climatic climax late-successional habitats within the mixed conifer type, and to move the ponderosa pine type towards fire-climax late-successional conditions. Both types are to be managed for late-successional habitat conditions in fire climax stands that allow for low intensity/severity prescribed or natural fire (USDA 1996a p. 65).

Matrix (approximately 16,300 acres, 39% of the project area)
This management allocation consists of federal lands outside of LSR, Riparian Reserve and Administratively Withdrawn designated areas. Most timber harvest and other silvicultural activities would be conducted in the matrix where there is suitable forest land, according to standards and guidelines. Most scheduled timber harvest takes place in the matrix (USDA 1994 p. C-39). The central portion of the project area is located within the Matrix land allocation. This area burned in a different pattern than other parts of the fire areas. The plant associations are primarily dry mixed conifer and ponderosa pine. Much of the fire in these areas resulted from suppression burnout operations to protect nearby wildland-urban interface areas, the Metolius Wild and Scenic River and tributaries, and lower elevation ponderosa pine forests. These areas typically burned with lower intensity and did not result in large areas of stand replacement fire. Map 1-1 depicts burn intensity within the fire perimeter. In the fire areas, Matrix lands provided connectivity between patches of suitable habitat. Connectivity has been reduced as a result of the fire. However, Matrix lands within remaining green stands currently provide a refuge for species associated with late and old structured forest habitat.

Administratively Withdrawn (approximately 1.030 acres, 2% of the project area)

These are areas identified in current Forest and District Plans or draft plan preferred alternatives that are already being managed to provide benefit to late and old species. Management emphasis precludes scheduled timber harvest (USDA 1994 p. C-29). In the B&B Fire Recovery project area, the area around Suttle Lake is Administratively Withdrawn under the NWFP/Deschutes Land and Resource Management Plan (DLRMP). Approximately 1030 acres of this allocation are within the fire perimeters and includes the shoreline of Suttle Lake. The burn severity to overstory vegetation is high in most areas of the shoreline.

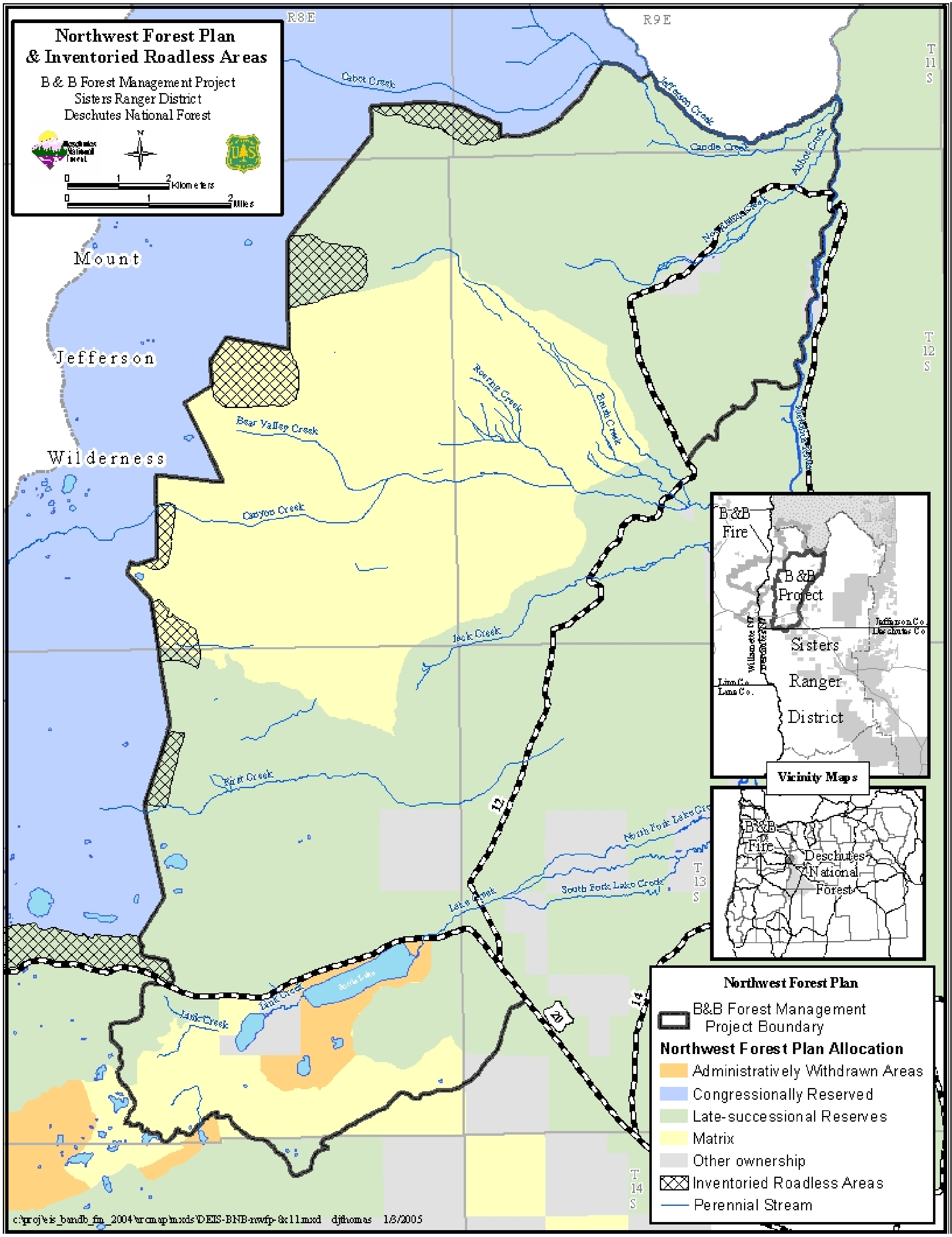
Riparian Reserve (approximately 6,800 acres, 16% of the project area)
Riparian Reserves overlap other management allocations and are one of four components of the Northwest Forest Plan's Aquatic Conservation Strategy (USDA 1994 p. B-12). They are portions of watersheds where riparian-dependent resources receive primary emphasis and

where special standards and guidelines apply that prohibit and regulate activities that retard or prevent attainment of the Aquatic Conservation Strategy objectives. In the fire areas riparian reserve exists in association with streams, lakes and other wetland features where riparian-dependent resources receive primary emphasis. These areas burned with various intensity throughout the fire.

Key Watershed (approximately 41,781 acres, 99% of the project area)

Key watersheds as described under the Northwest Forest Plan (NWFP) contribute directly to the conservation of the threatened bull trout and resident fish populations. All subwatersheds within the Metolius Watershed, except the Cache Creek subwatershed, are “key watersheds” as described under the Northwest Forest Plan. The NWFP provides standards and guidelines for Key Watersheds and Riparian Reserves that prohibit or regulate activities that retard or prevent attainment of the Aquatic Conservation Strategy objectives. As another component of the Aquatic Conservation Strategy, key watersheds provide high quality habitat for at-risk stocks of resident fish species. They are refugia for maintaining and recovering habitat for these at-risk species. The key watershed designation overlaps other management allocations (USDA 1994 p. B-18).

Map 1-4. Northwest Forest Plan Allocations and Inventoried Roadless Areas Within Project Area



Deschutes Land and Resource Management Plan (Forest Plan) Direction

Guidance for management activities is provided by the Deschutes National Forest Land and Resource Management Plan of 1990 (LRMP) as amended. The LRMP establishes goals, objectives, standards, and guidelines for each specific management area of the Forest, as well as Forest-wide standards and guidelines. Management Areas and associated standards and guidelines are described in Chapter 4 of the LRMP. This document tiers to the FEIS Land and Resource Management Plan for the Deschutes National Forest. Management Areas (MA) affected by the fire within the project area include the following (see Map 1-5) (this discussion can also be found in more detail in the Deschutes LRMP pp. 4-90 – 4-202):

Management Area 3: Bald Eagle
(approximately 808 acres; 2% of the project area)

Habitat within BEMAs is to be managed to enhance the carrying capacity of bald eagles. Objectives include protecting and enhancing nesting habitat and foraging areas; providing suitable nesting sites on a continuing basis; and emphasizing old growth stands with large trees. Human disturbance will be minimal during nesting season (USDA 1990a p 4-94).

Management Area 8: General Forest
(approximately 2214 acres; 5% of the project area)

Within the General Forest MA, timber production is to be emphasized while providing forage production, visual quality, wildlife habitat, and recreational opportunities for public use and enjoyment. The objective is to continue to convert unmanaged stands to managed stands with the aim of having stands in a variety of age classes with all stands utilizing the site growth potential (USDA 1990a p 4-117).

Management Area 9: Scenic Views
(approximately 947 acres; 2% of the project area)

The project area contains scenic views in the foreground and midground. The goal of scenic views management areas is to provide high quality scenery that represents the natural character of Central Oregon. Landscapes seen from selected travel routes and use areas are to be managed to maintain or enhance their appearance. To the casual observer, results of activities either will not evident, or will be visually subordinate to the natural landscape (USDA 1990a p 4-121).

Management Area 11: Intensive Recreation
(approximately 1,492 acres; 4% of the project area)

The goal of this MA is to provide a wide variety of quality outdoor recreation opportunities within a Forest environment where the localized settings may be modified to accommodate large numbers of visitors and where undeveloped recreation opportunities may occur (USDA 1990a p 4-135).

Metolius Conservation Area

The Metolius Conservation Area was established in the 1990 Deschutes Land and Resource Management Plan –

> "The Metolius Basin is truly unique in the quality and diversity of its natural resource and spiritual values. The River's headwaters well from the ground in scenic springs,

ensuring pristine water quality and excellent fisheries. Abundant rainfall and rich soils have combined to produce luxuriant forests of fir, cedar, larch and Ponderosa pine which have contributed greatly to the demand for forest products locally and regionally. Big, yellow-barked Ponderosa pine trees are a highlight of the Basin. The Metolius ecosystem provides habitat for a wide variety of plant and animal species."

"Outstanding natural scenery exists throughout the Basin and attracts visitors who seek a variety of recreation pursuits…The Metolius is outstanding in the abundance of its resources and depth of feeling with which they are held by all who visit this special place."

Management Area 19: Metolius Heritage (approximately 4,495 acres; 11% of the project area)

The goal of this MA is to perpetuate a unique ecosystem represented by large yellow-belly Ponderosa pine and spring-fed streams; one that is part of Oregon's heritage. Significant historical character is found in this area and should be perpetuated. This ecosystem is an integral part of the Metolius Basin as a whole, and should be managed with that consideration.

Management Area 21: Metolius Black Butte Scenic (approximately 540 acres; 1% of the project area)

The goal of this MA is to perpetuate the unique scenic quality of Black Butte – "Black Butte is a unique and dominant landform in the Central Oregon landscape" (USDA 1990a p. 4-173)

Management Area 22: Metolius Special Forest (approximately 19,933 acres; 47% of the project area)

The goal of this MA is to rehabilitate and sustain a healthy forest with an emphasis on timber production, while maintaining a near-natural appearance, and providing a range of recreational opportunities for public use and enjoyment.

Management Area 26: Metolius Scenic Views (approximately 8,777 acres; 21% of the project area)

The goal of this MA is to provide Forest visitors witrh high quality scenery that represents the natural character of the Metolius Basin.

Management Area 28: Metolius Wild and Scenic River (approximately 1,730 acres; 4% of the project area)

After publication of the Deschutes LRMP a separate Metolius Wild and Scenic River Management Plan was prepared (USDA 1993). The Wild and Scenic River plan set forward management that protects the resource values of the Metolius River on public lands on the Deschutes National Forest. The outstandingly remarkable values associated with the Metolius Wild and Scenic River are: geologic features, hydrologic resource, ecological resource, fisheries resource, wildlife resource, scenic resource, prehistoric and historic values. This DEIS tiers to the Final EIS for the Metolius Wild and Scenic River, however, there are no proposed actions within the Wild and Scenic River area.

Table 1-5 describes the acreages and burn severities associated with the Deschutes Land and Resource Management Plan Land Use Designations for the Project Area.

Table 1-5 . Deschutes Land and Resource Management Plan Management Areas

Designation	Acres	Project Area	High Severity	Mixed Severity	Unburned or Underburned
Bald Eagle	808	2%	135	436	200
General Forest	2214	5%	1268	366	580
Scenic View	947	2%	708	164	73
Intensive Recreation	1492	4%	193	496	505
Metolius Heritage	4495	11%	988	498	3007
Metolius Black Butte Scenic	540	1%	0	94	446
Metolius Special Forest	19933	47%	9882	3584	6467
Metolius Scenic Views	8777	21%	4189	1700	2848
Metolius Wild and Scenic River	1730	4%	131	191	1330

Metolius Key Elk Area

Elk management objectives were developed in concert with Oregon Department of Fish and Wildlife to meet a level of habitat effectiveness to support a healthy elk population. Road densities will be managed to reduce disturbance during critical time periods as well as reduce overall densities. In addition, vegetation management should result in a mix of hiding and thermal cover linked by travel corridors to provide for an array of habitat conditions. (USDA 1990a p. 4-55 thru 4-58)

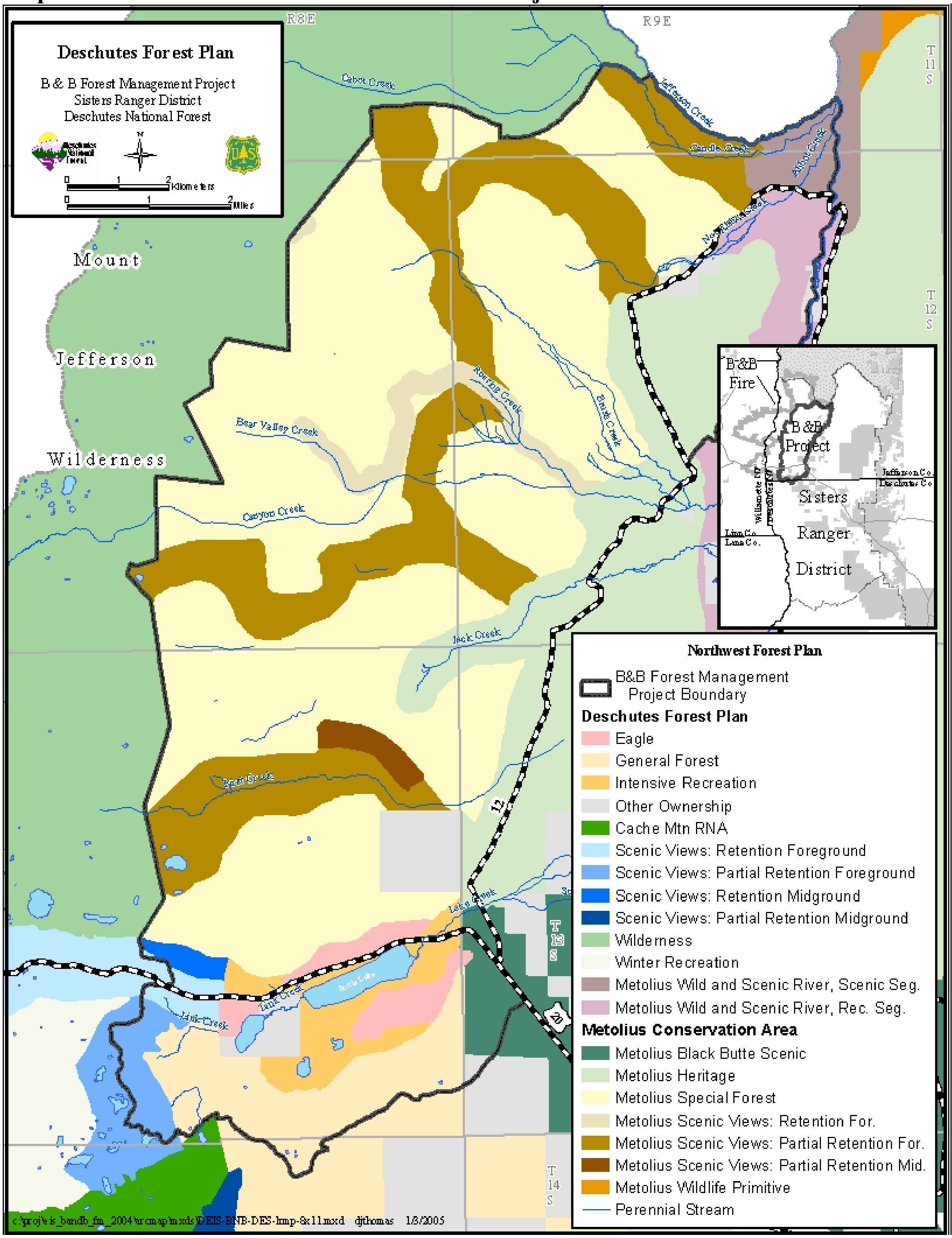
Management Indicator Species (MIS)

During the preparation of the Deschutes National Forest Land and Resource Management Plan (USDA 1990a), a group of wildlife species were identified as management indicator species (MIS). These species were selected because their welfare could be used as an indicator of other species dependent upon similar habitat conditions. Indicator species can be used to assess the impacts of management actions on a wide range of other wildlife with similar habitat requirements. These species are not assigned Management Areas. Rather, Standards and Guidelines are applicable Forest-wide. The species selected for the Deschutes National Forest are listed in Chapter 3, under the MIS section.

National Fire Plan

The purpose of the National Fire Plan is to help protect communities and natural resources, and most importantly, the lives of firefighters and the public. An overall framework for implementing fire management and forest health problems was presented in the September 2000 report *Managing Impacts of Wildfires on Communities and the Environment* (The National Fire Plan). The *Cohesive Strategy* was approved in October 2000. This report provides a strategic framework for reducing hazardous fuels buildup within priority areas such as the wildland-urban interface. The *10-Year Comprehensive Strategy* was signed August 2001. It established four goals and a set of actions for each to facilitate progress in attaining each goal. The *10-Year Comprehensive Strategy Implementation Plan* was signed in 2002 establishing a collaborative, performance based framework for achieving the goals and actions set forth in the Comprehensive Strategy. The Implementation Plan also provides a framework for measuring progress toward achieving the goals of the 10-Year Strategy. Community Protection Plans are an integral component of the Comprehensive Strategy. A Community Protection Plan for the Sisters, Oregon, area has been initiated, this plan includes the Camp Sherman community near the project area. This plan is expected to be submitted for approval in April 2005.

Map 1-5. Forest Plan Land Allocations Within Project Area



1.12 Scoping and Public Involvement

Scoping and public involvement began early in the process and are continuing throughout the planning stages. These processes are used to invite public participation and to obtain input on a particular proposed action. Information received during these processes are used to determine the extent of analysis needed to reach an informed decision. The Council on Environmental Quality regulations (40 CFR 1501.7) were followed to determine the scope of issues and opportunities to be addressed in the environmental analysis and to identify major concerns related to the Proposed Action. Public comment was sought through several means which are summarized below. The complete record of the public involvement process to date is available for review in the project file. The following list highlights some of the public involvement activities that have occurred since the fires in 2003:

- In October, 2003 the Forest Service provided two visits to the B&B Complex Fire area to the general public, many participants were residents of Camp Sherman and the local area.
- A workshop and large tour was held In the fall of 2003 for Oregon State University and Pacific Northwest Research Station researchers.
- A letter was sent to Regional Forester Linda Goodman by Crook County [Oregon] Judge Scott R. Cooper on December 6, 2003 which outlined the request by the judge on behalf of the county's Natural Resources Planning Committee. The request called for the need for immediate salvage efforts to address the effects of the B&B Complex Fires.
- The project was listed in the *Schedule of Projects for the Deschutes and Ochoco National Forests and the Prineville District of the BLM* beginning with the Spring 2004 issue.
- On July 8 and 9, 2004, two similar public field trips to the project area were provided by the Forest Service and Oregon Forest Resources Institute (OFRI). Approximately 70 interested public, university, and agency resource specialists participated.
- The B&B Fire Recovery Project was initially presented to the public in a letter dated July 20, 2004 that was sent to the Sisters Ranger District's NEPA mailing list of individuals, groups, and agencies. The letter described the purpose and need and the proposed action.
- The proposed action was posted on the Deschutes National Forest's web site on July 26, 2004.
- A radio news feature describing the proposal appeared on OPB Radio on July 27, 2004, and in *The Sisters Nugget* newspaper on July 29, 2004.
- A Notice of Intent to Prepare an Environmental Impact Statement was published in the Federal Register on July 30, 2004 (Vol. 69, No. 146). A Conservation Group Leaders Field Tour was conducted by Sisters Ranger District personnel and ONRC representative Tim Lillebo on August 12, 2004. Twenty-six Forest Service employees and conservation group members participated in the field visit.
- On August 14, 2004, a public field visit occurred and approximately 20 members of the interested public attended.
- On August 17, 2004 a field visit was conducted with Forest Service Washington Office staff.
- On September 13, 2004, the B&B Working Group met with Deschutes Provincial Advisory Committee (PAC) community members, including local conservation and industry representatives.
- On October 13, 2004 a field visit and project briefing was held with the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWRSO).
- On October 20, 2004, a field visit was held with an Environmental Protection Agency representative.

- On October 26, 2004 the project interdisciplinary team (ID Team) met with Forest Service Pacific Northwest (PNW) science community personnel (Jamie Barbour, Paul Hessburg, John Lehmkuhl, Janet Ohmann, Jane Smith, Tom Spies, Rick Woodsmith) to discuss project and landscape considerations.
- On October 27, 2004, a project design discussion and field visit with Forest Service Region 6 Environmental Office (REO) representatives occurred.
- On November 7, 2004, a field visit of the Lower Jack Timber Sale and B&B Fire Recovery Project areas was led by Oregon Natural Resources Council. As a result, comment letters were received and are located in the project record.

During the initial scoping process in the summer of 2004, written comments, letters, electronic mail responses or phone calls were received from 55 individuals, agencies, businesses, and organizations in response to this scoping effort. All comments were read by the ID Team and other staff to ensure consideration of all comments during the analysis process. Comments are located in the Project File at the Sisters Ranger District office.

As the result of scoping at a government-to-government level, the Confederated Tribes of the Warm Springs Reservation (CTWSR) was informed, and provided comments on the proposed action. The Sisters Ranger District also provided a briefing to the Natural Resources Group which is composed of the Natural Resources staff of the CTWSR in October, 2004. Communications with representatives of CTWSR continued throughout development of the project.

Coordination has also occurred with other federal, state, and local government officials. The U.S. Fish and Wildlife Service (USFWS) has been kept informed of proposed activities and numerous meetings between USFWS and the Sisters Ranger District staff have occurred throughout the development of the project. The Sisters Ranger District convened a ‘Steering Committee’ for the project composed of Sisters Ranger District, Deschutes National Forest, Forest Service Region 6 and USFWS staff to discuss development of the project on a monthly basis. A working group of the chartered Deschutes Provincial Advisory Committee has also been working with the ID Team during the development of the project. Both of these groups offer guidance and direction as well as valuable feedback on the process and direction for the project.

1.13 Planning Issues

Comments received from members of the public and various public, governmental and non-governmental groups and concerns described in the Metolius Watershed Analysis Update have generated issues and analysis concerns that are discussed in this document. During comment analysis individual comments were evaluated to determine whether they constituted issues relevant to this planning process. These issues were then evaluated to determine where in the planning process they most appropriately applied – project design; alternative development, environmental effects. Issues that applied to all parts of the planning process were further evaluated to determine ‘Key Issues’. Key Issues are defined as resource or other values that drive the development of an alternative, may be adversely affected by the proposed action, or involve unresolved conflicts regarding alternative uses of available resources. Key issues provide focus for the analysis and are used directly in formulation of the alternatives and/or mitigation or are used to compare and contrast the environmental effects of the alternatives. Listed with each key issue are indicators to show a measurement of how each key issue is affected by proposed activities for each alternative, these measures are derived to help differentiate the differences and similarities between the alternatives based on actions proposed.

In addition to key issues identified by the IDT, there are “analysis” issues addressed in the effects analysis and often used to compare alternatives. For example, heritage resources will always be addressed in actions that have site-specific ground-disturbing actions. Although alternatives may not be designed specifically to address heritage resources, the consequences of all the alternatives must be measured against compliance with direction to provide adequate protection for these resources.

Key Issues

Issues identified as key issues for this DEIS are listed below. They are not listed in any particular order. They will be discussed in detail in the analysis and throughout the remaining chapters of this document.

Effects to Water Quality from Sedimentation	Ground based activities such as salvage operations, danger tree removal, mechanical fuels reduction, road closures and decommissioning activities within the areas most likely to supply sediment to stream areas could increase erosion and consequent sedimentation during the short term. Reforestation and closure and/or decommissioning of roads which contribute sediment or overland flow to a stream area could reduce stream sedimentation over the long term. There are threats to water quality associated with wildfire including: sediment from upland erosion, channel instability and erosion, debris slides in the upper watersheds, and storm runoff can stress the road drainage network and wash out roads, including roads at stream crossings (USDA 2004c). Several subwatersheds are at higher risk after the wildfires to sediment deposition into important fish spawning areas, morphological changes to stream channels or temperature increases. This includes Abbot Creek, Candle Creek, Canyon Creek, First Creek and Lower Lake Creek subwatersheds (USDA 2004c). There is an increased risk of erosion due to wildfire effects and potential to channel fine sediment into aquatic habitats. Consider expanded riparian buffers for activities in burned and unburned riparian reserves (USDA 2004c)

Indicators:

- Acres of and type of treatment in areas at risk and/or with detrimental soil conditions.

Effects to Soils Productivity

Maintenance of soil productivity is an important objective for forest management under the Forest Plan. Past management activities have incurred varying levels of impact that when coupled with the proposed actions could affect soil productivity. The proposed actions may alter properties and/or components of the soil resource inherent to soil productivity such as compaction, displacement and nutrient availability. There are elevated erosion risks associated with burned areas especially within the headwater areas of First Creek, Jack Creek, Canyon Creek and Brush Creek.

Indicators:

- Acres and distribution (extent) of detrimental soil disturbance (i.e. total acres of compaction, displacement, burn severity) within each subwatershed.
- Amount of nutrients (carbon, nitrogen and phosphorus) remaining on site.

Effects to Wildlife Habitat – Snags and Downed Wood

There has been a loss of large tree habitats and snags in the Metolius watershed. (USDA 2004c)

The Metolius watershed has been experiencing increasing levels of snags and down woody material since the early 1990's primarily from insect and disease outbreaks (USDA 2004c).

The recent fires have created an additional large pulse of dead standing and downed wood habitat in the area which will benefit species associated with this type of habitat until the relative abundance of this habitat type decreases over time.

The removal of fire damaged merchantable material can reduce the abundance of this habitat component.

A lag time exists between the current availability and the future recruitment of this habitat type – currently the abundance is high, however, as dead standing trees fall this habitat abundance will decline eventually leaving a shortage of this type of habitat until future forest stands can provide a new supply of standing dead and downed wood.

Due to the relatively short standing time of dead trees there will be a very long lag time before snag recruitment will be a natural levels.

This lag time will result in a reduction in habitat for dead wood associated wildlife species at some point in the future.

The proposed actions may affect the level of snag habitat available for wildlife species associated with dead standing and downed wood.

The retention and maintenance of large trees (both live and dead) in green forests and clumps of snags across the landscape may be critical for providing nest trees for cavity excavators (USDA 2004c).

Indicators:

- Snag levels by size class through time within the Matrix area and Metolius LSRA Management Strategy Areas within LSR.
- Tons per acre of downed wood by size class through time within the Matrix area and Metolius LSRA Management Strategy Areas within the LSR.

Effects to Wildlife Habitat – Northern Spotted Owl Habitat

Recent wildfires within the Metolius watershed have resulted in the loss or degradation of over 10,000 acres of suitable habitat across the project area. The proposed actions could reduce additional fire risk through salvage and fuels reduction adjacent to existing or degraded habitat. The proposed actions could also promote the development of suitable spotted owl habitat by accelerating the development of large trees of desired species. Planting desired trees species initially can reduce competition and accelerate the development of future desired stand structure. However, some concern suggests that passive management will result in suitable habitat conditions sooner and therefore support the recovery of species. Salvage harvest activities in concert with small tree and fuels removal may reduce the risk to existing habitat for northern spotted owls and/or affect the development of suitable habitat (nesting, roosting and foraging (NRF) with large tree stands and structure composed of desired species.

Reduced population levels are expected within the watershed due to the loss of suitable habitat, the limited area in which to produce sustainable long-term habitat, the potential isolation of remaining pairs, and the loss of connectivity and dispersal habitat (USDA 2004c)

Indicators:

- Acres of suitable habitat and dispersal habitat developed within 100 years within the Metolius LSR
- Acres of landscape where risk reduction has occurred to existing and potential nesting, roosting and foraging spotted owl habitat

1.14 Analysis Issues

Issues or concerns listed below (identified by the IDT Team or through the scoping process) have been tracked through the planning process. Some of these issues are already addressed through other processes or in the Forest Plan, some led to project design (see Chapter 2), and some are analyzed in Chapter 3 – Environmental Consequences; these issues did not; however, drive the development alternatives.

Air Quality

The action alternatives include prescribed fire (i.e. underburning, jackpot burning, pile burning) activities for treating fuels related to the salvage and fuels reduction actions proposed. The effects of smoke on Class I and II areas, communities, residences, or recreation sites are a concern. All prescribed burning would comply with the Clean Air Act and would be coordinated with the Oregon State Department of Environmental Quality and Oregon State Department of Forestry. All burning would be in compliance with State smoke management plans. Prescribed fires would only be ignited under prescribed conditions. Under prescribed fire conditions there is less fuel consumption, fewer emissions, and conditions for smoke dispersal are favorable.

Fire and Fuels

Comments were received expressing concern for the potential of heavy fuel loading which may occur as a result of salvage operations or as standing dead trees fall contributing to the potential intensity of future wildfire. Treatment of fuels resulting from the proposed salvage activity is a connected action included in the action alternatives and described as part of the purpose and need of the project. Additional follow-up fuels treatments may also be proposed on areas outside of salvage units, these are a reasonably foreseeable future action and are described in Chapter 3 – Environmental Consequences.

Fish Habitat

Comments were received expressing concern that the effects of the proposed salvage operations would impact bull trout habitat, which is listened as a threatened and endangered species, in the project area. This issue is strongly connected with the Key Issues of Soil and Water Quality described previously. In addition a biological evaluation and/or a biological assessment will be prepared for actions proposed during the consultation and/or coordination process with USFWS.

Forest Vegetation

There is a concern that natural reforestation may not be successful, and conversely, that planting may not be necessary to establish forest vegetation and that the future forest vegetation needs to be more resilient and sustainable and able to withstand periodic natural disturbances. This is discussed in the Forest Vegetation section of Chapter 3 – Environmental Consequences.

Heritage Resources

Comments were received expressing concern for the effects of the proposed salvage to Native American traditional uses and heritage resources. Alternative design includes protection for heritage resources. The effects on heritage resources and traditional uses is described in Chapter 3 – Environmental Consequences.

Insect and Disease

Comments were received related to the risk of damage or loss from insects and disease. Potential for insect and disease related damage and effects on forest trees is addressed in Chapter 3 – Environmental Consequences.

Metolius Conservation Area Allocations

Comments were received related to the Deschutes National Forest Plan and the specific land allocations as described in the Metolius Conservation Area for management of this area. Theses allocations and actions proposed are summarized in Chapters 1 and 2 and the effects of proposed actions are more thoroughly described in Chapter 3 – Environmental Consequences.

Noxious Weeds

Comments were received expressing concern that noxious weed areas would increase or expand as a result of the proposed actions. Design elements aimed at preventing the spread of noxious weeds are incorporated into the action alternatives. The effects of the alternatives on noxious weeds are described in Chapter 3 – Environmental Consequences.

Recreation

Several comments were received in response to the proposed project expressing concern over proposed road management, specifically against any road closures that would reduce access for motorized recreational pursuits. However, most comments favored road closures because of the benefits of reducing the potential for soil erosion and associated effects on water quality and fish habitat.

Road management proposed actions have been identified as a result of an interdisciplinary road analysis for the B&B Fire Recovery Project area. The proposed road management includes actions to implement road strategies identified in the road analysis for existing roads.
The effects of the alternatives on recreation will be measured by describing changes to the recreation experience (Recreation Opportunity Spectrum – ROS).
There is concern that the proposed activities could affect recreation. The effects of the alternatives on recreation are described in Chapter 3 – Environmental Consequences.

Roadless and Unroaded

No salvage or connected actions are proposed within the inventoried roadless area. The roadless areas are located adjacent to wilderness areas on the west side of the project area. The effects of the alternatives on roadless areas is described in Chapter 3 – Environmental Consequences.

Scenic Quality

There is concern for the effects of the Link and B&B Complex fires and proposed actions on the scenic quality of the area. The effects of the proposed salvage and connected actions on scenic quality are described for alteration or enhancement of scenery and amount of affected area on short-term scenery within middle and foreground landscapes.

Threatened, Endangered and Sensitive (TES) Species

Several comments were received regarding the effects of the proposed action on TES species. The effects of the proposed salvage and connected actions on TES species are described in Chapter 3 – Environmental Consequences, in the Wildlife, Fish, and Botany Sections.

Wildlife Habitat

There is an issue that salvage logging and fuels treatment activities could adversely affect management indicator species (MIS). Effects of the alternatives are discussed in the Wildlife section, Chapter 3 – Environmental Consequences.

Some populations of neotropical migratory birds are considered in decline. There is a concern that salvage logging could contribute to further population decline. This concern is addressed in the Wildlife section, Chapter 3 – Environmental Consequences.

1.15 Decision Framework

The Responsible Official for this proposal is the Forest Supervisor of the Deschutes National Forest. After completion of the DEIS, there will be a 45-day public comment period. Based on responses to the DEIS and analysis to be disclosed in the Final EIS (FEIS), the Responsible Official will make a decision and document it in a Record of Decision (ROD). The Responsible Official can decide to:

- Select the proposed action; or
- Select an action alternative that has been considered in detail; or
- Modify an action alternative; or
- Select the no-action alternative; and
- Identify which mitigations measures will apply; and
- Amend the Deschutes National Forest LRMP to
    - Allow actions that may not meet visual quality standards and guidelines; and
    - Allow fuelwood collection in the Metolius Heritage Area.

The Responsible Official will also determine if the selected alternative is consistent with the Forest Plan as amended.

The decision regarding which combination of actions to implement will be determined by comparing how each factor of the project purpose and need is met by each of the alternatives, and the manner in which each alternative responds to the issues raised and public comments received during the analysis. The alternative which provides the best mix of prospective results in regard to the purpose and need, the issues and public comments, will be selected for implementation.

Based on the nature of the proposed project and associated decaying wood values the Responsible Official may also decide to implement all or portions of this project under an Emergency Situation Determination (ESD). Moving the project implementation forward according to ESD does not alter or affect the nature or extent of any of the environmental effects as described in Chapter 3 – Environmental Consequences.

1.16 Project Record

This DEIS incorporates by reference the Project Record (40 CFR 1502.21). The Project Record contains technical documentation used to support the analysis and conclusions of this DEIS.

Incorporating the Project Record helps implement the Council on Environmental Quality (CEQ) Regulations provision that agencies should reduce NEPA paperwork (40 CFR 1500.4), that EISs shall be “analytic rather than encyclopedic” and that EISs “shall be kept concise and no longer than absolutely necessary” (40 CFR 1502.2). The objective is to provide enough site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated, without repeating detailed analysis and background information available elsewhere. The Project Record is available for review at the Sisters Ranger District Office, Pine Street and Highway 20, *PO Box 249*, Sisters, Oregon, Monday through Friday, 8 a.m. to 4 p.m.

Chapter 2

Alternatives
Including the Proposed Action

ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Introduction

This chapter describes the proposed action and alternatives to the proposed action, including the no action alternative. This chapter describes how the alternatives were created, reviewed, and either eliminated from detailed study or considered in further detail. Included in this chapter are: 1) Design Elements – measures and project design criteria applied in order to reduce or eliminate environmental effects; 2) Monitoring and Study – post activity information gathering actions to evaluate the effectiveness of the implemented actions; 3) Comparison of Alternatives – a brief description of each alternative along with measures of environmental effects with regard to the purpose and need and key issues (all quantified figures such as mileage and acreage used throughout the document are approximate).

The B&B Fire Recovery Project DEIS tiers to the FEIS for the Deschutes Land and Resource Management Plan (LRMP) of 1990, as amended by both the Northwest Forest Plan and Metolius Wild and Scenic River Plan, and incorporates information and relies on direction provided in the LRMP. The proposed action and all alternatives considered in detail are consistent with those plans and the direction they provide. The proposed action and all alternatives are also designed to adhere to State and Federal laws and regulations. This chapter is divided into the following sections:

- ✓ Development of Alternatives
- ✓ Alternatives Considered and Eliminated from Detailed Study
- ✓ Alternatives Considered in Detail
- ✓ Project Design Elements
- ✓ Monitoring and Study
- ✓ Comparison of Alternatives
- ✓ Identification of the Preferred Alternative

Discussions of the affected environment and environmental consequences of implementing the proposed action or alternatives for the B&B Fire Recovery Project area can be found in Chapter 3 – Environmental Consequences. The project analysis file is referenced throughout this document and contains additional documentation and analysis.

2.2 Development of Alternatives

Alternative development began once the Purpose and Need for Action (as described in Sections 1.6 and 1.7) was articulated and approved by the Deschutes National Forest Supervisor. During the formulation of alternatives the ID Team reviewed and considered all comments received during the scoping process. The ID Team also reviewed and considered the Metolius Watershed Analysis and Update, the Metolius Late Successional Reserve Assessment, the B&B Area Roads Analysis and the B&B Burn Area Emergency Rehabilitation (BAER) report to identify Key Issues (see Section 1.11) .

A total of five alternatives, which respond to one or more of the Key Issues and describe various options to meet the purpose and need of the project, are analyzed in detail. One of the goals in developing the action alternatives was to ensure that each option available to the decision maker was “technically and physically feasible”, as well as reasonable as specified by 40 CFR 1502.14. The alternatives developed should provide the Forest Service decision maker and the public with a range of reasonable options to consider.

The alternatives meet, to varying degrees, the Purpose and Need for the project (see Sections 1.6 & 1.7), while protecting soils, water quality, fish and wildlife habitat at the same time as allowing for the economic recovery of timber resources. All of the action alternatives are feasible and any one could be reasonably implemented.

2.3 Alternatives Considered and Eliminated from Detailed Analysis

During initial public scoping and alternative development the ID Team considered a wide range of potential action alternatives. Many suggestions were received as a result of the public scoping process which was initiated by a mailing to all interested citizens that requested their comments and input in the NEPA process. In addition the Deschutes National Forest has previously prepared other Environmental Impact Statements to address treatments in fire areas. These assessments were also reviewed for alternative approaches to determine if alternatives proposed in those efforts would apply in the B&B Fire Recovery Project or if approaches that were not developed in those other efforts could apply to the B&B Fire Recovery Project. Efforts reviewed for this purpose include the Eyerly Fire Salvage project and the Davis Fire Recovery Project. This section describes alternatives or design elements considered and describes why they either were not fully developed or how they were incorporated in the alternatives that were fully developed.

Restoration without Commercial Salvage:

This approach utilizes a passive management approach for fire area recovery and is similar to recommendations described in Beschta et al. 2004 and Beschta et al 1995 (see Appendix D). This approach is reflective of implementation of the No Action – Alternative 1 in many respects. Alternative 1 describes some of the components of this approach and the effects analysis for Alternative 1 provides an analysis of the expected results of no management action. Treatments described under Alternative 5 for the LSR areas also reflect a more limited commercial salvage approach (all large trees over 20 inches diameter at breast height (DBH) would be retained). While a ‘Restoration Only’ alternative is entirely exclusive of commercial salvage operations, the proposed action and alternatives which address economic recovery on approximately 6823 acres are not entirely exclusive of a passive management approach to recovery. For example in the Proposed Action – Alternative 2, management actions would occur on approximately 6823 acres (~17% of the project area) while passive management consistent with this approach would occur on the remaining 35,400 acres (~83% of the project area) within the project boundary.

Delay Treatment:

This approach primarily addresses future fuels reductions and reforestation needs by postponing management activities until fuels levels as a result of fallen snags and downed wood exceed desired fuel levels or natural revegetation proves to be inadequate to recover desired tree species. This approach is inconsistent with the Purpose and Need of this project which addresses economic recovery of the fire killed and damaged timber resource and is reflective of implementation of the No Action – Alternative 1. In the specific areas proposed for treatment economic utilization of the commercially valuable timber resource can serve to offset costs related to fuels reduction and reforestation. The economic viability of this project's fire killed and damaged timber resource is fleeting and to delay treatment until this resource has no economic value would push the brunt of fiscal responsibility for other desired actions such as fuels reduction and reforestation to American taxpayers through the use of appropriated funding. While the Proposed Action describes treatment on approximately 6823 acres, the remaining projects acres could receive delayed treatment if conditions in the future warrant further action.

Maximize Commercial Salvage Recovery:

This approach addresses the treatment of more acres within the burn area perimeter for recovery of the commercially valuable timber resource from fire killed and damaged trees. While the burn area exceeds 94,000 acres and the project area addresses approximately 41,000 acres, treatment would only occur on at most 6823 acres. During initial public scoping additional acres were being considered for recovery, however, based upon further field review and an economic logging systems analysis any additional acres proposed for recovery would be economically deficit and would jeopardize the potential for implementation of the project as a whole. The value of the timber resource is steadily declining and the earliest implementation is likely to be two years after the fire event. The acres included in the Proposed Action represent the most economically feasible areas with regard to salvage harvest in the project boundary. Including additional acres that are marginal or clearly deficit would risk implementation on all acres proposed for treatment if the values decline to a point at which the project as a whole would not be economically feasible.

Commercial Salvage Within Riparian Reserve Areas:

This approach addresses the commercial salvage recovery of trees within the Riparian Reserve designated areas. As a result of lack of timber removal and fuels treatments in these areas the Riparian Reserve has become heavily stocked with trees and exhibits high fuel loadings in many areas. Treatment of these areas could remove a commercial product while at the same time reduce risk to these areas from future fire events. The ID Team initially reviewed treatments in these areas. Due to the high concern and potential risk of erosion of soil and sedimentation to streams in the Metolius Watershed the Watershed Analysis recommended expanded activity buffers in riparian reserves (USDA 2004c p. FR-2). As a result of the erosion and sedimentation concern in these areas the Riparian Reserves were excluded from broadscale treatment.

Commercial Salvage Within the Inventoried Roadless Areas:

This approach addresses the commercial salvage recovery of trees within inventoried roadless areas. The Metolius Watershed Analysis and Update of 1996 and 2004 respectively both address the proliferation of roads in the Metolius Watershed and their effects to resources such as fish and wildlife habitat and water quality. Salvage recovery would require either helicopter yarding or road creation. Since helicopter yarding was not economically viable in most of these areas, road creation in inventoried roadless areas was inconsistent with the management of the area and road density reduction guidelines from the Deschutes Land and

Resource Management Plan and activities in these areas tend to be highly controversial leading to delays in project implementation, these areas were not included for treatment.

Commercial Salvage Only from Existing Open Roads:

This approach addresses concerns of impacts to soil productivity from skidding or mechanized equipment use off roads and previously compacted areas. To adhere to these objectives hand felling and full suspension yarding would be required. The operational limit for equipment that could meet these objectives is 35 feet on each side of the road. In addition, to protect the integrity of the roads, trees would be felled away from the road and many would not be retrievable from the road based on equipment limitations. This approach is feasible and would be implemented as described for the purpose of increasing public safety in the danger tree removal portion of the proposed actions. However, units within the project area would not be treated for salvage, fuels reduction, or reforestation and therefore does not address those concerns as described in the Purpose and Need. Therefore this alternative was not considered in further detail.

Exclude Commercial Salvage from Fire Suppression Burnout Operation Areas:

This approach addresses concerns regarding commercial salvage recovery in areas that may have been deliberately burned to contain wildfire during the suppression effort. This approach was not fully developed based on similar rationale as described in the Davis Fire Recovery Project –

> “Determination of which areas were backfired and which were not is an imprecise estimate as it is undeterminable exactly where the backfire and the approaching wildfire interface. Also, backfiring operations are often successful in stopping the fire, but sometimes not. Some areas within the fire perimeter were backfired, but subsequently lost to the wildfire. Given these variables, this alternative was considered but eliminated from detailed consideration because of the uncertainty of where and how much of these areas exist.”

Creation of Landscape Fuel Breaks in Fire Area to Reduce Future Catastrophic Wildfire Risk:

This approach address concerns regarding the risk of future catastrophic or uncharacteristic fire in the project area. The Deschutes National Forest and Sisters Ranger District have recognized the concern for wildfire risk reduction in many areas including the B&B Fire Recovery Project Area. The Sisters Ranger District prepared a Fuels Strategy for the project area which addresses desired conditions and approaches to treat fuels in the project area. This strategy addresses fuels reduction in wildland-urban interface areas, risk reduction and maintenance of nesting, roosting and foraging habitat for spotted owls, and fuels reduction in defensible space along roads (ingress and egress for firefighters and public during fire events). The proposed actions implement this strategy within the acres proposed for treatment, however full implementation of this strategy would not occur across the landscape in the current proposal. Full implementation of this strategy would require the inclusion of additional areas that are economically marginal or clearly deficit and would risk implementation on all acres proposed for treatment if the values decline to a point at which the project as a whole would not be economically feasible.

Reforestation Without Existing Biomass Reduction – Particularly Larger Snags and Downed Wood:

This approach addresses the concerns regarding reforestation without the commercial removal of biomass. Large down woody material can contribute to potential fire behavior as described in Brown et al. 2003:

> "Large woody fuels have little influence on spread and initiating surface fire in current potential fire behavior models; however, they can contribute to the development of large fires and fire severity. Fire persistence, resistance-to-control, and burnout time (which affects soil heating) are significantly influenced by loading, size, and decay state of large woody fuel."

Without biomass reduction – including large wood – future fires can be expected to be large, severe and resistant to control posing a significant risk to reforested areas. To reduce the risk of future stand replacement fire and the associated risk of loss it poses to reforested stands, proper site preparation including large fuels reduction is a prudent action. In addition, this alternative does not meet the Purpose and Need with regard to economic recovery; therefore this approach was not developed further.

Utilize Only Non-Ground-Based Harvest Methods for Commercial Salvage:

This approach is similar in nature to a previous approach – salvage only from existing open roads. It differs in that it could include helicopter logging methods in all areas. However, based on economic logging systems analysis and the existing fire killed and damaged timber resource, helicopter logging would not be economically feasible and skyline systems weren't considered due to the infeasibility of maintain desired wildlife tree numbers and distribution, therefore this approach would be exactly like a previous approach – salvage only from existing roads approach – which did not meet the Purpose and Need and was dropped from further analysis.

Proposed Alternative from the Friends of the Metolius:

In response to the initial public scooping, the Friends of the Metolius offered a detailed alternative for treatment within the project area. Many of their proposals having been included in the action alternatives fully analyzed, especially in Alternative 5. The following account summarizes their input and how the ID Team worked with their recommendations:

- *Look at the project through the Deschutes Forest Plan Allocations – not just the Northwest Forest Plan Allocations*
  Throughout the document the alternatives and effects have been displayed by how they affect both the Northwest Forest Plan and the Deschutes Forest Plan allocations. Each allocation has associated standards and/or guidelines which pertain to project design and implementation – in all cases, under both allocations, the proposed treatments are consistent with these standards and guidelines.
- *What occurs in the project area will effect the Metolius Wild and Scenic River.*
  Two of the key issues discussed in Chapter 1 (Soil Productivity and Sedimentation) address the potential for upslope erosion and instream sedimentation which would effect the values of the Wild and Scenic River. As a result, Riparian Reserve Areas have been largely excluded from

treatment to minimize ground disturbing impacts that could lead to erosion and sedimentation of stream areas. Other specific areas outside of the Riparian Reserves that are at higher risk to erosion from ground disturbing impacts (potential sediment contribution areas (PSCA) – see Chapter 2) have been included with specific restrictions to activities in Alternatives 2,4 & 5, and have been entirely excluded from treatment in Alternative 3.

- *Wildlife trees need to be provided for during the short and mid-term so that the forest gets a chance to renew and heal.*

  Snag levels remaining after implementation is also a key issue as discussed in Chapter 1. The alternatives described in Chapter 2 display a range of options for remaining snag levels and Chapter 3 discusses the environmental consequences of each scenario.
- *Impacts to soil and productivity are paramount.*

  Soil productivity is also a key issue as discussed in Chapter 1. The inclusion of helicopter logging systems in Alternative 2, the exclusion of ground based logging systems in higher erosion risk areas (PSCA) in Alternative 3, and the exclusion of treatments in the Riparian Reserve (except for danger tree removal and defensible space fuels reduction) are all designed to limit impacts to the soil resource and protect soil productivity.
- *This is the opportunity to make major headway towards road density reductions as described in the Deschutes Forest Plan.*

  Each of the action alternatives describes road decommissioning and inactivation. While this action would not totally achieve Deschutes Forest Plan goals for road densities in the Metolius Watershed, it does proposed to close approximately 25% of the roads in the basin, half of which are associated with water quality concerns and are not roads that provide unique access concerns for public use.

Friends of the Metolius Suggestions for Design Elements Specific to Deschutes Forest Plan Allocations::

- *Metolius Heritage Area*
  - Salvage only those dead trees less than 21 inches DBH
  - Above 21 inches DBH salvage only dead white fir trees
  - Thin out remaining green stands using Metolius Project prescriptions and wildlife protocol
  - Remove excess live white fir to some historic range of variability
  - Retain larch and Douglas-fir green and dead where possible
  - Set up so that future treatments can be low-impact prescribe burns, mowing and burning
  - Look at research plot studying forest restoration of ponderosa pine ecosystems following catastrophic fire
- *Metolius Scenic Views- 24%*
  - Create some key vista points and interpretive sites along primary routes
  - Salvage 85 percent of dead trees less that 16 inches DBH in foreground
  - Salvage 50 percent of dead trees between 16 to 21 inches DBH in foreground
  - Over 21 inches DBH salvage only white-fir

    - In middleground and background areas try to intermingle openings with leave patches, wildlife clumps
    - In middleground and background areas replicate naturally occurring opening in harvest units in scale and shape
    - Thin out live trees using Metolius Project prescriptions and wildlife protocols
    - Set up so future treatments can be low-impact prescribed burns, mowing and burning and commercial from below
- *Metolius Special Forest*
    - Salvage all dead trees except wildlife needs up to 21 inches DBH
    - Over 21 inches DBH salvage only white fir
    - Leave all green trees over 16 inches DBH unless the tree is expected to die within 5 years
    - Normally, created openings will be less than 10 acres in size where they might be seen from a Metolius Scenic Views route
    - Conduct low thinning wherever possible discriminating against white fir
    - Consider low thinnings in riparian areas with helicopter to restore stands and insure future resilience in face of future fires
    - Set up for future treatments that can be primarily mow and burn, burn and low thinning.

- *Bald Eagle, Intensive Recreation and Other Scenic Views*
    - Salvage from below less than 21 inches DBH dead trees only
    - Retain dead trees over 21 inches DBH unless imminent danger tree in high use area
    - Thin using accepted protocols in live stands using a standard of around 16 inches DBH
    - Set up for future treatments of low thinning, mow and burn and prescribed burn

While the alternative described above was not individually developed for implementation many of the design specifications described were incorporated into the action alternatives to the extent possible. The following discussion described how each of these elements were considered and addressed in the current project.

Throughout the alternative descriptions the actions proposed within the various Deschutes Land and Resource Management Plan allocations have been described and are consistent with the management goals and objectives described in that document. The Metolius Heritage Area comprises approximately 16 percent of the project area; the Metolius Scenic Views Area comprises approximately 24 percent of the project area.; the Metolius Special Forest comprises approximately 8 percent of the project area. Restricting salvage removal to trees less than 21 inches in DBH is a design element described in Alternative 5 for the Late Successional Reserve Areas, this also corresponds to 33 units and 2,095 acres (56% of treatment in this Alternative) in the Bald Eagle, Intensive Recreation, Metolius and Other Scenic Views, Metolius special Forest and Metolius Heritage Areas. This project does not propose to treat trees with a high likelihood of survival except in approximately 20 acres of riparian reserve defensible space within the project area, in these areas thinning would use accepted protocols and remove smaller size class live trees. Salvage and fuels treatments within units would leave units in a condition suitable for reintroduction of fire as a resource management component thereby setting up future management of these stands within their historic range of variability. Salvage operations would focus on primarily economically viable trees, generally those greater than 16 inches DBH – therefore smaller dead trees in the foreground area will likely remain or would be removed through post-salvage fuels treatments or other projects in the future. Since areas described for treatment are generally in stand replacement burn areas the consideration of openings for scenic views becomes less relevant since these areas are open as a result of the fire. Efforts would be made (see Design Criteria) to blend activities with the surrounding environment; however, the surrounding environment is currently extremely altered and will reflect this altered appearance for many years into the future.

Several research opportunities are being considered for this area; however, these research studies will not be presented in this document.

Suggestions from the Conservation Community Perspective:

- Prevent and Treat noxious weeds
- Control off road vehicles
- Install fish friendly culverts and bridges
- Conifer planting in highly disturbed areas
- Maintain native species diversity
- Retain all trees on the landscape that would have been there before fire suppression began
- Retain the largest trees in areas missed by most fire cycles
- Leave large trees unless a hazard
- Thin uncharacteristically thick trees in ponderosa pine.
- Focus on ponderosa pine and dry mixed conifer zones
- Thin small dead trees similar to thinning small green trees in a live stand
- Retain what structure you can while new forest develops
- Use "Firewise" Concepts around urban interface areas
- Close and obliterate roads
- No logging in riparian areas, planting if necessary
- Minimize the effect to soils to less than 10 percent on the landscape – no new roads
- Use light impact equipment
- Take a careful economic look
- Be sensitive to Metolius area concerns

As a result of Burned Area Emergency Rehabilitation, several areas of noxious weeds were treated, off road vehicle closures were implemented, fish friendly culverts and bridges were installed along several tributaries to the Metolius River and conifer planting occurred using desired species in several burned areas. The alternatives described in detail include various approaches to the removal of fire killed and damaged trees including retention of all small and large structure under the No Action Alternative. Retention in the late successional reserve areas in Alternative 5 would also retain all large structure over 20 inches in DBH. This project would not treat trees with a high probability of survival within salvage units and would focus primarily on the mixed conifer and ponderosa pine areas. The action alternatives described in detail include various logging system approaches including helicopter, ground or ground modified systems to help minimize the effects to soils from project activities. The riparian reserve areas are largely excluded from treatment with the exception of 20 acres identified for defensible space fuels treatment. The alternatives also include the decommissioning and inactivation of roads within the project area. The Deschutes Land and Resource Management Plan land allocations have been addressed and analyzed throughout the document and all activities proposed are consistent with direction and guidelines described in that plan. A social and economic analysis is also included in Chapter 3 to address concerns over the economics of the proposed alternatives.

2.4 Alternatives Considered In Detail

The NEPA process requires the Forest Service to consider a range of reasonable alternatives. Alternatives to the proposed action were developed and analyzed to address the Key Issues while assessing various avenues to achieve the Purpose and Need of the project. Additionally, the alternatives address social and environmental issues, respond to public and agency concerns and input, and satisfy regulations of the National Environmental Policy Act (NEPA).

Under the action alternatives, harvest and associated fuels reduction and reforestation activities would take place within designated units, subject to legal, safety, and environmental stipulations established by the Forest Service. Each of the action alternatives would, by design, be subject to these stipulations as described in Section 2.5 – Project Design elements. All harvest units offered for competitive sale would be bound by the provisions of the standard Forest Service timber sale contract and additional clauses used to implement mitigation measures selected by the decision maker.

A comparison of the various components and environmental effects of each alternative is described in Section 2.7 – Comparison of Alternatives. The locations of the units proposed for timber harvest are displayed in Section 2.9 – Maps Displaying Proposed Action and Alternatives. Within each designated harvest and treatment unit, practices would be carried out as detailed in Section 2.5 - Project Design Elements. A description of the alternatives analyzed in detail is presented in the discussion that follows.

2.4.1 Alternative 1 – No Action

Summary:
The purpose of this alternative is to allow current processes to continue, along with associated risks and benefits.

In this document the “No Action” alternative means the proposed project (which includes all activities identified in the proposed action) would not take place in the B&B Fire Recovery Project area at this time. The “No Action” alternative is required by NEPA and is described to represent the existing condition. It serves as a baseline to compare and describe the differences and effects between taking no action and implementing action alternatives.

Under the No Action Alternative, current management plans would continue to guide management of the project area. Activities such as motorized access travel management, road maintenance, dispersed recreation, noxious weed management, and fire protection would be allowed to continue as they currently take place in the project area and are not part of the proposed actions for this project. In addition, separate resource recovery projects (see Chapter 3) would not be affected with the selection of this (or any other) alternative.

Description of Actions:

Commercial Removal/ Fuels Treatment

No salvage or fuels treatment activities would be implemented. The accomplishment of project goals to recover economic value of the dead and dying trees and reduce future fuel loading would not occur.

Danger Tree Removal for Public Health and Safety

Trees that pose a hazard to public safety on open roads and in recreation areas would continue to be monitored and felled when identified as an imminent danger as described in the B&B Hazard Tree Categorical Exclusion. In some cases danger trees would be felled and left on-site, in other cases these trees may be included in a small sale of wood products.

Forest Vegetation

There would be no reforestation under this alternative. For the purpose of comparison of alternatives, this alternative would analyze the effect of natural regeneration as a baseline condition.

Forest Roads

All roads identified in the Metolius Watershed Analysis in need of closure for resource protection would remain open under this alternative.

2.4.2 Actions and Design Elements Common to All Action Alternatives

Commercial Removal

All fully developed action alternatives include commercial utilization in the form of salvage removal. Trees marked for removal would follow specific guidelines to evaluate the fire damage and likelihood of tree survival as described in Scott et al. 2002 and Ryan 1988. For the purposes of this project, trees will be identified as dead or alive depending on whether the tree has any green needles. Trees without any green needles will be considered dead. Trees with any green needles will be considered alive. For all practical purposes, all trees within the boundary of the B&B fire were affected by the fire to some degree. Consequently, for this project, live trees will be evaluated to determine the likelihood of surviving the effects of the fire based primarily on guidelines developed by Scott, et al. (2002). Trees rated moderate and high likelihood of surviving the effects of the fire will be retained under all alternatives. Trees rated low probability of survival will be variably retained depending on the Northwest Forest Plan management allocation (late-successional reserve versus matrix). Low probability of survival trees that are retained will serve as “green tree replacements” for existing snags once those snags fall over. This retention is in addition to the stands that will have no removal of low probability of survival trees.

All trees rated as moderate to high probability of survival will be left within harvest units. Trees with low-moderate crown and bole scorch, trees with healthy live crowns at least 20 percent of the total height of the tree, and trees with little or no evidence of bark beetles, are the types of trees that are considered to be likely to survive the effects of the fire and that are expected to survive for an extended period. These trees will provide genetic diversity, through their seed, to the regenerating stands. Some incidental cutting of trees that are rated as moderate to high probability of surviving the effects of the fire may occur in order to facilitate placement of skid trails and landings, however, attempts will be made to minimize the removal of these types of trees.

Ground based operations are likely to utilize conventional tracked harvesters to fell and bunch merchantable trees and either rubber-tired skidders or tracked forwarders to yard this material to the landings. Cut-to-length harvester forwarder systems may also be utilized for ground-based operations. Harvest methods would be restricted on steep slope (>30%) inclusions in ground based units. These steep slope areas would be excluded or would utilize hand falling trees and winching. Machinery access through these steep slope areas would be allowed using existing roads and skid trails. These steep slope areas would be prioritized as wildlife clumps for snag retention.

Fuels Treatments

All salvage units would include fuels treatment activities to reduce and remove fuels created as a result of harvest activities. All salvage units could include fuels treatments of non-merchantable material (typically <16” DBH) contributing to overall fuel loading. These actions could involve:

- Piling harvest slash and small logs with machines from existing skid trails (Machine Piling)
- Yarding entire trees or leaving the tops attached to the last log (Whole Tree Yarding)
- Pile Burning of Log Landings
- Felling of smaller non-merchantable trees (Whip Felling)

- Burning high fuels concentrations (Jack Pot Burning)
- Hand Piling and Hand Pile Burning

Danger Tree Removal for Public Health and Safety

Roads used to haul for commercial utilization of harvest units would be treated for danger trees. Danger trees would also be removed from within the Round Lake concentrated use area as well. Danger tree removal would occur primarily within 150 feet of the roadside; however, danger trees would also be removed from areas further from the roadside when those trees are tall enough or the slope is steep enough for those trees to reach the road. Danger trees include: 1) trees that were killed outright by the fire, 2) live trees that were heavily damaged by the fire with a low potential for survival or with pre-existing structural defects that have a high potential for failure, 3) live trees with little or no fire damage, but with pre-existing structural defects that have a high potential for failure, and 4) trees that were dead prior to the fire.

Outside of Riparian Reserve Areas, material would be felled and removed with ground based machinery operating on and off the roadways. Ground-based operations would utilize hand-felling and/or excavator shears to cut trees and grapple loaders or skidders to yard material designated for removal. Areas with high concentrations of trees could have a designated skid trail implemented paralleling the haul road in order to yard material toward landings located on road spurs or other designated areas. Machine operations for felling would be limited to out and back passes only, while machines used for yarding would be restricted to a designated skid trail in order to limit the extent of area on which multiple trips of machinery occurred. Material would be piled on areas of compaction such as skid trails wherever possible. Machine and hand piles would be burned under prescriptions when soil moistures were at sufficient levels to minimize the transport of heat down into the soil profile.

Generally, danger trees within riparian reserves would be felled and left on site, however, several areas (11 discreet areas totaling ~2.5 miles) of high fuels concentration within riparian reserve and defensible space along roads have been identified for commercial utilization (see Map 2-1 or 2-2, see Appendix C – Alternative Tables) in order to approach desired surface fuel levels. Within these areas, danger trees would be hand felled and removed using low impact methods (heavy machinery would be restricted to the road). Down wood would be retained in these areas to satisfy wildlife and erosion concerns (typically 11 to 15 down trees per/acre). No downed wood would be removed from the primary wood recruitment area (within 100 feet of the stream channel). Snags that are stable, likely to persist and which do not pose a public safety hazard would be retained. Generally the trees furthest from the road would remain as downed wood to reduce yarding distances and potential ground impacts.

Danger trees and surface fuels loading in excess of defensible space fuels targets would be removed from the Round Lake Christian Camp permit site (~20 acres – see Appendix C – Alternative Tables). The permit site includes areas both within and outside the Riparian Reserve. Within the Riparian Reserve area (~10 acres) trees would be hand-felled and transported to the road or parking area via low impact methods, some down wood would be retained within the area for Camp purposes such as firewood supply or foot traffic control along the lake, the small diameter fuels may be cut and hand piled and burned. Outside the Riparian Reserve area (~10 acres), trees would be felled and removed with ground-based equipment. Some down wood would be retained within the area for Camp purposes such as firewood supply or foot traffic control within the Camp. Generally, down wood would be retained at a 20 to 30 foot spacing, and small diameter fuels could be cut and hand piled and burned.

Reforestation

Natural Regeneration

For all proposed treatment units in all alternatives, natural regeneration is the preferred method of reforestation if it would result in the following stand characteristics, with or without thinning intervention:

1. Species composition dominated by ponderosa pine and/or Douglas-fir and/or western larch.
2. Tree Densities of at least 100 to 150 well established average trees per acre over 80% of the unit.

For all units, pre-planting stocking surveys will be done to determine the density and species composition of natural regeneration. If the desired stand characteristics are not expected to be met, based on pre-planting surveys, then artificial regeneration by hand planting will be done.

Excessive amounts of natural regeneration may be present in some areas, especially in areas that experienced low and moderate mortality. In these areas, once the natural regeneration becomes well established, if the desired characteristics can be met by thinning these overstocked areas, thinning of the natural regeneration will be done to meet the desired characteristics regarding species composition and density. Subsequent planting may be needed if the desired species composition is not present at desired levels (e.g., where natural regeneration is heavy to white fir)

Artificial Regeneration by Hand Planting:

Artificial Regeneration would be done to accelerate the establishment and development of the next forest stand in order to meet present and future management objectives (e.g., wildlife habitat in late-successional reserve and matrix allocations and timber production in the matrix allocation). Depending on the level of natural regeneration on any given unit, planting specifications will be designed to complement the existing natural regeneration.

Site Preparation

Site preparation in salvage units, beyond planned fuels clean-up, is not expected to be needed.

Scalping

Scalping is removing vegetation and other organic or inorganic material to expose underlying mineral soil and prepare a spot for planting a tree. Generally, scalps will be approximately 1’ x 1’ in size. However, depending on the amount of competing vegetation present and the likelihood of that vegetation to affect survival of seedlings, scalps may be as large as 3’ x 3’. Larger scalps would only be implemented to improve seedling survival and not to improve growth.

Density

Trees will be planted at a maximum average density of 194 trees per acre or 15’ x 15’ spacing. Planting density will be allowed to vary between 400 trees/acre (10’ x 10’ spacing) and 50 trees/acre (30’ x 30’ spacing). Density is also expected to vary due to the presence of unplantable areas and limited use of animal damage control. Planting at this density is also expected to eliminate the need for pre-commercial thinning. Gaps and openings up to 1 acre in size will be acceptable across up to 10% of each unit.

Species Composition:

Tree species to be planted will be a mixture dominated by ponderosa pine and Douglas-fir with minor amounts of western larch and western white pine. Actual species mixtures will depend on several factors including, available seed, specific management objectives and plant association.

Animal Damage Control

Animal damage control will be implemented only when tree survival or the number of undamaged trees is expected to fall below the thresholds of 50 trees/acre in late-successional reserve or 100 trees/acre in matrix. The anticipated kinds of animal damage that could require remedial action include browse damage by big game and root and/or bole damage or mortality caused by pocket gophers. The kinds of animal damage control that may be implemented include application of big game repellant or tree guard to prevent browse damage by big game and/or baiting (with poisoned oats) and/or trapping gophers to prevent root and bole damage or mortality. Poisoned oats would not be used in the Suttle Lake Bald Eagle Management Area (BEMA) or any newly identified essential bald eagle habitat (see Resource Protection Measures for Individual Wildlife Species, Section 2.5). Non-baited trapping would be the only gopher control measure utilized in these areas.

Competing and Unwanted Vegetation

Competing and unwanted vegetation has the potential to be a problem; especially the longer from the date of the disturbance (i.e., fire) the planting is done. To minimize the need to take remedial action regarding competing and unwanted vegetation, planting will be accomplished as quickly as possible after salvage has been completed. If it appears that competing and unwanted vegetation may significantly reduce stocking levels, then two remedial actions may be implemented under this project, large scalps (up to 3’ x 3’) at the time of planting and mulch mats at the time of planting or after planting.

Soils and Water Quality

The Riparian Reserve areas would be generally excluded from treatment activities. The Watershed Analysis (USDA 2004c) recommended the consideration of expanded buffers for activities in burned and unburned riparian reserves. For this reason, the ID Team has identified areas within treatment units that are more sensitive to ground disturbing activities as a result of the wildfires, and which exhibit a higher short-term risk of erosion from management activities which could contribute to stream sedimentation. These areas are called potential sediment contribution areas (PSCA). Within these areas for all alternatives additional protective measures would be applied to reduce the risk of erosion from management activities. The PSCA is the area most likely to contribute sediment and overland flow to waterbodies. The amount of sediment transported to waterbodies decreases the further the activity is from the waterbody and the flatter the slope. A potential sediment contribution area was delineated in the B&B project area based on the proximity to Riparian Reserves, fire mortality, slope, and hydrologic connectivity. The potential sediment contribution area includes:

- Riparian Reserves[1]
- Portions of stand replacement or mixed mortality slopes adjacent to riparian reserves based on the following criteria:
- If slope <15% and not hydrologically connected[2] (by ephemeral draws or road segments), then PSCA is the riparian reserve width
  If <15% slope and hydrologically connected, then PSCA is 320ft from each side of channel
- If 15 to 30% slope and not hydrologically connected, the PSCA is 320ft from each side of channel
  If 15 to 30% slope and hydrologically connected, then PSCA is 480ft from each side of channel
- If >30% slope, then PSCA is 480ft from each side of channel
  If >15% slope with a hydrologically connected road segment within or adjacent to the 480 ft PSCA, extend PSCA an additional 480ft upslope of hydrologically connected road segment (eg. north loop of the 1210 rd)
- 50 ft on each side of ephemeral draws regardless of burn severity. In special cases this will be extended to 160 on each side of draw (i.e. steep, high mortality ephemeral draws above Abbott spring and steep, high mortality ephemeral draw hydrologically connected by 1237 road.

Snag Retention

Treatments would include snag retention within proposed treatment units. Within the treatment areas Decay Class 1 and 2 snags would contribute to desired retention levels. These snags types are defined by Thomas (1979) and Brown (1985) as:

> Decay Class 1 – generally a newly dead tree, usually tall, that is sound (hard) with limbs and branches still present and the top and bark are still intact.
> Decay Class 2 – generally trees where decay has set in, is still hard overall with some softer decayed areas appearing. The majority of limbs and branches have fallen off and the bark is starting to slough and loosen somewhat and the tops have generally broken off as well.

Any post-harvest burning would occur in such a manner as to protect and retain existing snag structure (large wood likely to persist for several decades).

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[1] Riparian Reserve widths within the Metolius Basin meet the Northwest Forest Plan standards and were refined in the Metolius Watershed Analysis to provide addition protection (USDA Forest Service 1996). All fish-bearing streams (class 1 and 2, category 1) would be buffered 320 ft on both sides of the stream. All perennial, non-fish-bearing and intermittent streams (class 3 and 4, category 2 and 4) would be buffered 160 ft on both sides of the stream

[2] Hydrologically connected road segments drain directly into a stream. They are identified by the hydrologist and are defined as:

41. the road segment or ditch between the stream crossing and the last drainage structure (i.e. relief culvert, waterbar, etc…)
41. roads in Riparian Reserves with drainage structures that feed directly into streams (i.e. segments of the north loop of 1210 road)

Down Woody Material

Treatments would retain all existing large (16 inch DBH and greater) down woody material. Down wood levels to be retained in treatment units are defined by Plant Association Group (PAG) and fuels treatment type as described in Table 2-1:

Table 2-1. Down Wood Material to Be Retained in Treatment Units

PAG	Fuels Treatment Type	
	WUI/Defensible Space (Tons/Acre)	Other Forest Areas (Tons/Acre)
Ponderosa Pine	7-10 (3-10" DBH)	10-15 (3-10" DBH)
Dry Mixed Conifer	7-10 (3-10" DBH)	12-15 (3-10" DBH)
Wet Mixed Conifer	15-25 (3-10" DBH)	20 (3-20" DBH) >5 (>20" DBH)

Forest Roads

Existing Forest roads would provide the primary access to designated units for harvest and hauling of logs. Along these haul routes the outlets of road waterbars, dips, and relief culverts that are within 320 feet of a stream and have slopes below the outlet that are 20 percent and greater, including undersized culverts that extend beyond the edge of the road fill (includes culverts off the northern loop of the 1210 road and relief culverts on the 1232 road within the PSCA- see Appendix C – Alternative Tables) would be armored. In the PSCA areas : 1) Relief culverts or drivable waterbars would be installed during haul at every 10 ft drop in elevation, if not already present; 2) Additional relief culverts or drivable waterbars would be installed 160 feet before stream crossings that are downslope of proposed units and down-road of road segments that drain into streams in Riparian Reserves (referred to as hydrologically connected) – see Appendix C – Alternative Tables; and 3) Temporary roads would be rehabilitated before the subsequent wet season or waterbars would be installed at every 10 ft drop in elevation if unit is not completed.

Temporary road construction would be utilized to access harvest units not readily accessible from existing forest roads (see Map 2-2). Temporary roads would require minimal excavation, would be native surface, and would be restored and sub-soiled (if necessary and physically possible (i.e. not too rocky)) after logging operations were completed.

Decommissioned roads have no long term needs, are not planned to be used again and will be removed form the transportation system status. Treatment would involve "hydrologically closing" roads and could potentially include subsoiling or recontouring the road surface. Inactivated roads are closed roads, operational maintenance level 1. While remaining on the transportation system they are managed in a storage or closed category, and only non-motorized vehicles or USFS vehicles receiving special permission are allowed. An inactivated road is "hydrologically closed," even though the landscape is not restored to near original shapes. Hydrologic closing a road is intended to leave the road in a "self-maintaining" state and would include repairing any drainage problems, potentially removing culverts from stream crossings, and installing a closure device (i.e. barricade, earth berm, logs, gates, ect.).

2.4.3. Alternative 2 – Proposed Action

Summary:

This alternative proposes salvage harvest, fuels reduction and reforestation on approximately 6803 acres (~16% of the project area) in 142 units within Matrix, Late-Successional Reserve and Administratively Withdrawn land allocations and 20 acres of danger tree and defensible space fuels treatments in the Round Lake Christian Camp area for a total of 6823 acres treated. Ground based yarding would occur on 5,867 acres while helicopter yarding would occur on 955 acres. This alternative would yield approximately 29.7 MMBF (See Table 2-1); reduce fuels and reforest up to 6823 acres; remove danger trees along 146 miles of roads, remove danger trees and reduce fuels to defensible space fuels targets within 20 acres of high public use areas around Round Lake. Reconstruction of existing roads used for haul would also occur. Approximately 51 miles of road would be decommissioned and approximately 20 miles of road would be inactivated.

Description of Actions:

Commercial Removal(See Map 2-1)

Matrix and Administratively Withdrawn

Salvage harvest is proposed on 1,726 acres (27% of the treatment area for this alternative) within 52 units of Matrix and 117 acres (2% of the treatment area for this alternative) within 3 units on Administratively Withdrawn areas around Suttle Lake. Salvage harvest would remove dead and damaged trees with a low probability of survival that have economic value (generally greater than 16 inches in diameter at breast height (DBH)).

The salvage treatment areas include 40 acres (<1% of the treatment area for this alternative) within 4 units that are designated for biomass product (this includes firewood, posts, poles and rails etc.) removal only (see Appendix C – Alternative Tables). Wood products to be removed from these salvage units would follow the same design elements as commercial salvage, however, trees removed as biomass products would typically include those of smaller diameters than are identified for commercial timber salvage sales. All ground based commercial salvage units would also be available for biomass product utilization post-harvest to recover additional wood value and further reduce fuel loads.

All soft snags with high wildlife value would be retained where they do not present a public safety hazard; all existing down wood would be retained across the project area; two of the most likely to persist dead or low probability of survival trees on an average per acre basis would be left in each unit. Generally snags selected would be the largest Douglas-fir then ponderosa pine with the least bole damage, minimal lean with large limbs or broken tops first. Snags would be scattered throughout the stand away from roads and landings. Substantial amounts of non-merchantable, most likely smaller size class, trees would remain as snags within the units. In units exceeding 40 acres, 15 percent retention patches would be left in clumps. Clumps would be representative of the stand species composition, located primarily away from the edge of the unit, range from 1 to 15 acres in size within the stand and each unit could contain 2 to 6 individual clumps. All suitable habitat areas (nesting, roosting and foraging areas (NRF))would be excluded from treatment areas.

Late-Successional Reserve

Salvage harvest is proposed on 4,980 acres (73% of the proposed treatment area) within 87 units. Salvage harvest would remove dead trees that have economic value (generally greater than 16 inches in diameter at breast height (DBH)).

The salvage treatment areas include 414 acres (~1% of the project area) within 10 units that are designated for biomass product removal only (see Appendix C – Alternative Tables). Wood products to be removed from these salvage units would follow the same design elements as commercial salvage, however, trees removed as biomass products would typically include those of smaller diameters than are identified for commercial timber salvage sales. All ground based commercial salvage units would also be available for biomass product utilization post-commercial salvage to recover additional wood value and further reduce fuel loads, except as noted below.

All soft snags would be retained where they do not present a public health and safety hazard; all existing down wood within surface fuel loading desired conditions would be retained across the project area; two of the most likely to persist snags on average per acre would be left in each unit; substantial amounts of non-merchantable, most likely smaller size class, trees would remain as snags within the units. In units exceeding 40 acres 15 percent retention patches would be left in clumps. All suitable habitat areas (nesting, roosting and foraging areas (NRF))would be excluded from treatment areas. In units adjacent to existing NRF habitat all units exceeding 20 acres would contain 15 percent retention patches of snags left in clumps.

Salvage would include 419 acres within 11 units that are white fir dominated and exhibit mixed mortality or underburn in order to facilitate reforestation of desirable tree species and accelerate the development of nesting, roosting and foraging habitat for northern spotted owls in the future. In these units dead and low probability of survival white fir less than 28 inches DBH would be removed. all ponderosa pine and Douglas-fir will remain within the unit – these units would not be utilized as biomass product areas.

Salvage proposed in LSR's is consistent with NWFP LSR objectives, standards and guidelines (see Appendix B). Table 2-2 displays the treatment acres by LSRA Management Strategy Area (MSA) and plant association group (PAG); a description of the management strategy areas goals and objectives is included in Appendix B.

Table 2-2. Treatment Acres by LSRA Management Strategy Area and Plant Association Group

Plant Association Group	LSRA Management Strategy Areas			
	B	C	J	K
Dry Mixed Conifer	1794	89	1247	950
Wet Mixed Conifer	339	9	0	230
Dry Ponderosa Pine	0	0	159	0
Wet Ponderosa Pine	91	0	0	0

Riparian Reserve (see Map 2-2)

Danger trees would primarily be hand felled and left along haul routes and within high public use areas. In specific areas such as Round Lake Christian Camp (10 acres) and within defensible space Riparian Reserve areas along haul routes (3 miles) danger trees would be removed and commercially utilized. In the Round Lake area additional fuels would be removed to attain Defensible Space fuel loading targets (see Appendix A). In areas where existing roads and landings occur within the Riparian Reserve adjacent to proposed treatment units these roads and would be utilized for harvest operations to reduce additional ground disturbing impacts in adjacent areas (units 34 (off road machine travel could occur), units 45 & 46 (landings would occur on existing roadbed and some decking could occur adjacent to road bed in Riparian Reserve), units 10, 99 & 113 (temporary roads would be constructed through Riparian Reserve to access units)

Logging Systems

Ground based and helicopter logging systems would be utilized to accomplish harvest activities. Machine traffic would be excluded within 50 feet of either side of ephemeral draws except for designated crossings perpendicular to the draw. Ephemeral draws would be considered for snag and snag clump retention. Special yarding subdivisions requiring hand felling and line pulling or machinery yarding from outside the 50 foot buffer would be designed in flat, marginally defined draws (example unit 16) as defined by the hydrologist or soil scientist. Removal of standing down wood would not occur in steep or well defined draws (example unit 45) identified by the hydrologist or soil scientist.

Treatment Summary

Table 2-3 displays the acres within each treatment type by logging system and land allocation within the Northwest and Deschutes Forest Plan. Table 2-3 displays acres treated by each Northwest and Deschutes Forest Plan land allocation.

Table 2-3. Land Allocation and Treatment Acres by Logging System

NWFP Allocation	Deschutes Forest Plan Allocation	Treatment	Logging System	Alt. 2 Acres	Area %	Alt. 2 Vol. (mbf)
Administratively Withdrawn	Intensive Recreation	Salvage, Danger Tree, WUI and Defensible Space	Ground	117	2	390
Late Successional Reserve	Bald Eagle	Salvage	Ground	11	<1	42
Late Successional Reserve	General Forest	Salvage	Ground	47	1	189
Late Successional Reserve	Intensive Recreation	Salvage	Ground	4	<1	16
Late Successional Reserve	Intensive Recreation	Salvage	Helicopter	5	<1	31
Late Successional Reserve	Metolius Heritage	Salvage	Ground	298	4	1111
Late Successional Reserve	Metolius Scenic Views	Salvage	Ground	865	13	4320
Late Successional Reserve	Metolius Scenic Views	Salvage	Ground Modified	164	2	692
Late Successional Reserve	Metolius Scenic Views	Salvage	Helicopter	457	7	2590
Late Successional Reserve	Metolius Special Forest	Salvage	Ground	1713	25	7574
Late Successional Reserve	Metolius Special Forest	Salvage	Ground Modified	14	<1	42
Late Successional Reserve	Metolius Special Forest	Salvage	Helicopter	371	5	2057
Late Successional Reserve	Scenic Views	Salvage	Ground	57	1	228
Late Successional Reserve	Scenic Views	Salvage	Helicopter	121	2	727
Matrix	Metolius Scenic Views	Salvage	Ground	532	8	2293
Matrix	Metolius Scenic Views	Salvage	Ground Modified	22	<1	87
Matrix	Metolius Special Forest	Salvage	Ground	1121	16	5036
Matrix	Metolius Special Forest	Salvage	Ground Modified	10	<1	38
Late Successional Reserve	Bald Eagle	Biomass Material	Ground	41	1	41
Late Successional Reserve	General Forest	Biomass Material	Ground	38	1	38
Late Successional Reserve	Intensive Recreation	Biomass Material	Ground	1	<1	1
Late Successional Reserve	Metolius Black Butte Scenic	Biomass Material	Ground	15	<1	15
Late Successional Reserve	Metolius Heritage	Biomass Material	Ground	219	3	275
Late Successional Reserve	Metolius Scenic Views	Biomass Material	Ground	10	<1	10
Late Successional Reserve	Metolius Special Forest	Biomass Material	Ground	89	1	89
Matrix	General Forest	Biomass Material	Ground	15	<1	15
Matrix	Metolius Special Forest	Biomass Material	Ground	23	<1	23

NWFP Allocation	Deschutes Forest Plan Allocation	Treatment	Logging System	Alt. 2 Acres	Area %	Alt. 2 Vol. (mbf)
Matrix	Scenic Views	Biomass Material	Ground	3	<1	3
Late Successional Reserve	Metolius Heritage	White Fir	Ground	194	3	775
Late Successional Reserve	Metolius Scenic Views	White Fir	Ground	38	1	151
Late Successional Reserve	Metolius Special Forest	White Fir	Ground	188	3	798
Late Successional Reserve	Metolius Scenic Views	Danger Tree & Defensible Space	Ground	10	<1	15
Late Successional Reserve/ Riparian Reserve	Metolius Scenic Views	Danger Tree & defensible Space	Ground	10	<1	15
Total				**6823**		**29697**

Table 2-3. Treatment Acres By Land Allocation

Allocation	Acres	Percentage by Treatment	Volume (mbf)	Percentage by Volume
Administratively Withdrawn	117	2	390	1
Late Successional Reserve	4980	73	21812	73
Matrix	1726	25	7495	25
Riparian Reserve	10	<1	15	<1
Intensive Recreation	127	2	438	1
Bald Eagle	52	1	83	<1
General Forest	100	1	242	1
Metolius Heritage	711	10	2161	7
Metolius Scenic Views	2108	31	10143	34
Metolius Special Forest	3529	52	15657	53
Scenic Views	181	3	958	3
Metolius Black Butte Scenic	15	<1	15	<1

Fuels Treatments

The removal of harvest created slash and fuels remaining post-harvest would be treated on 6823 acres within salvage units to reduce fuel loads – Table 2.4 (see also Appendix C – Alternative Tables). These additional fuels treatments would move unit conditions towards the desired future fuel characteristics that would allow restoration of fire as an ecosystem component and improve fire suppression effectiveness. In the Round Lake area approximately 20 acres would be treated to defensible space fuels targets as described in Appendix A - Fire and Fuels Strategy and displayed in Table 2-6.

Table 2-4. Alternative 2 Fuels Treatments

Fuels Treatments Within Salvage Units	Acres
Whole-Tree Yard/Machine Pile/Burn Landings	2702
Whole-Tree Yard/Burn Landing Piles	3585
Pile Burn of Landings/Whip Felling/Jack Pot Burn	516

Danger Tree Removal for Public Safety(See Map 2-3)

Trees determined to be a danger to human life or property, according to the appropriate evaluation criteria would be felled along haul routes and commercially utilized in areas outside of Riparian Reserve. These are trees that have a high potential for failure and have the potential to strike the roadbed or fall within a concentrated public use area and would include approximately 146 miles of designated haul routes and 20 acres within the Round Lake camp area (see Map 2-1).

A previous project – B&B Hazard Tree Categorical Exclusion – treated approximately 67 miles of these haul roads for trees that posed a public health and safety hazard. Danger trees along these road miles have already been addressed, therefore danger trees primarily along the untreated haul routes (79 miles) would be felled.

Reforestation

Reforestation of desired tree species could occur on up to 6,823 acres primarily where stand replacement burn severity occurred and where desired natural reforestation does not occur. This includes approximately 4,979 acres of reforestation treatments in LSR.

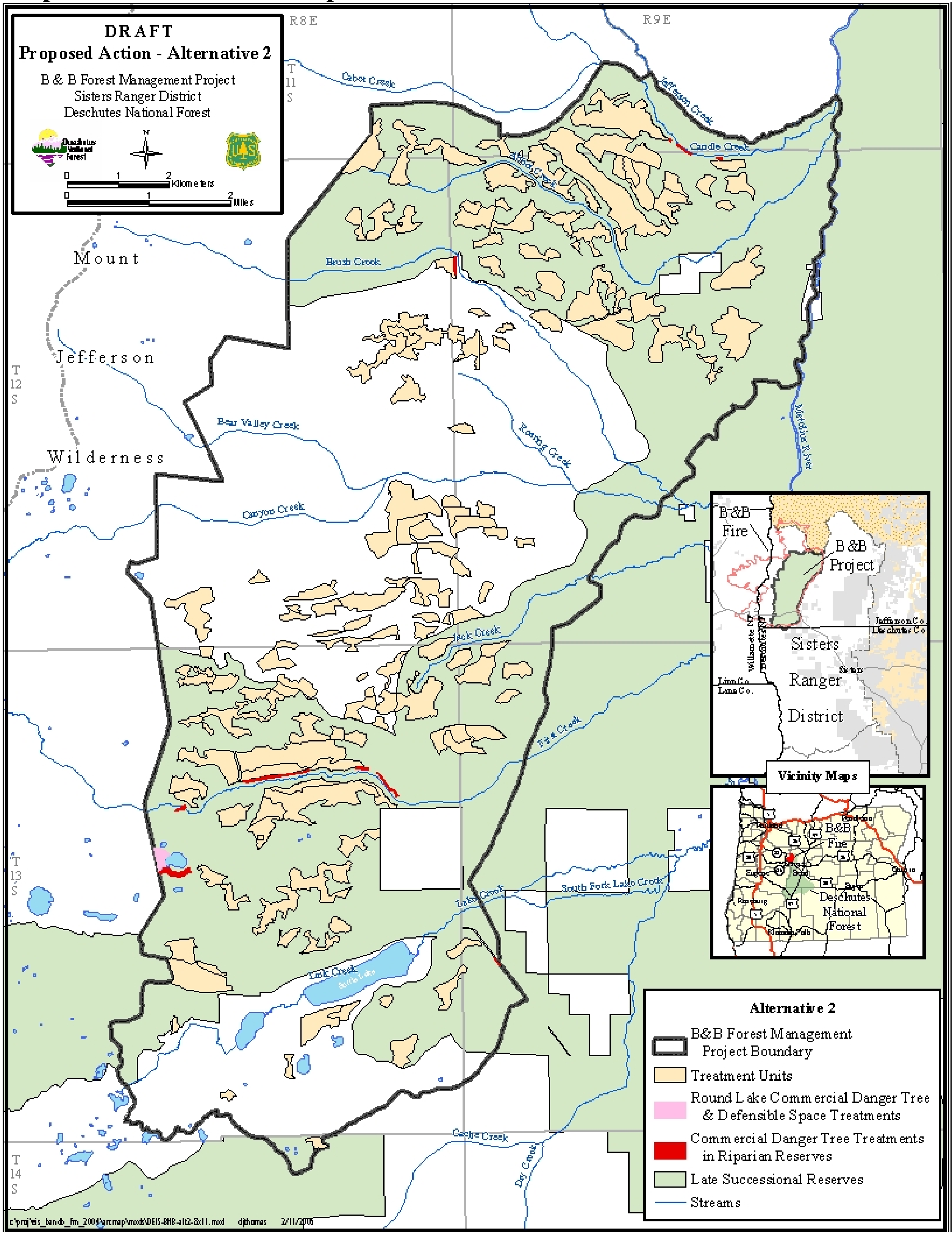
Forest Roads (See Map 2-4)

Access to designated units for harvest and hauling of logs would occur primarily on existing forest roads. An estimated 5.1 miles of temporary road construction would be required to access harvest units not readily accessible from existing forest roads. Temporary roads would require minimal excavation, would be native surface, and would be restored after logging operations were completed. Haul road reconstruction is included in this alternative. The reconstruction activities on existing forest system roads would include (see Appendix C – Alternative Tables):

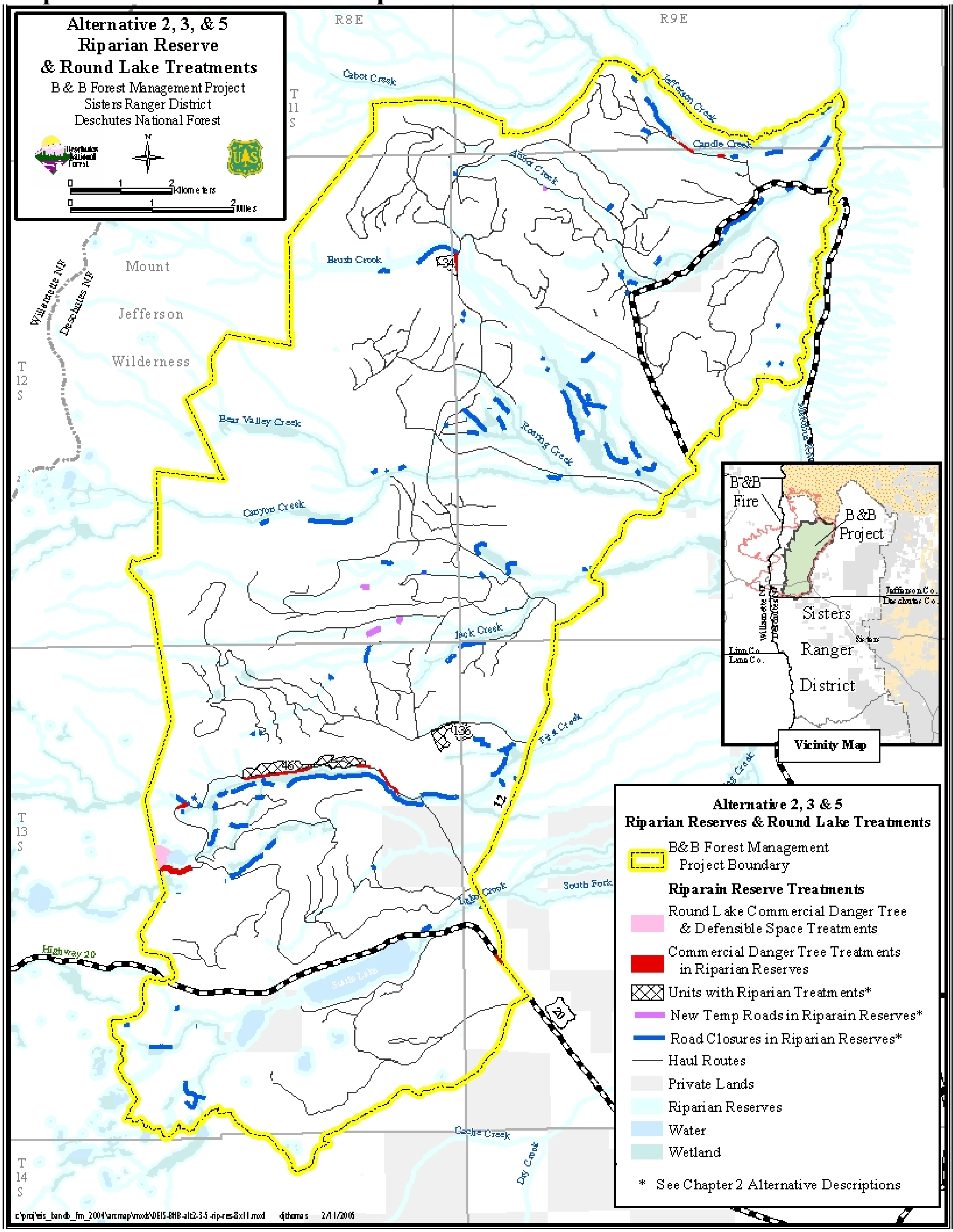
- Armour approximately 155 outlets
- Installation of approximately 18 relief culverts
- Installation of approximately 32 relief waterbars .

Approximately 51 miles of road would be decommissioned and approximately 20 miles of road would be inactivated – see Appendix C – Alternative Tables.

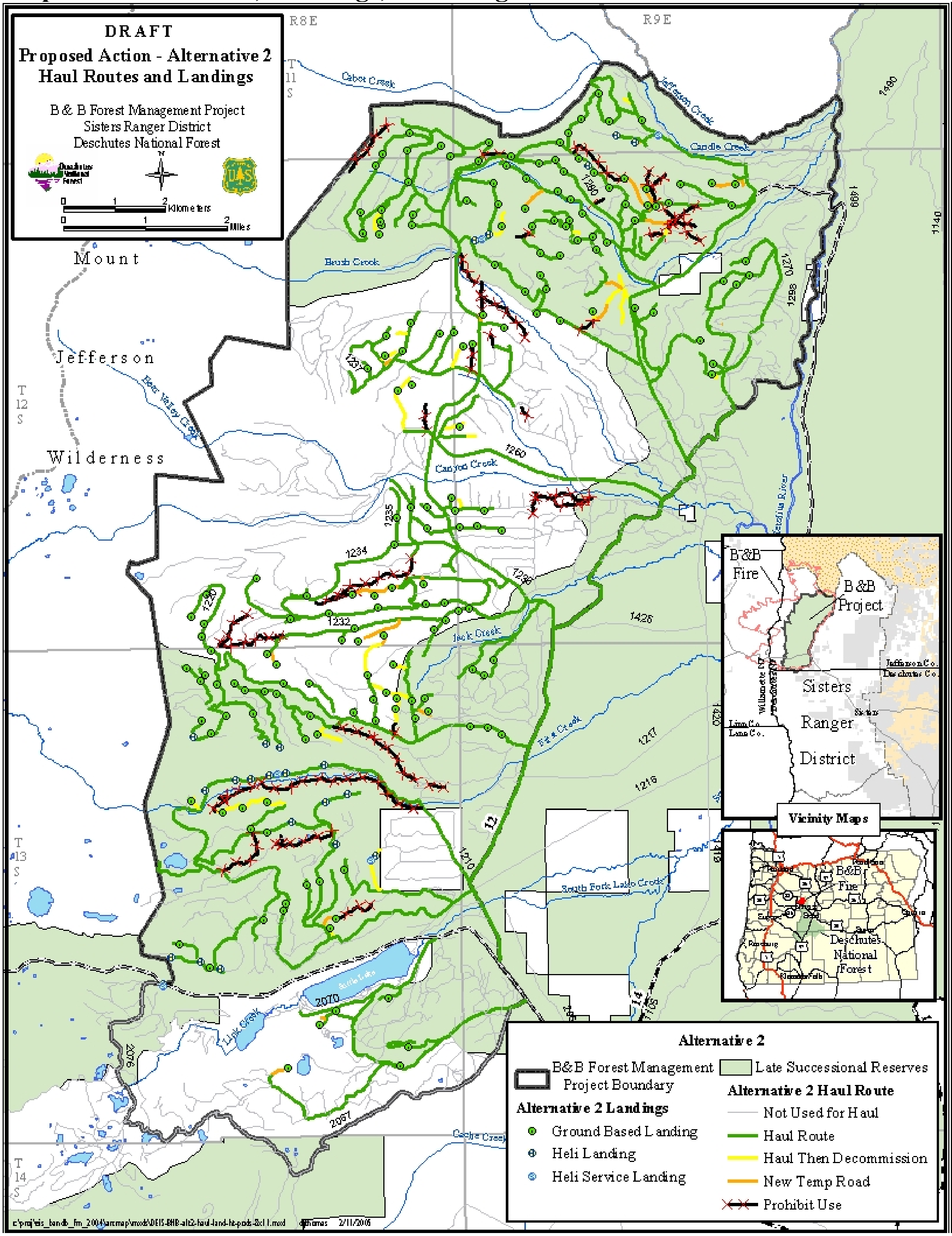
Map 2-1. Alternative 2 Proposed Treatment Units



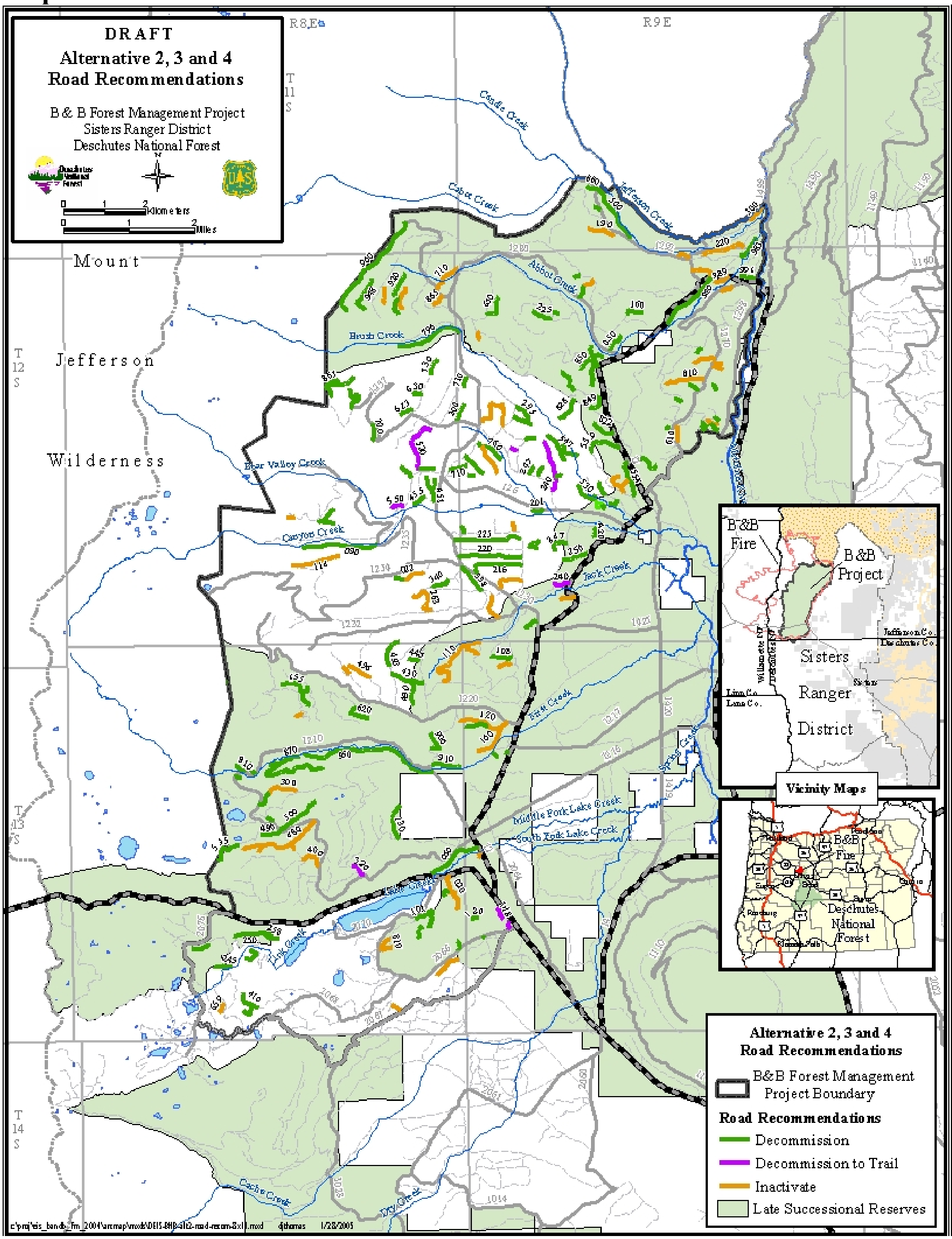
Map 2-2. Treatments Within Riparian Reserve



Map 2-3. Haul routes, Landings, and Danger Tree Treatments



Map 2-4. Road Recommendations



2.4.4 Alternative 3

Summary:

This alternative proposes salvage harvest, fuels reduction and reforestation on approximately 3,762 acres (~9% of the project area) in 83 units within Matrix, Late-Successional Reserve and Administratively Withdrawn land allocations and 20 acres of danger tree and defensible space fuels treatments in the Round Lake Christian Camp area for a total of 3782 acres treated. Ground based yarding would occur on 3,782 acres This alternative would yield approximately 14.0 MMBF (See Table 2-7); reduce fuels and reforest up to 3782 acres; remove danger trees along 122 miles of roads, remove danger trees and reduce fuels to defensible space fuels targets within 20 acres of high public use areas around Round Lake. Reconstruction of existing roads used for haul would also occur. Approximately 51 miles of road would be decommissioned and approximately 20 miles of road would be inactivated.

Description of Actions:

Commercial Removal(see Map 2-5)

Matrix and Administratively Withdrawn

Salvage harvest is proposed on 1,643 acres (44% of the treatment area for this alternative) within 47 units of Matrix and 117 acres (3% of the treatment area for this alternative) within 3 units on Administratively Withdrawn areas around Suttle Lake. Salvage harvest would remove dead and low probability of survival trees that have economic value (generally greater than 16 inches in diameter at breast height (DBH)). Snag levels would be retained according to plant association group desired conditions that meet or exceed the Deschutes LRMP standards. Snag levels would be based on a per acre basis. Snags to be retained would include the two most likely to persist snags and the remaining snags would be representative of the stand composition. Clumping is desired. At least 70 percent but no more than 90 percent of required snags would be clumped with remaining snags left scattered across the unit. Desired arrangement would be located away from the unit edge. A distribution of sizes remaining throughout a specified range is desired. For example, leaving a range of sizes available in the 10-20 inches DBH range and not leaving all 10 inch DBH snags.

Late-Successional Reserve

Salvage harvest is proposed on 2,002 acres (53% of the treatment for this alternative) within 33 units. Salvage harvest would remove dead or low probability of survival trees that have economic value (generally greater than 16 inches in diameter at breast height (DBH). Snag levels would be retained within a treatment unit on a per acre basis on average according to the Metolius LSRA – see Table 2-5. Snags to be retained would include the two most likely to persist snags and the remaining snags would be representative of the stand composition. Clumping is desired. At least 70 percent but no more than 90 percent of required snags would be clumped with remaining snags left scattered across the unit. Desired arrangement would be located away from the unit edge. Snags would be substituted on a one to one ratio to a lower size class when lacking until the 10-15 inches DBH size class is reached. Then only 10-15 inches DBH snags would be substituted for larger size classes when there are no other snags available. While the small snags are not habitat equivalents for the snags they are substituting, these snags still provide valuable habitat to various species and decrease the visual impacts associated with units containing inadequate numbers of existing snags to satisfy snag retention criteria.

Table 2-5. Desired LSR and Matrix Snag Levels

Within Metolius LSR		Within Matrix	
Size Class	**Snag Levels**	**Size Class**	**Snag Levels**
Mixed Conifer Wet		**Mixed Conifer Wet**	
10-15”	1.9	--	--
15-20	3.0	**10-20”**	8.3
15-25	3.0	--	--
25+	5.0	**20+**	4.3
Total	**12.9**	**Total**	**12.6**
Mixed Conifer Dry		**Mixed Conifer Dry**	
10-15”	1.04	--	--
15-20	1.07	**10-20”**	4.0
15-25	1.07	--	--
25+	3.33	**20+**	2.7
Total	**6.51**	**Total**	**6.7**
Ponderosa Pine Wet		**Ponderosa Pine Wet**	
10-15”	0.96	--	--
15-20	1.04	**10-20”**	1.6
15-25	1.04	--	--
25+	1.33	**20+**	1.1
Total	**4.37**	**Total**	**2.7**
Ponderosa Pine Dry		**Ponderosa Pine Dry**	
10-15”	0	--	--
15-20	0.74	**10-20”**	0.42
15-25	0.74	--	--
25+	1.0	**20+**	1.1
Total	**2.48**	**Total**	**1.52**

Salvage proposed in LSR’s is consistent with NWFP LSR objectives, standards and guidelines (see Appendix B). Table 2-7 displays the treatment acres by LSRA Management Strategy Area (MSA) and plant association group (PAG); a description of the management strategy areas goals and objectives for each MSA is included in Appendix B.

Table 2-7. Treatment Acres by LSRA Management Strategy Area and Plant Association Group

Plant Association Group	LSRA Management Strategy Areas			
	B	**C**	**J**	**K**
Dry Mixed Conifer	692	19	657	360
Wet Mixed Conifer	163	9	0	83
Dry Ponderosa Pine	0	0	27	0
Wet Ponderosa Pine	67	0	0	0

Riparian Reserve

Danger trees would primarily be hand felled and left along haul routes and within high public use areas. In specific areas such as Round Lake Christian Camp (10 acres) and within defensible space Riparian Reserve areas along haul routes (1 mile) danger trees would be removed and commercially utilized. In the Round Lake area additional fuels would be removed to attain Defensible Space fuel loading targets (see Appendix A). In areas where existing roads and landings occur within the Riparian Reserve adjacent to proposed treatment units these roads and would be utilized for harvest operations to reduce additional ground disturbing impacts in adjacent areas (unit 46 (landings would occur on existing roadbed and some decking could occur adjacent to road bed in Riparian Reserve), units 10, 99 & 113 (temporary roads would be constructed through Riparian Reserve to access units).

Logging Systems
Ground based logging systems would be utilized to accomplish harvest activities. Harvest activities or machinery traffic would not occur within areas more sensitive to ground disturbing activities, as a result of the wildfires, and which exhibit a higher short-term risk of erosion which contributes to stream sedimentation (Potential Sediment Contribution Areas (PCSA's)).

Treatment Summary

Table 2-7 displays the acres within each treatment type by logging system and land allocation within the Northwest and Deschutes Forest Plan. Table 2-8 displays acres treated by each Northwest and Deschutes Forest Plan land allocation.

Table 2-7. Land Allocation and Treatment Acres by Logging System

NWFP Allocation	Deschutes Forest Plan Allocation	Treatment	Logging System	Alt. 3 Acres	Area %	Alt. 3 Vol. (mbf)
Administratively Withdrawn	Intensive Recreation	Salvage, Danger Tree, WUI and Defensible Space	Ground	117	3	390
Late Successional Reserve	Bald Eagle	Salvage	Ground	11	<1	27
Late Successional Reserve	General Forest	Salvage	Ground	47	1	123
Late Successional Reserve	Scenic Views	Salvage	Ground	57	2	148
Late Successional Reserve	Metolius Heritage	Salvage	Ground	95	3	323
Late Successional Reserve	Metolius Special Forest	Salvage	Ground	1207	32	3706
Late Successional Reserve	Metolius Scenic Views	Salvage	Ground	582	15	1999
Late Successional Reserve	Intensive Recreation	Salvage	Ground	4	<1	11
Matrix	Metolius Special Forest	Salvage	Ground	1109	30	5010
Matrix	Metolius Scenic Views	Salvage	Ground	532	14	2294
Late Successional Reserve	Metolius Scenic Views	Salvage, Danger Tree & Defensible Space	Ground	10	<1	27
Late Successional Reserve/ Riparian Reserve	Metolius Scenic Views	Salvage, Danger Tree & Defensible Space	Ground	10	<1	27
Total				**3782**		**14085**

Table 2-8. Treatment Acres By Land Allocation

Allocation	Acres	Percentage by Treatment	Volume (mbf)	Percentage by Volume
Administratively Withdrawn	117	2	390	1
Late Successional Reserve	2022	53	6337	45
Matrix	1641	45	7304	52
Riparian Reserve	10	<1	27	<1
Intensive Recreation	127	2	438	1
Bald Eagle	52	1	83	<1
General Forest	100	1	242	1
Metolius Heritage	711	10	2161	7
Metolius Scenic Views	2108	31	10143	34
Metolius Special Forest	3529	52	15657	53
Scenic Views	181	3	958	3
Metolius Black Butte Scenic	15	<1	15	<1

Fuels Treatments

The removal of harvest created slash and fuels remaining post-harvest would be treated on 3782 acres within salvage units to reduce fuel loads – Table 2.9 (see also Appendix C – Alternative Tables). These additional fuels treatments would move unit conditions towards the desired future fuel characteristics that would allow restoration of fire as an ecosystem component and improve fire suppression effectiveness. In the Round Lake area approximately 20 acres would be treated to defensible space fuels targets as described in Appendix A - Fire and Fuels Strategy and displayed in Table 2-9.

Table 2-9. Alternative 3 Fuels Treatments

Fuels Treatments Within Salvage Units	Acres
Whole-Tree Yard/Machine Pile/Burn Landings	1710
Whole-Tree Yard/Burn Landing Piles	2053

Danger Tree Removal for Public Safety (see Map 2-6)

Trees determined to be a hazard to human life or property, according to the appropriate evaluation criteria would be felled along haul routes and commercially utilized in areas outside of Riparian Reserve. These are trees that have a high potential for failure and have the potential to strike the roadbed or fall within a concentrated public use area and would include approximately 122 miles of designated haul routes and 20 acres within the Round Lake camp area (see Map 2-5).

A previous project – B&B Hazard Tree Categorical Exclusion – treated approximately 61 miles of these haul roads for trees that posed a public safety hazard. Hazards along these road miles have already been addressed, therefore danger trees primarily along the untreated haul routes (61 miles) would be felled under this project.

Reforestation

Reforestation of desired tree species could occur on up to 3,782 acres primarily where stand replacement burn severity occurred and where desired natural reforestation does not occur. This includes approximately 2,022 acres of reforestation treatments in LSR.

Forest Roads (see Map 2-4)

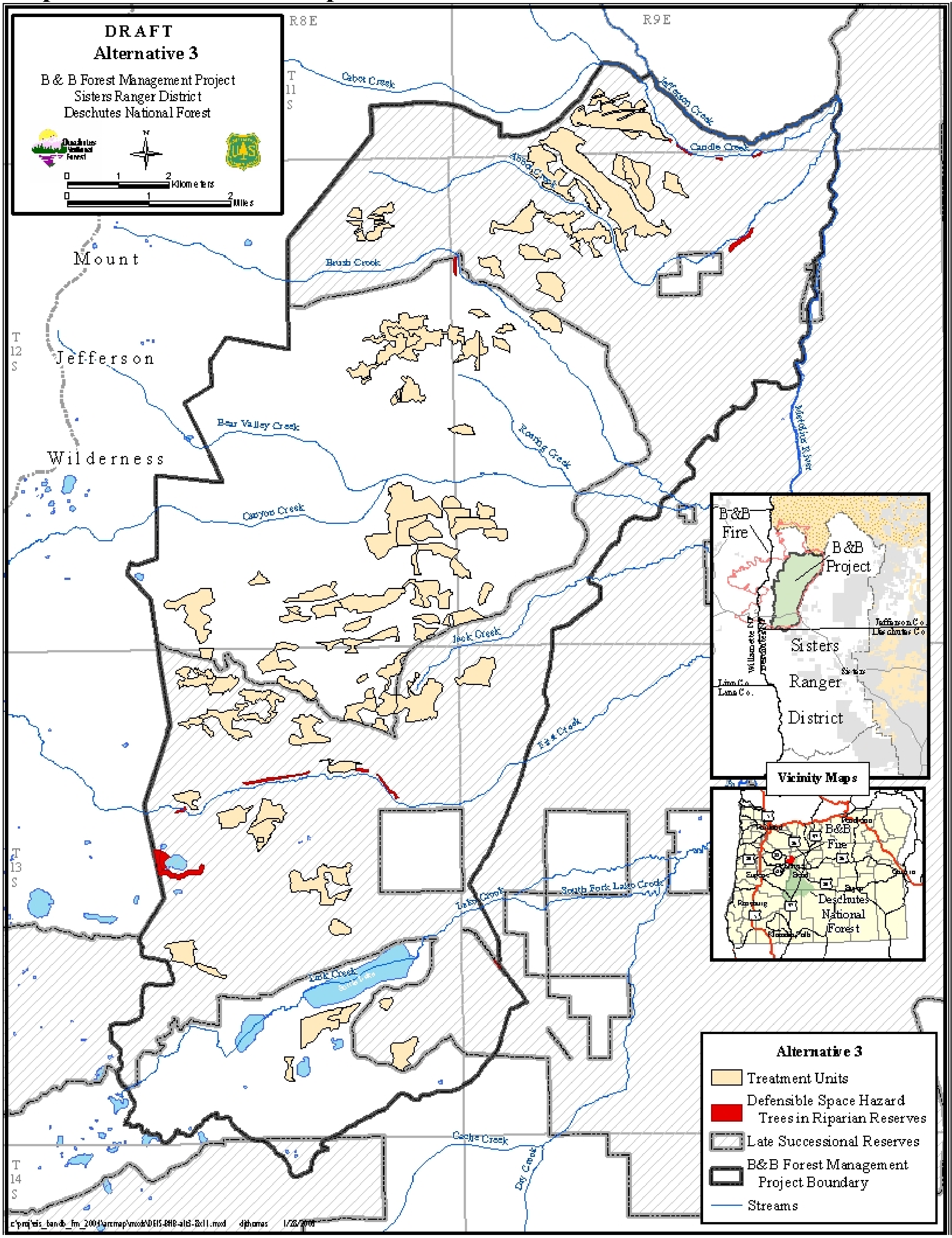
Access to designated units for harvest and hauling of logs would occur primarily on existing forest roads. An estimated 3.9 miles of temporary road construction would be required to access harvest units not readily accessible from existing forest roads (see Map 2-4). Temporary roads would require minimal excavation, would be native surface, and would be restored and possibly sub-soiled after logging operations were completed.

Haul road reconstruction is included in this alternative. The reconstruction activities on existing forest system roads would include (see Appendix C – Alternative Tables):

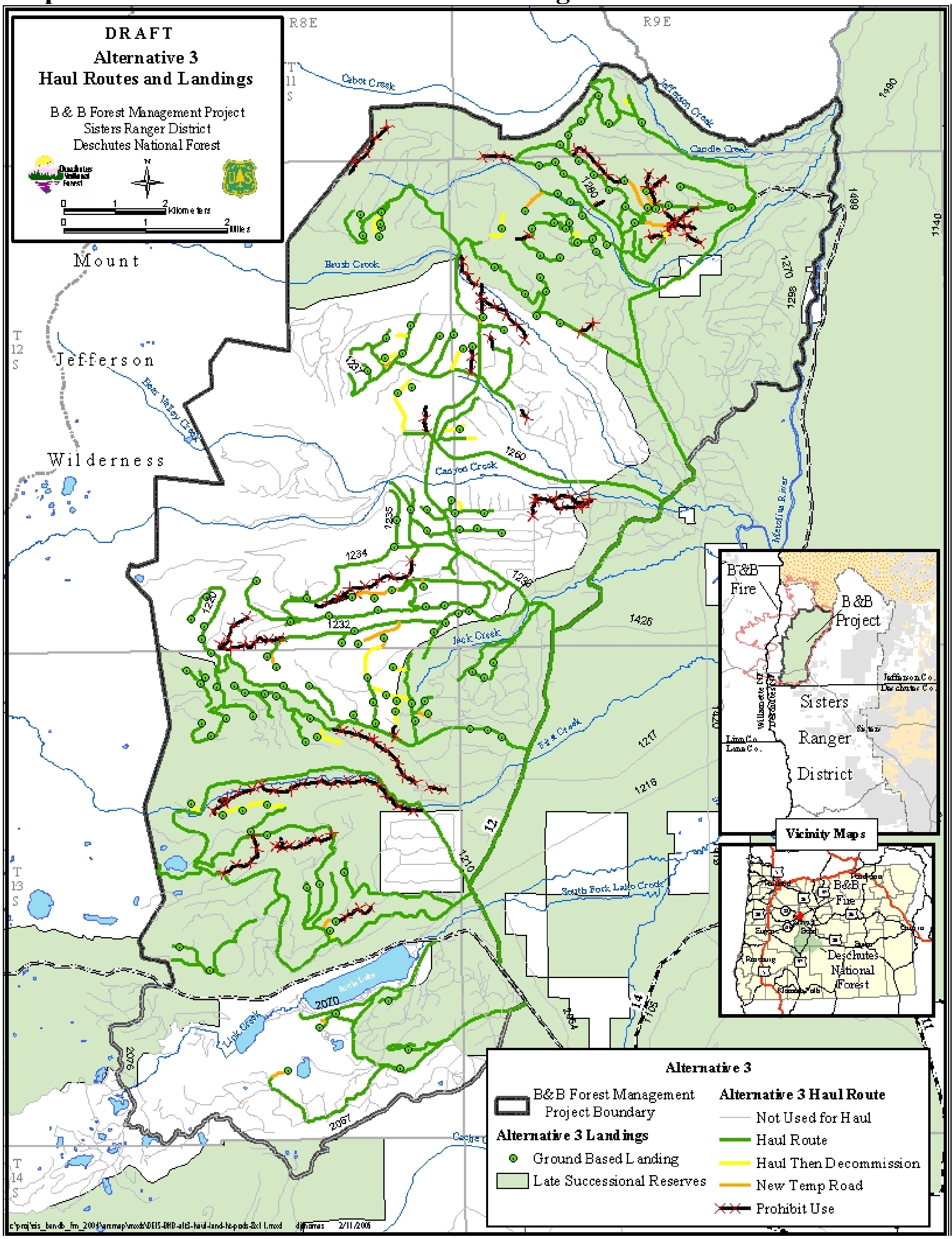
- Armour approximately 109 outlets
- Installation of approximately 16 relief culverts
- Installation of approximately 21 relief waterbars
- Replacement of .approximately 30 undersized culverts (roads 1210, 1232 & 1270)

Approximately 51 miles of road would be decommissioned and approximately 20 miles of road would be inactivated – see Appendix C – Alternative Tables for a description of these roads.

Map 2-5. Alternative 3 Proposed Treatment Units



Map 2-6. Haul Routes and Potential Landing Areas



2.4.5 Alternative 4

Summary:
This alternative would treat 1842 acres (~4% of the project area) in 53 units within the Matrix and Late-Successional Reserve and Administratively Withdrawn land allocations and 20 acres of danger tree and defensible space fuels treatments in the Round Lake Christian Camp area for a total of 1862 acres treated. Ground based yarding would occur on 1862 acres. This alternative would yield approximately 7.5 MMBF (See Table 2-10); reduce fuels and reforest up to 1862 acres; remove danger trees along 54 miles of roads, remove danger trees and reduce fuels to defensible space fuels targets within 20 acres of high public use areas around Round Lake. Reconstruction of existing roads used for haul would also occur. Approximately 51 miles of roads would be decommissioned and approximately 20 miles of road would be inactivated .

Description of Actions

Commercial Removal (see Map 2-7)

Matrix and Administratively Withdrawn

Salvage harvest is proposed on 1,842 acres (95% of the treatment area for this alternative) within 53 units of Matrix and 117 acres (5% of the treatment area for this alternative) within 3 units on Administratively Withdrawn areas around Suttle Lake. Salvage harvest would remove dead and low probability of survival trees that have economic value (generally greater than 16 inches in diameter at breast height (DBH)).

The salvage treatment areas include 40 acres (<1% of the project area) within 4 units that are designated for biomass product (this includes firewood, post, poles and rails, etc.) removal only (see Appendix C – Alternative Tables). Wood products to be removed from these salvage units would follow the same design elements as commercial salvage, however, trees removed as biomass products would typically include those of smaller diameters than are identified for commercial timber salvage sales. All ground based commercial salvage units would also be available for biomass product utilization post-harvest to utilize additional value and further reduce fuel loads.

All soft snags with high wildlife value would be retained where they do not present a public safety hazard; all existing down wood would be retained across the project area; two of the most likely to persist dead or low probability of survival trees on average per acre would be left in each unit. Generally snags selected would be the largest Douglas-fir then ponderosa pine with the least bole damage, minimal lean with large limbs or broken tops first. Snags would be scattered throughout the stand away from roads and landings. Substantial amounts of non-merchantable, most likely smaller size class, trees would remain as snags within the units. In units exceeding 40 acres, 15 percent retention patches would be left in clumps. Clumps would be representative of the stand species composition, located primarily away from the edge of the unit, range from 1 to 15 acres in size within the stand and each unit could contain 2 to 6 individual clumps. All suitable habitat areas (nesting, roosting and foraging areas (NRF))would be excluded from treatment areas.

Late-Successional Reserve

Approximately 20 acres associated with the Round Lake Christian Camp would be treated for danger trees and fuels would be reduced to defensible space fuels targets.

Riparian Reserve

Danger trees would primarily be hand felled and left along haul routes and within high public use areas. In specific areas such as Round Lake Christian Camp (10 acres) and within defensible space Riparian Reserve areas along haul routes (1 miles) danger trees would be removed and commercially utilized. In the Round Lake area additional fuels would be removed to attain Defensible Space fuel loading targets (see Appendix A). In areas where existing roads and landings occur within the Riparian Reserve adjacent to proposed treatment units these roads and would be utilized for harvest operations to reduce additional ground disturbing impacts in adjacent areas (units 34 (off road machine travel could occur), units 99 & 113 (temporary roads would be constructed through Riparian Reserve to access units).

Logging Systems

Ground based logging systems would be utilized to accomplish harvest activities. Machine traffic would be excluded within 50 feet of either side of ephemeral draws except for designated crossings perpendicular to the draw. Ephemeral draws would be considered for snag and snag clump retention. Special yarding subdivisions requiring hand felling and line pulling or machinery yarding from outside the 50 foot buffer would be designed in flat, marginally defined draws (example unit 16) as defined by the hydrologist or soil scientist. Removal of standing down wood would not occur in steep or well defined draws (example unit 45) identified by the hydrologist or soil scientist.

Treatment Summary

Table 2-10 displays the acres within each treatment type by logging system and land allocation within the Northwest and Deschutes Forest Plan. Table 2-11 displays acres treated by each Northwest and Deschutes Forest Plan land allocation.

Table 2-10. Land Allocation and Treatment Acres by Logging System

NWFP Allocation	Deschutes Forest Plan Allocation	Treatment	Logging System	Alt. 4 Acres	Area %	Alt. 4 Vol. (mbf)
Matrix	Metolius Special Forest	Salvage	Ground	1117	65	5021
Matrix	Metolius Scenic Views	Salvage	Ground	535	31	2307
Matrix	Metolius Special Forest	Salvage	Ground Modified	10	<1	40
Matrix	Metolius Scenic Views	Salvage	Ground Modified	22	1	88
Matrix	General Forest	Special Forest Products	Ground	17	1	17
Matrix	Metolius Special Forest	Special Forest Products	Ground	23	1	23
Administratively Withdrawn	Intensive Recreation	Salvage, Danger Tree, WUI and Defensible Space	Ground	117	3	390
Late Successional Reserve	Metolius Scenic Views	Salvage, Danger Tree & Defensible Space	Ground	10	<1	27
Late Successional Reserve/ Riparian Reserve	Metolius Scenic Views	Salvage, Danger Tree & Defensible Space	Ground	10	<1	27
Total				**1862**	**100**	**7940**

Table 2-11. Treatment Acres By Land Allocation

Allocation	Acres	Percentage by Treatment	Volume (mbf)	Percentage by Volume
Matrix	1725	100	7496	95
General Forest	17	1	17	<1
Metolius Scenic Views	577	32	2395	32
Metolius Special Forest	1150	66	15657	68
Late Successional Reserve	20	1	54	<1
Riparian Reserve	10	<1	27	<1
Administratively Withdrawn	117	6	390	5

Fuels Treatments

The removal of harvest created slash and fuels remaining post-harvest would be treated on 1862 acres within salvage units to reduce fuel loads – Table 2.12 (see also Appendix C – Alternative Tables). These additional fuels treatments would move unit conditions towards the desired future fuel characteristics that would allow restoration of fire as an ecosystem component and improve fire suppression effectiveness. In the Round Lake area approximately 20 acres would be treated to defensible space fuels targets as described in Appendix A - Fire and Fuels Strategy and displayed in Table 2-12.

Table 2-12. Alternative 4 Fuels Treatments

Fuels Treatments Within Salvage Units	Acres
Whole-Tree Yard/Machine Pile/Burn Landing Piles	270
Whole-Tree Yard/Burn Landing Piles	1456

Danger Tree Removal for Public Safety(see Map 2-8)

Trees determined to be a hazard to human life or property, according to the appropriate evaluation criteria would be felled along haul routes and commercially utilized in areas outside of Riparian Reserve. These are trees that have a high potential for failure and have the potential to strike the roadbed or fall within a concentrated public use area and would include approximately 54 miles of designated haul routes and 20 acres within specific concentrated use areas such as Round Lake and within defensible space along roads.

A previous project – B&B Hazard Tree Categorical Exclusion – treated approximately 22 miles of these haul roads for trees that posed a public safety hazard. Hazards along these road miles have already been addressed, therefore danger trees primarily along the untreated haul routes (32 miles) would be felled.

Reforestation

Reforestation of desired tree species could occur on up to 1,862 acres primarily where stand replacement burn severity occurred and where desired natural reforestation does not occur. This includes approximately 20 acres of reforestation treatments in LSR.

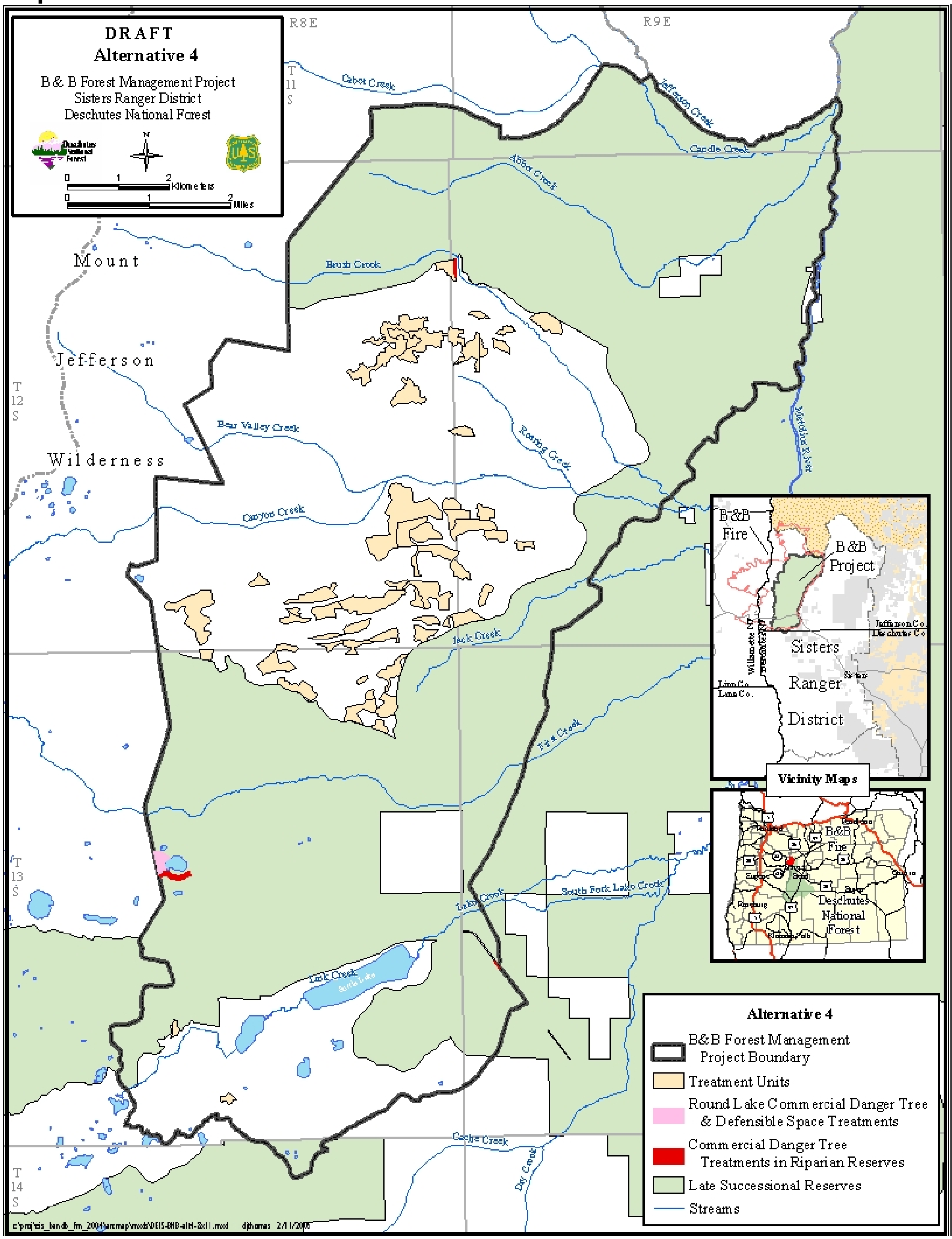
Forest Roads(see Map 2-4)

Access to designated units for harvest and hauling of logs would occur primarily on existing forest roads. An estimated 1.7 miles of temporary road construction would be required to access harvest units not readily accessible from existing forest roads (see Map 2-8). Temporary roads would require minimal excavation, would be native surface, and would be restored and possibly sub-soiled after logging operations were completed. Haul road reconstruction is included in this alternative. The reconstruction activities on existing forest system roads would include (see Appendix C – Alternative Tables):

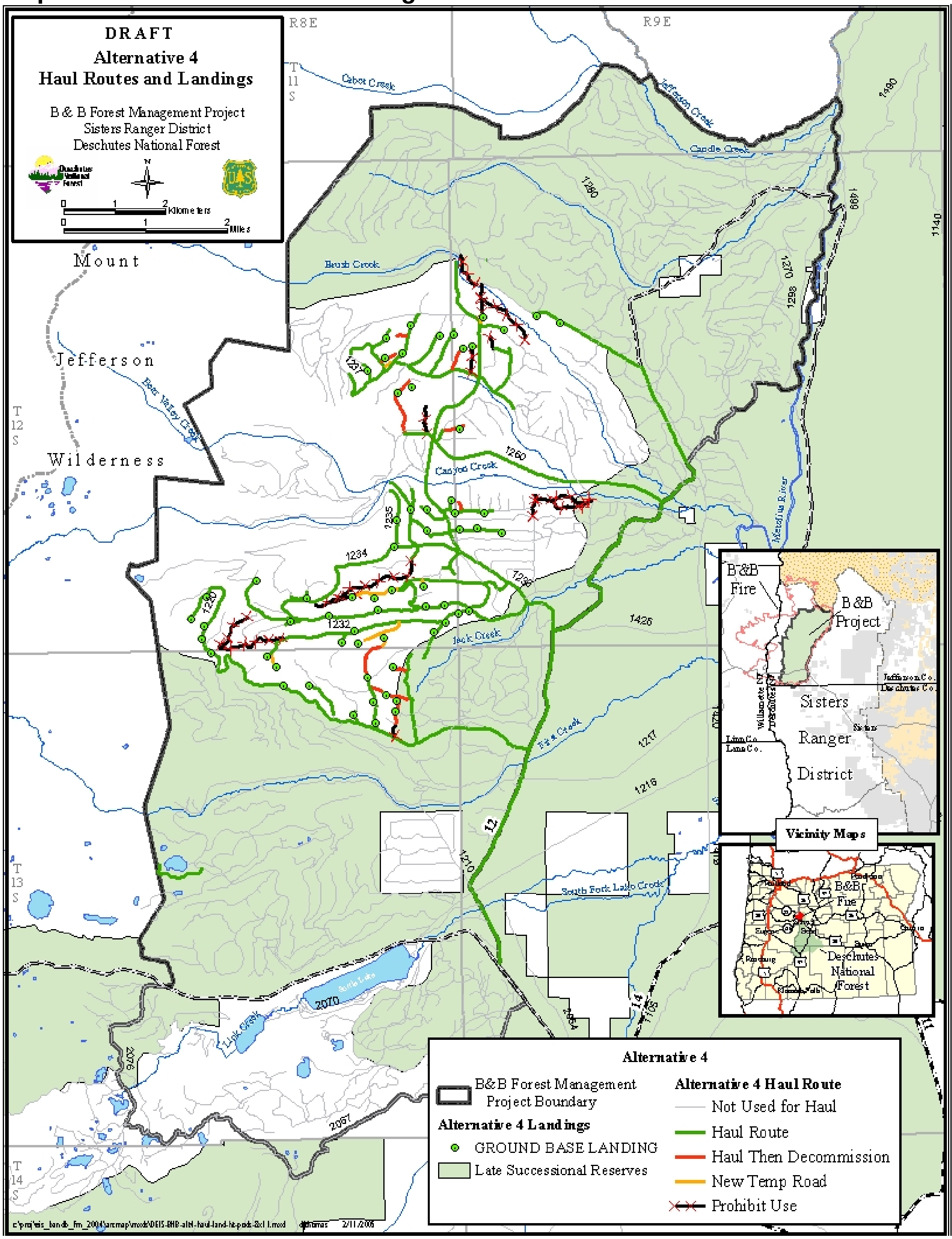
- Armour approximately 28 outlets
- Installation of approximately 3 relief culverts
- Installation of approximately 7 relief waterbars

Approximately 51 miles of road would be decommissioned and approximately 20 miles of road would be inactivated – see Appendix C – Alternative Tables for a description of these roads.

Map 2-6. Alternative 4 Treatment Units



Map 2-7. Haul Routes and Landings



2.4.6 Alternative 5

Summary:

This alternative would treat 4653 acres (~11% of the project area) in 106 units within Matrix, Late-Successional Reserve and Administratively Withdrawn land allocations. Ground based yarding would occur on 4,653 acres. This alternative would yield approximately 13.3 MMBF (See Table 2-14); reduce fuels and reforest up to 4653 acres; remove danger trees along 122 miles of roads, remove danger trees and reduce fuels to defensible space fuels targets within 20 acres of high public use areas around Round Lake. Reconstruction of existing roads used for haul would also occur. Approximately 55 miles of road would be decommissioned and approximately 21 miles of road would be inactivated.

Description of Actions

Commercial Removal (see Map 2-8)

Matrix and Administratively Withdrawn

Salvage harvest is proposed on 1,694 acres (37% of the treatment area for this alternative) within 51 units of Matrix and 117 acres (~1% of the project area) within 3 units on Administratively Withdrawn areas around Suttle Lake. Salvage harvest would remove dead and low probability of survival trees that have economic value (generally greater than 16 inches in diameter at breast height (DBH)).

The salvage treatment areas include 40 acres (<1% of the treatment area for this alternative) within 4 units that are designated for biomass product (this includes firewood, posts, poles and rails, etc.) removal only (see Appendix C – Alternative Tables). Wood products to be removed from these salvage units would follow the same design elements as commercial salvage, however, trees removed as biomass products would typically include those of smaller diameters than are identified for commercial timber salvage sales. All ground based commercial salvage units would also be available for biomass product utilization post-harvest to utilize additional value and further reduce fuel loads.

All soft snags with high wildlife value would be retained where they do not present a public safety hazard; all existing down wood would be retained across the project area; two of the most likely to persist dead or low probability of survival trees on average per acre would be left in each unit. Generally snags selected would be the largest Douglas-fir then ponderosa pine with the least bole damage, minimal lean with large limbs or broken tops first. Snags would be scattered throughout the stand away from roads and landings. Substantial amounts of non-merchantable, most likely smaller size class, trees would remain as snags within the units. In units exceeding 40 acres 15 percent retention patches would be left in clumps. Clumps would be representative of the stand species composition, located primarily away from the edge of the unit, range from 1 to 15 acres in size within the stand and each unit could contain 2 to 6 individual clumps. All suitable habitat areas (nesting, roosting and foraging areas (NRF))would be excluded from treatment areas.

Late-Successional Reserve

Salvage harvest is proposed on 2,842 acres (61% of the treatment area for this alternative) within 52 units. Salvage harvest would remove dead trees that have economic value (generally those greater than 16 inches in diameter at breast height (DBH)).

The salvage treatment areas include 414 acres (~1% of the project area) within 10 units that are designated for biomass product (this includes firewood, posts, poles and rails, etc.) removal only (see Appendix C – Alternative Tables). Wood products to be removed from these salvage units would follow the same design elements as commercial salvage, however, trees removed as biomass products would typically include those of smaller diameters than are identified for commercial timber salvage sales. All ground based commercial salvage units would also be available for biomass product utilization post-harvest to utilize additional value and further reduce fuel loads.

All ponderosa pine and/or Douglas-fir greater than or equal to 20 inches DBH would be retained as snags. If ponderosa pine/Douglas-fir snags greater than or equal to 20 inches DBH total less than four snags per acre, then other species or smaller size ponderosa pine or Douglas-fir would be retained to achieve four snags per acre, the preference being size before species.

Salvage would include 419 acres (9% of the treatment area for this alternative) within 11 units that are white fir dominated and exhibit mixed mortality or underburn in order to facilitate reforestation of desirable tree species and accelerate the development of nesting, roosting and foraging habitat for northern spotted owls in the future. In these units only dead or low probability of survival white fir less than 28 inches DBH would be removed, all ponderosa pine and Douglas-fir would remain within the unit. These units would not be utilized as biomass product areas. Table 2-13 displays the treatment acres by LSRA Management Strategy Area (MSA) and plant association group (PAG); a description of the management strategy areas goals and objectives is included in Appendix B.

Table 2-13. Treatment Acres by LSRA Management Strategy Area and Plant Association Group

Plant Association Group	LSRA Management Strategy Areas			
	B	C	J	K
Dry Mixed Conifer	819	89	877	360
Wet Mixed Conifer	302	9	0	194
Dry Ponderosa Pine	0	0	27	0
Wet Ponderosa Pine	91	0	0	0

Riparian Reserve

Danger trees would primarily be hand felled and left along haul routes and within high public use areas. In specific areas such as Round Lake Christian Camp (10 acres) and within defensible space Riparian Reserve areas along haul routes (3 miles) danger trees would be removed and commercially utilized. In the Round Lake area additional fuels would be removed to attain Defensible Space fuel loading targets (see Appendix A). In areas where existing roads and landings occur within the Riparian Reserve adjacent to proposed treatment units these roads and would be utilized for harvest operations to reduce additional ground disturbing impacts in adjacent areas (units 10, 99 & 113 (temporary roads would be constructed through Riparian Reserve to access units).

Logging Systems

Ground based logging systems would be utilized to accomplish harvest activities. Machine traffic would be excluded within 50 feet of either side of ephemeral draws except for designated crossings perpendicular to the draw. Ephemeral draws would be considered for snag and snag clump retention. Special yarding subdivisions requiring hand felling and line pulling or machinery yarding from outside the 50 foot buffer would be designed in flat, marginally defined draws (example unit 16) as defined by the hydrologist or soil scientist. Removal of standing down wood would not occur in steep or well defined draws (example unit 45) identified by the hydrologist or soil scientist.

Treatment Summary

Table 2-14 displays the acres within each treatment type by logging system and land allocation within the Northwest and Deschutes Forest Plan. Table 2-15 displays acres treated by each Northwest and Deschutes Forest Plan land allocation.

Table 2-14. Land Allocation and Treatment Acres by Logging System

NWFP Allocation	Deschutes Forest Plan Allocation	Treatment	Logging System	Alt. 5 Acres	Area %	Alt. 5 Vol. (mbf)
Administratively Withdrawn	Intensive Recreation	Salvage	Ground	117	3	390
Late Successional Reserve	Metolius Heritage	White Fir	Ground	117	3	235
Late Successional Reserve	Metolius Scenic Views	White Fir	Ground	38	1	75
Late Successional Reserve	Metolius Special Forest	White Fir	Ground	146	3	316
Late Successional Reserve	Bald Eagle	Salvage	Ground	11	0	19
Late Successional Reserve	General Forest	Salvage	Ground	47	1	85
Late Successional Reserve	Scenic Views	Salvage	Ground	57	1	103
Late Successional Reserve	Intensive Recreation	Salvage	Ground	5	0	8
Late Successional Reserve	Metolius Heritage	Salvage	Ground	172	4	372
Late Successional Reserve	Metolius Special Forest	Salvage	Ground	1249	27	2611
Late Successional Reserve	Metolius Scenic Views	Salvage	Ground	568	12	1321
Late Successional Reserve	Bald Eagle	Special Forest Products	Ground	41	1	41
Late Successional Reserve	General Forest	Special Forest Products	Ground	38	1	38
Late Successional Reserve	Intensive Recreation	Special Forest Products	Ground	1	0	1
Late Successional Reserve	Metolius Heritage	Special Forest Products	Ground	219	5	219
Late Successional Reserve	Metolius Black Butte Scenic	Special Forest Products	Ground	15	0	15
Late Successional Reserve	Metolius Special Forest	Special Forest Products	Ground	89	2	89
Late Successional Reserve	Metolius Scenic Views	Special Forest Products	Ground	10	<1	10
Matrix	Metolius Scenic Views	Salvage	Ground	532	12	2293
Matrix	Metolius Special Forest	Salvage	Ground	1121	24	5036
Matrix	General Forest	Special Forest Products	Ground	15	0	15
Matrix	Metolius Special Forest	Special Forest Products	Ground	23	0	23
Matrix	Scenic Views	Special Forest Products	Ground	3	0	3
Late Successional Reserve	Metolius Scenic Views	Salvage, Danger Tree & Defensible Space	Ground	10	<1	27
Late Successional Reserve/ Riparian Reserve	Metolius Scenic Views	Salvage, Danger Tree & Defensible Space	Ground	10	<1	27
Total				**4653**	100	**13317**

Table 2-15. Treatment Acres By Land Allocation

Allocation	Acres	Percentage by Treatment	Volume (mbf)	Percentage by Volume
Administratively Withdrawn	117	2	390	3
Late Successional Reserve	2826	61	5541	42
Matrix	1694	37	7370	55
Riparian Reserve	10	<1	27	<1
Intensive Recreation	123	3	399	3
Bald Eagle	52	1	60	<1
General Forest	100	2	138	1
Metolius Heritage	508	11	826	6
Metolius Scenic Views	1138	25	3689	28
Metolius Special Forest	2621	57	8068	61
Scenic Views	60	1	106	<1
Metolius Black Butte Scenic	15	<1	15	<1

Fuels Treatments

The removal of harvest created slash and fuels remaining post-harvest would be treated on 4653 acres within salvage units to reduce fuel loads – Table 2.16 (see also Appendix C – Alternative Tables). These additional fuels treatments would move unit conditions towards the desired future fuel characteristics that would allow restoration of fire as an ecosystem component and improve fire suppression effectiveness. In the Round Lake area approximately 20 acres would be treated to defensible space fuels targets as described in Appendix C - Fire and Fuels Strategy and displayed in Table 2-16.

Table 2-16. Alternative 5 Fuels Treatments

Fuels Treatments Within Salvage Units	Acres
Whole-Tree Yard/Machine Pile/Burn Landing Piles	2091
Whole-Tree Yard/Burn Landing Piles	2542

Danger Tree Removal for Public Safety(see Map 2-9)

Trees determined to be a hazard to human life or property, according to the appropriate evaluation criteria would be felled along haul routes and commercially utilized in areas outside of Riparian Reserve. These are trees that have a high potential for failure and have the potential to strike the roadbed or fall within a concentrated public use area and would include approximately 122 miles of designated haul routes and 20 acres within the Round Lake Camp area (see Map 2-8).

A previous project – B&B Hazard Tree Categorical Exclusion – treated approximately 61 miles of these haul roads for trees that posed a public health and safety hazard. Hazards along these road miles have already been addressed, therefore danger trees primarily along the untreated haul routes (61 miles) would be felled.

Reforestation

Reforestation of desired tree species could occur on up to 4653 acres primarily where stand replacement burn severity occurred and where desired natural reforestation does not occur. This includes approximately 2,842 acres of reforestation treatments in LSR.

Forest Roads (see Map 2-10)

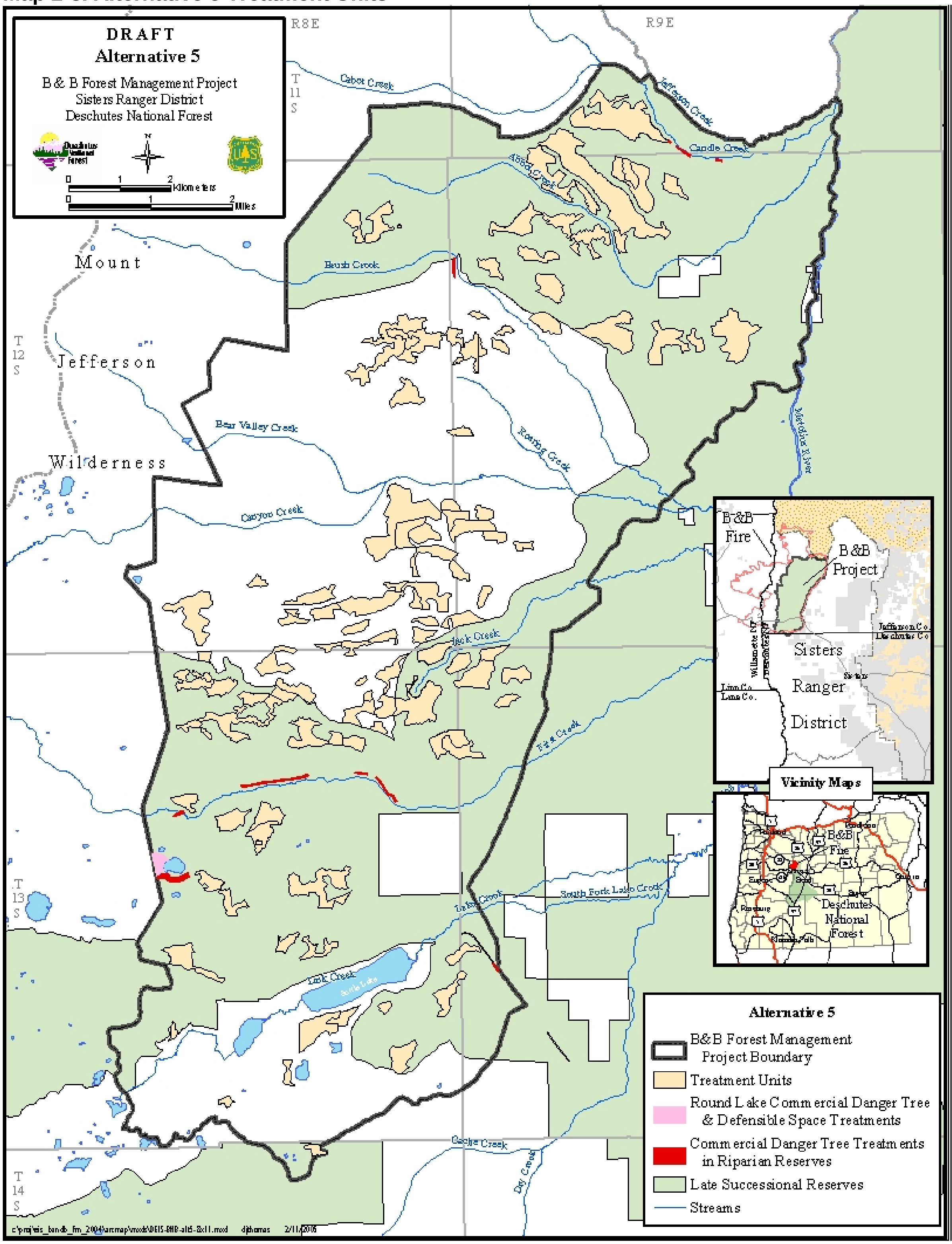
Access to designated units for harvest and hauling of logs would occur primarily on existing forest roads. An estimated 3.7 miles of temporary road construction would be required to access harvest units not readily accessible from existing forest roads (see Map 2-9). Temporary roads would require minimal excavation, would be native surface, and would be restored and possibly sub-soiled after logging operations were completed.

Haul road reconstruction is included in this alternative. The reconstruction activities on existing forest system roads would include (see Appendix C – Alternative Tables):

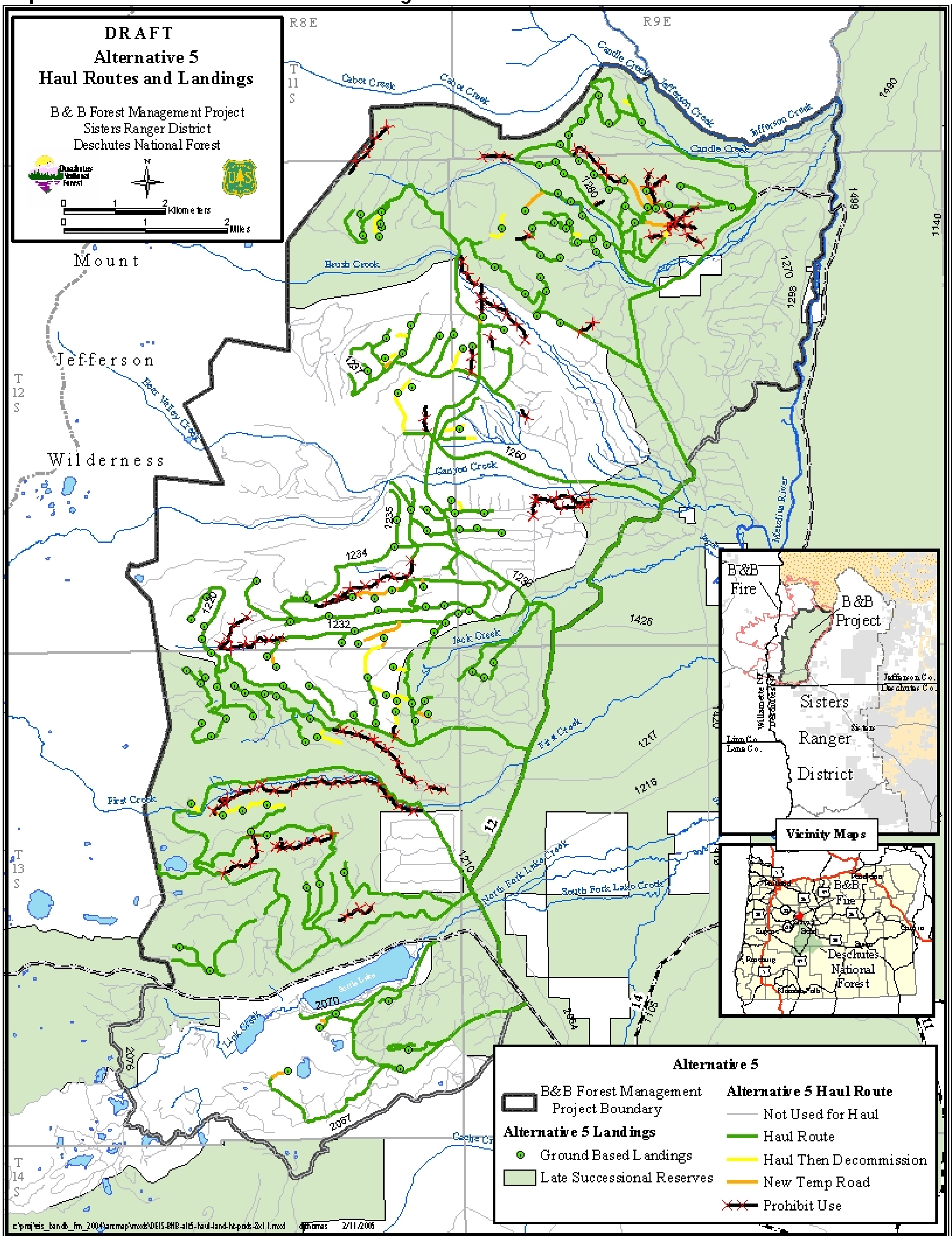
- Armour approximately 28 outlets
- Installation of approximately 3 relief culverts
- Installation of approximately 7 relief waterbars

Approximately 55 miles of road would be decommissioned, and subsoil high priority areas as described in the B&B Area Roads Analysis (see Project Record); and approximately 22 miles of road would be inactivated (repair drainage problems, remove culverts from designated stream crossings and prevent public access) – see Appendix C – Alternative Tables for a description of these roads.

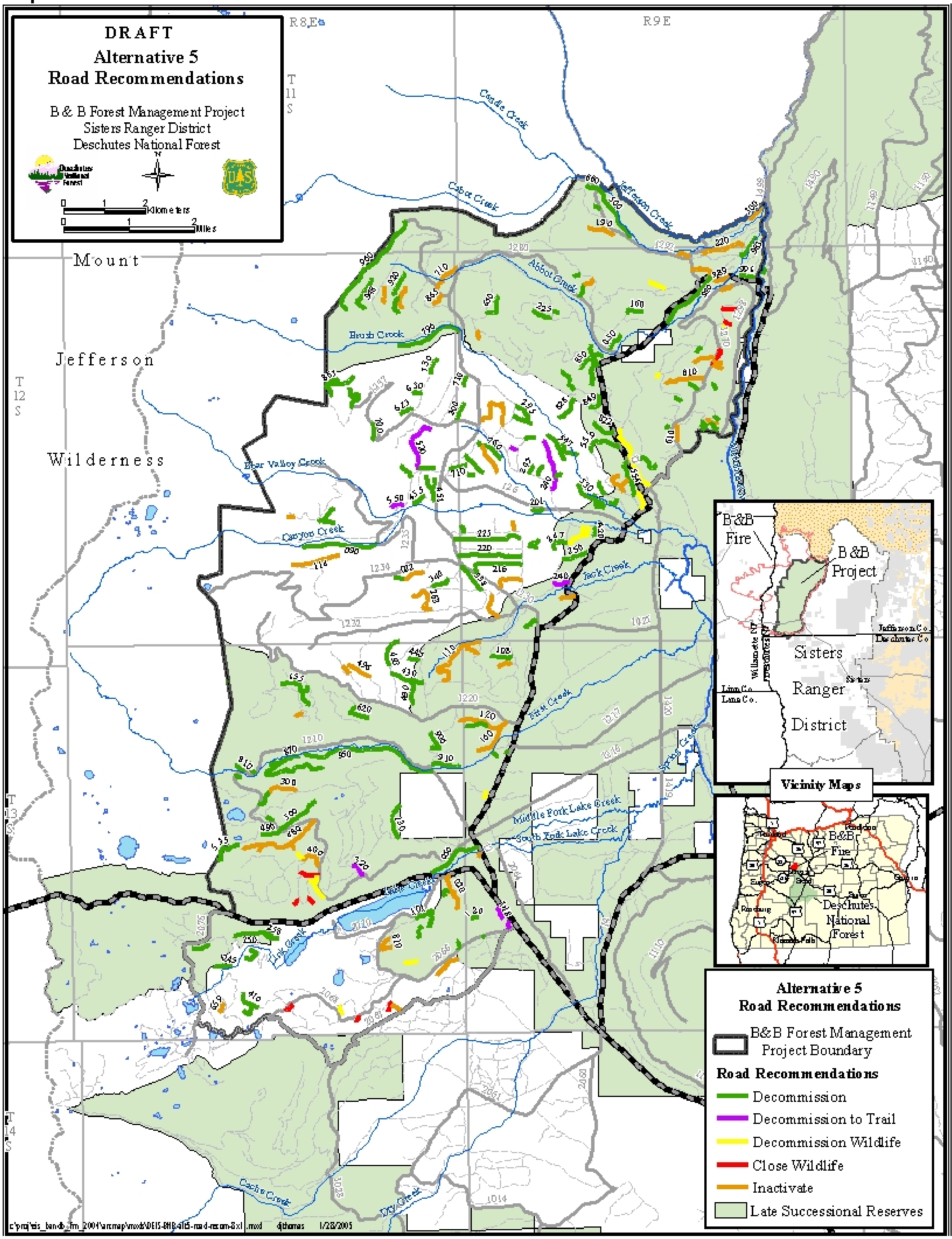
Map 2-8. Alternative 5 Treatment Units



Map 2-9. Haul Routes and Potential Landing Areas



Map 2-10 Road Decommission and Inactivation



2.5 Resource Protection Measures

These design features are an integral part of each of the action alternatives. They are listed here separately to avoid repeating them in each alternative description.

The effectiveness of each measure is rated at high, moderate, or low to provide a qualitative assessment of expected effectiveness that the implemented practice will have on preventing or reducing impacts on resources. These mitigation measures and design elements are considered in the effects discussions of Chapter 3.

Effectiveness ratings of High, Moderate or Low are based on the following criteria: a) Literature and Research, b) Administrative Studies (local or within similar ecosystem), c) Experience (judgment of qualified personnel by education and/or experience, d) Fact (obvious by reasoned, logical, response).

High: Practice is highly effective (greater than 90 %), meets one or more of the rating criteria, and documentation is available.

Moderate: Documentation shows that practice is 75 to 90 percent effective; or Logic indicates that practice is highly effective, but there is no documentation. Implementation and effectiveness of this practice needs to be monitored and the practice will be modified if necessary to achieve the mitigation objective.

Low: Effectiveness is unknown or unverified, and there is little or no documentation; or applied logic is uncertain and practice is estimated to be less than 60 percent effective. This practice is speculative and needs both effectiveness and validation monitoring.

Soils and Water

1. Within unit 34 equipment would only be allowed on the existing skid trail within the Riparian Reserve area (located approximately 250 feet from Brush Creek and 50 feet from the 1230 road) during the dry season (June 15 to October 15). Harvest of danger trees would be allowed within the Riparian Reserve within the unit boundary and would be accomplished by hand felling and winching or equipment located on the skid trail. *Moderate*
2. Machine traffic would be excluded within 50 feet upslope of selected hydrologically connected road segments identified by the hydrologist, except at designated crossings. Allow hand falling and winching away from the road cutbank, machine yarding away from the road cutbank, or hand felling and full suspension across the road cut and ditch. *High*
3. Harvest would be excluded for an area 50 feet long and 25 feet wide below outlets of drainage structures below hydrologically connected road segments. *High*
4. Prior to the subsequent wet season, waterbars would be constructed and/or slash placed on skid trails with slopes greater than 15 percent that drain to hydrologically connected road segments. *Moderate*
5. Specific units would be excluded from winter logging due to stream crossings, proximity to hydrologically connected road ditches, the location of temporary roads in low elevation areas with intermittent snow conditions, or where plowed roads accessing units can negatively affect seasonally wet soils and hydrologically connect roads to streams. Activities in several riparian reserve defensible space areas (6, 11, 12 – see Appendix C – Alternative Tables) and specified units would be restricted to the dry season (Approximately June 15 and October 15. (Units 1, 10, 26, 34, 37, 45, 46, 82, 93, 99, 100, and 113). *High*
6. Operations within specific units would be restricted to the dry season (Approximately June 15-Oct. 15), **or** the winter season under sufficient snowpack conditions (minimum

20" depth), in order to mitigate impacts to seasonally wet soils (SRI 30) and/or minimize soil disturbance in areas adjacent to riparian reserves. (Units 23, 25, 27, 31, 32, 36, 67, 71, 73, 74, 76, 105, 106, 107, 111, 112, 115, 116, 118, 122, 124, 133, and 136). *High*

7. Within portions of specific units within the PCSA the following would apply: *High*
   - Restrict skid trail spacing to 120ft and hand-fell and winch or exclude that portion of the unit. Restrict machine traffic to designated trails (Units 6, 26, 34 & 46).
   - Based on existing levels of non-merchantable material, designate the portion of the unit within the PSCA for a) leave tops in unit, lop and scatter or b) fall and leave submerch, lop and scatter (Units 6, 26, 34 & 46).
   - Exclude machine traffic within 50 ft upslope of road cuts, except in designated crossings. Allow hand falling and winching away from the road cutbank, machine yarding away from the road cutbank, or hand felling and full suspension across the road cut and ditch (Units 6, 26, 34 & 46)
   - Prioritize skid trails and temporary roads within the PSCA for subsoiling (Units 6, 10, 26, 34, 46, 99, 113 & 136).
   - Construct waterbars and/or place slash on all skid trails and temporary roads within the PSCA for the period between logging operations and subsoiling mitigation (Units 6, 10, 26, 34, 46, 99, 113 & 136).
   - Locate newly created landings outside of PSCA, or if no other options exist, mitigate landings if possible with sediment traps during implementation and subsoiling and/or seeding afterwards if necessary (Units 6, 26, 34, 45 & 46).
   - Restrict use on temporary roads, skid trails, and landings within the Riparian Reserve to dry season (June 15 to October 15)(Units 10, 34, 45, 46, 99 & 113).
   - Restrict travel to existing skid trails within Riparian Reserve (i.e. unit 34) and only allow harvest of danger trees associated with the skid trail in the Riparian Reserve.
8. Haul across stream fords would be prohibited when stream is flowing at the crossing (see Appendix C – Alternative Tables). *High*
9. Usage of specific haul routes with multiple stream crossings or other hydrologic connections to streams would be restricted to dry season use (Approximately June 15 to October 15) in order to prevent snow plowing from affecting seasonally wet soils and/or creating temporary hydrologic connections to streams. Haul routes include roads 1210, 1230300, 1232, 1280200, 1292 and 1230100 affecting the following units (Units 1, 2, 4, 6, 10, 25, 37, 38, 44, 45, 46, 47, 59, 91, 92, 93, 95, 99, 100, 124, 127 and 128)(see also Appendix C – Alternative Tables). *High*
10. Site specific exceptions to soil and water resource protection measures when conditions warrant could be allowed with approval from the soil scientist, fish biologist or hydrologist and confirmed by the District Ranger or other responsible official. *Moderate*

Snag Habitat

11. Stands within a 2 mile buffer of existing NRF (Nesting, Roosting, Foraging) habitat and with the ability to develop into NRF habitat within 100 years or less would follow the following guidelines which applies to the units: 36, 91, 102, 103, 104, 105, 106, 111, 112 and 118: *High*
    - Retain 3 snags/acre plus 15% retention in units greater than or equal to 20 acres.
    - Snag requirements addressed above apply with these additions:
    - Species preference for the additional snag/acre may be any species available that are greater than 20" dbh.

- This is to provide additional large wood for spotted owl prey species habitat requirements.
- 15% Retention Clump requirements addressed above apply with these additions:
- Minimum clump size may be reduced to no smaller than 0.5 acres to address issues associated with smaller unit sizes. This should apply to those units between 20 and 40 acres.
- The objective is to provide additional patches for long term spotted owl foraging.

Individual Wildlife Species

12. Northern Spotted Owl
    - Surveys according to the R6 protocol will be conducted during the spring of 2005 on all existing habitat and former home ranges. *High*
    - Disruptive work activities will not take place within ¼ mile (1.0 miles for blasting, ½ mile for helicopter) of nest sites or activity centers of all known pairs or resident singles between March 1 and September 30. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that spotted owls are non-nesting or that no young are present that year. Waivers are valid only until March 1 of the following year. This applies to the following units: 110 & 112. *High*

13. Bald Eagle
    - Retain and protect known perch and roost trees along the Suttle Lake shoreline. *High*
    - Predator and rodent control using baited traps and/or poisons will not take place within BEMAs or newly identified essential habitat. *High*
    - No human disturbance within ¼ mile non line-of-sight or ½ mile line-of-sight (1/2 mile for helicopter and 1.0 mile for blasting) of known bald eagle nests between January 1 and August 31. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that bald eagles are non-nesting or that no young are present that year. Waivers are valid only until January 1 of the following year. This applies to the following units: 166, 167 & 168. *High*

8. Great Gray Owl
    - Surveys will be conducted in the spring of 2005 using the 2004 R6 protocol to determine additional use of the project area by great gray owls. *High*
    - Where existing nest stands are surrounded by underburned stands dominated by ponderosa pine/Douglas fir, provide a ¼ mile protection zone (USDA NWFP 2001) to minimize disturbance to the activity center. *High*

9. Northern Goshawk
    - Surveys will be conducted in summer of 2005 to determine use of known nest sites. *High*
    - Known nest stands will be avoided. (30 acres) *High*

10. Seasonal Restrictions for Various Raptor Species
    - Disruptive work activities will not take place within ¼ mile (1/2 mile for helicopter) of known nest sites or activity centers for the following species. Haul restrictions will be assessed on a case by case basis. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that the species indicated is non-nesting or that no young are present that year. Waivers are valid only until the start date of the restriction of the following year. Table 2-40 outlines the restrictions that apply to the following units: 110, 119 & 120 for Great Gray Owls; 109, 132 & 133 for goshawk; 61 & 79 for osprey. If surveys reveal additional nest sites then seasonal restriction will apply in those areas. *High*

Table 2-40. Raptor Species Seasonal Restrictions

Species	Seasonal Restriction Dates
Northern Spotted Owl	March 1 to September 30
Northern Bald Eagle	January 1 to August 31
Northern Goshawk	March 1 to August 31
Coopers Hawk	April 15 to August 31
Sharp-shinned Hawk	April 15 to August 31
Red-tailed Hawk	March 1 to August 31
Osprey	April 1 to August 31
Great Gray Owl	March 1 to June 30

11. Big Game (Key Elk Habitat Area (KEHA))
    - An average of 30% hiding cover, 20% thermal cover, and 30% black-barked ponderosa pine stands are needed within the KEHA as a whole. Harvest in mixed severity stands may alter the amount of these components. Follow the guidelines below if any component is below required levels and harvest is occurring within mixed severity stands: *High*

Table 2-41. Required Cover within Key Elk Habitat Area

Habitat Component	Required %	Habitat Specifications	Comments
Hiding Cover	30%	Stand height average 10' Stand not thinned in past 20 years Able to hide 90% of an adult elk at 200'	Black-barked stands do not figure in to this percentage
Thermal Cover	20%	≥10 acres Average stand height 40' Average canopy cover of 40%	Black-barked stands do not figure in to this percentage
Black-bark Stands	30%	Unthinned in past 20 years Average canopy cover of 40% Minimum stand height of 40' Dispersed clumps	

Habitat specifications are listed as guidelines for types of areas that would qualify as those listed habitat components.

Air Quality

12. Prescribed burning operations would be in accordance with Oregon State Smoke Management Guidelines and would be restricted during the period of July 1 – September 15. Also, conduct prescribe burn operations under conditions favorable to dissipate smoke away from the Class 1 airshed (i.e. burn during forecasted westerly winds). *High*
13. Warning signs will be posted at prominent road junctions to inform the public of prescribed burning operations, and will remain in place until there is no visible smoke. If feasible, roads may be temporarily closed for the protection of public safety. *Moderate*
14. As part of the plan to inform the public, notify local businesses prior to the burning season and on the day of planned prescribed burning operations. Also, notify adjacent landowners of burning operations conducted in units within ¼ mile of their property. *Moderate*
15. Reduce particulate emission through utilization to the extent practical (i.e. pulling trees to the landing with limbs attached and biomass utilization versus prescribed burning). *Moderate*
16. Prescribed fire managers would use smoke management forecasts in order to minimize smoke entering into suitable bald eagle and northern spotted owl habitat and to ensure that dissipation would be adequate as per the 2003 Joint Aquatic and Terrestrial Programmatic Biological Assessment for Federal Lands within the Deschutes Basin and associated concurrence letter from US Fish and Wildlife Service. This would apply to units 166, 167 and 168 for bald eagles and units 110 and 112 for spotted owls.. *High*

Heritage

17. Where sites need to be avoided by any treatment, an archaeologist will mark the area to be avoided prior to any needed implementation layout or design. Avoidance areas will be marked in any contractor files or maps as area to be avoided and not as archaeological sites. *High*

18. Road closures and obliterations will avoid impacts within site areas. *High*

TES Plants

19. During reforestation plant trees at a spacing of 20 x 20 feet, or wider, in areas occupied by Peck's penstemon (Units 73, 74, 76, 104, 105, 107, 109, 111, 112, 116, 124 & 130). *Moderate*
20. Prohibit the harvest of biomass products, specifically, firewood, in portions of commercially salvaged units occupied by Peck's penstemon to reduce risk of inadvertent introduction or spread of noxious weeds (Units 73, 74, 76, 104, 105, 107, 109, 111, 112, 116, 124 & 130). *Moderate*
21. Conduct ground-based salvage harvesting over snow or frozen ground if possible to reduce incidence of inadvertent, gouging-induced mortality of existing Peck's penstemon plants (Units 73, 74, 76, 104, 105, 107, 109, 111, 112, 11666, 124 & 130). *Moderate*

Noxious Weeds

22. Before ground-disturbing activities begin, prioritize and treat weed infestations in project operating areas and along access routes. *Moderate*
23. Use clean-equipment contract clauses (local and regional) to minimize the introduction and spread of noxious weeds by contractors. *High*
24. To reduce the risk of spreading weed infestations, begin project operations in uninfested areas before operating in weed-infested areas. If this is not feasible, clean all off-road equipment before moving it from an infested unit to a weed-free unit. Any on-Forest cleaning of equipment should be done at specified sites. *Moderate*
25. Known weed sites will be shown of the Sale Area Map. Landings and skid trails will not be allowed within these sites. *Moderate*
26. Minimize soil disturbance and retain native vegetation, in and around project activity areas, to the extent possible consistent with project objectives. *High*

Scenery and Recreation Resources

Foreground Landscape (0-½ mi.)

27. Approximately 80% of the slash generated in the treatment areas should be removed (to be coordinated with other resource areas) from the immediate foreground landscape area (0-300') and slash piles should be small and not be obvious to the casual forest visitor following post treatment activities. *Moderate*
28. Clean-up activities for foreground landscape areas within the proposed treatment units and landings along scenic and travel corridors frequented by the recreating public should be completed within 1 year for Retention, and 2 years for Partial Retention allocation areas as specified under Deschutes National Forest LRMP S & Gs (refer to Potential Treatment Areas & Deschutes LRMP, MA 9-8, pg. 123, for more detail). *Moderate*
29. Minimize ground disturbance and damage to vegetation in foreground landscape areas seen from recreation sites, scenic and travel corridors. For larger, or heavy use dispersed campsites, avoid the immediate area within 100 feet of campsite center. Protect larger or heavy use recreation sites from a prescribed fire by placing a fire line around the site. *Moderate*

Middleground Landscape (½ - 5 mi.)

30. To the extent possible, changes in form, line, color and texture elements in the landscape resulting from the proposed vegetation management activities should not be evident for more than two seasons in middleground (½ -5 miles) areas. Retain and utilize wildlife clumps as part of residual visual components in the middleground landscape areas. *Moderate*

Primary and Secondary Scenic and Travel Corridors (Including Highway 20; County Roads 12 and 14; Forest Roads 1210, 1220, 1230, 1232, 1234, 2070, 2076)

31. As part of the final clean-up effort, scenic and travel corridors, dispersed campsites and any developed facilities should be left in a safe condition. Safety hazards created from vegetation treatment, such as “widow makers” and other hazards should be removed. *Moderate*

32. Slash clean up within recreation sites, such as campgrounds and trailheads, and scenic and travel corridors should be completed with a low impact machine, or by hand piling. This recommendation is applicable primarily within the immediate foreground landscape area (0-300 feet from roadway). *Moderate*

33. Stumps visible from recreation sites, scenic and travel corridors should be cut to 8” or lower within the immediate foreground landscape area. Generally a much lower or flush cut stump for areas within Retention Foreground landscape is desired. Special consideration is given, on a case by case basis, to cover for areas where erosion control strategies may require a stump height taller than 8 inches. *Moderate*

34. Where possible, design and locate skid trail and landing area at least 300 feet away from recreation sites, scenic and travel corridors. Use parallel (to a travel corridor) skid trails to help reduce “shot gun” visual effect. *Moderate*

35. Where possible, use cut tree marking (blue paint) to minimize the amount of marking paint visible from recreation sites, scenic and travel corridors. Paint back side of tree if leave tree marking (orange paint) is used. *Moderate*

2.6 Monitoring and Study

Local Ongoing and Proposed Administrative Studies Pertaining to the Impacts of Severe Wildfire, Recovery Post Fire and Salvage Logging.

The large B&B Complex Fire and the Davis fire traversed the flanks of the eastern Cascades coupled with other recent and historical fires in the Central Oregon region–provide some positive opportunities to help offset some of the destructive aspects of those events. One of the potential benefits they afford is the opportunity to learn about fire effects on various ecosystems within this broad area. We are always very interested in gaining and accessing new scientific knowledge to better manage our natural resources, and understand the importance of taking advantage of these opportunities to gain this knowledge; especially in addressing critical controversial questions faced by natural resource managers. The following is a list of ongoing, or proposed studies that will help us understand the post fire environment. They cover a variety of important questions identified by natural resource and scientists as those they would like answers to in order to make more informed natural resource management decisions ranging from the effects of severe fire, the effects of restoration activities and salvage logging on upland and riparian forest and soils resources.

1) ***Soil Response to Contemporary Logging System****s(proposal)*. Principle Investigators, *Paul Adams, Ph.D. and Kevin Boston*, Ph.D. Dept of Forest Engineering, Oregon State University, Corvallis. Location: *Davis Fire, Crescent RD.*

   This proposed administrative study, if funded, will develop experimental procedures that can be used to evaluate response of various soil factors through time following post-fire harvesting, research that remains very limited especially for contemporary logging systems. The results will provide valuable information for practitioners and decision makers for improved decisions about post-fire harvest. Additionally, the results will provide guidance for refining future studies and monitoring of harvest effects through experience gained with analytical methods and the observed sources of variability. The study design will use three replicates of about 15 to 25 acres as the experimental units for both the ground-based and helicopter logging sites. An additional set of three replicates will be identified as control unites; they will be located near the treatment units with similar slope and stand conditions as the treatment units. There will be a total of 12 experimental units located on the Davis Fire Project. On the Lower Jack Fire Salvage Demo, we will select 6 replicates for the ground-based logging operations and similar control sites, for a total of 12 experimental units.

2) *Fire in Riparian Areas: Predicting Severity and Recovery(proposal). Principle Investigators*: David Hibbs, Ph.D. and Jessica Halofsky, Ph.D., Oregon State University.

The project, if accepted, will provide information on factors influencing riparian fire severity and post-fire recovery. Information gained in this study can then be used by managers to develop riparian management plans which incorporate the potential and realized effects of fire in riparian areas. Although riparian areas are of vital importance to biodiversity and water quality, and fire is a dominant disturbance process in the Deschutes, there is no on-going or recent research of fire severity and vegetation recovery in riparian areas on the Deschutes or elsewhere in eastern Oregon. Managers do not have as much information on the role of fire in riparian forests as they do for upland forests. As a result, it is very challenging to predict fire behavior and whether or not fuels treatments, silvicultural manipulations and/or prescribed fire in riparian forests would influence fire behavior and vegetation dynamics in a desirable way. Managers also need information on post-fire recovery patterns in riparian areas and whether or not some locations should be targeted for post-fire rehabilitation treatments.

3) *Impacts of post fire salvage logging and wildfire burn intensity on soil productivity and forest recovery. Principle Investigators:* Dr. Jane E. Smith (Pacific Northwest Research Station, Corvallis) and Elizabeth Sultzman, Ph.D. (Oregon State University. Corvallis), Proposed (Joint fire Science Program).

This project, if accepted will compare the effects of salvage logging operations (e.g. compaction and subsoiling to reduce compaction) vs. no treatment. The study will also compare burn intensity in reburned areas on soil productivity and forest recovery. The study will examine the effects of salvage logging on soil productivity and young tree growth on 7 replicate sites, salvage logged one year after the Booth and Bear Butte (B&B) fire. Within each site, the impacts of 3 treatments (burning with no further disturbance, compaction from heavy equipment, and compaction followed by subsoiling) on soil biological, chemical and physical properties critical to soil productivity and growth of planted tree seedlings. To examine effects of repeated fire and to assess the rate of recovery of detrimentally (burned soil investigators will continue measuring impacts of burn severity on soil recovery and growth of planted tree seedlings in a subset of 25 previously established paired plots of detrimentally burned and less severely burned soils.

4) *Response of Armillaria root disease to the post fire environment in mixed conifer forests(ongoing). Principal Investigators*: Kristen Fields, Helen Maffei, Ph.D. and Greg Filips, Ph.D. (Forest Health Protection, USDA Forest Service). *Location*: B&B Fire.

This administrative study will document the short- and long term response and development of Armillaria ostoye and other root disease pathogens in the aftermath of a severe wildfire. This information will then be used to adapt and or modify restoration activities, if warranted, in areas with varying levels of root disease infestations. The information will also be used to validate the predictions of the post stand replacement fire development of root disease in the western root disease model extension of forest vegetation simulator.

Prior to the B&B, this administrative study was designed to evaluate the impact of root disease over time on forest structure and flora. The study was also designed to compare thinning overstocked areas (to levels recommended by local stocking guides (Cochran)) to no treatment in post-budworm mixed conifer forests affected by root disease pathogens. Within the thinned treatment areas, several fuel treatments methods were also compared.

A series of Permanent plots were installed to accomplish this objective and detailed pre- and post management measurements were made of species composition, fuel characteristics (standing and down), and levels of soil compaction. The thinning treatments were implemented and probably accomplished the objectives of reducing stand density and ladder fuels. However, the fire occurred before the district was able to complete the follow-up treatment of the high fuel loads created by the thinnings. As a result, the fire was lethal to the trees both in the treated and in the non treated areas.

5) *Survival of Fire Damaged Trees(ongoing). Principal Investigator*: Rob Progar, Ph.D. PNW Research Station, Corvallis, Oregon. Location: B&B Fire and Davis Fire.

This administrative study involves the localized validation of the guidelines developed by Don Scott and others (2002) for determining the likelihood of tree survival following damage by fire. The guidelines were originally developed in the Blue Mountains and are now being validated in several locations including the Davis Fire and the B & B Fire. Within B & B, there are about 1000 trees that were tagged in 2004 and will be monitored over the next five-year period for survival. The study is intended to evaluate as many tree species as possible, with the entire array of damage symptoms (crown scorch, root damage, bole scorch) being considered so that we can be better prepared to predict tree survival after future fire events.

6) *Colonization of Fire-Damaged Ponderosa Pine by Bluestain Fungi and Insects After the Hash Rock Fire*, August 22, 2000. *Principal Investigator*: Andris Eglitis, Ph.D., Forest Health Protection, USDA Forest Service. *Location:* Hash Rock Fire

Another study with relevance to the B & B Fire was recently finished on the Hash Rock Fire. The key findings from that study were that:

- Fire-killed ponderosa pine can be heavily colonized by western pine beetles.
- Beetles can move into surrounding stands and kill trees not affected by the fire.
- Most dead trees are heavily colonized by bluestain fungi and wood boring insects within the first two years after the fire.
- Foraging activity by woodpeckers on the insects colonizing fire-killed trees can sometimes be very low (only 18% of the Hash Rock fire-killed and infested trees showed evidenced of woodpecker feeding).

7) Evaluation of native forb seed for use in post-fire disturbance areas where there is a high potential for invasive exotic species. Principle Investigator: Nan Vance, Ph.D., RMP Program, Pacific Northwest Research Station, Corvallis, OR (ongoing). Location: Eyerly Fire.

The objective of this administrative study is to evaluate the performance of sown native plant seed on a post-fire burn area prone to invasive exotic grasses and forbs.

The viability of locally collected native forb/grass seeds is also being evaluated. The information will be used to develop a native plant reseeding program for these types of highly disturbed, weed prone areas. The administrative study is located on Green Ridge in the Eyerly Fire. Twenty in situ plots have been established to accomplish the objectives. On these plots, 18 species of native plants were sowed and are being evaluated. The plots will be monitored and demographic data on plants also will be taken including, survival, maturity and reproduction.

Current and Ongoing or Potential Monitoring under Direction Provided in the Forest Plan

- Survey within and adjacent to the burned area to detect new weed sites and assess current condition of known sites. Update weed database and associated spatial layers. Hand-pull, bag, remove, and properly dispose of weeds at small sites encountered during these surveys. Patrol for, monitor and treat noxious weeds that occur in areas of disturbance associated with fire suppression, for at least three growing seasons after the fire. Identify potential noxious weed seed dispersal vectors associated with the fire suppression.
- Develop a simple, economical Administrative Study to monitor response of Peck's penstemon to 1) salvage treatment vs. no salvage treatment, and 2) conventional vs. modified salvage harvesting methods.
- Although much has been done after the fire in regards to surveying and analyzing the drainage features (culverts, dips, ditches, etc…..) of high risk roads, it is recommended that continued monitoring be done to insure that future unknown needs to remove, replace, or improve those features are discovered, documented, and planned for implementation.
- All maintenance level 3 through 5 roads are assessed for safety and maintenance needs at least once every year. A more thorough condition survey is conducted at least once every 5 years. Level 1 and 2 roads are assessed less frequently, and primarily for safety and resource concerns.

Implementation Monitoring of Project

Conduct post-sale monitoring and control of noxious weeds within and adjacent to the sale area and along haul routes for at least three growing seasons following completion of the project.

All areas to be avoided or otherwise within treatment areas should be monitored by an archaeologist once during implementation and after implementation has been concluded to confirm that avoidance measures were implemented and effective.

Specific Monitoring for Project Activities

- Monitoring of all units located on sensitive soils is required under the Forest Plan (LRMP SL-3). Units with seasonally high water tables (SRI Map Unit 30) are identified as sensitive in this analysis and included in Appendix B. Units proposed under Alternative 2 located on steep slopes sensitive to displacement or with an inherent risk of debris flows have hand-felling and helicopter yarding prescriptions intended to minimize detrimental disturbance. A subset of these units would be visually monitored following proposed activities to determine whether statistical monitoring for compliance with LRMP standards would be necessary. A representative sample of ground-based units among those located on non-sensitive soils that are predicted to exceed LRMP standards would also be monitored to determine whether detrimental disturbances incurred by this entry would require subsoiling mitigations to maintain compliance with the Forest Plan.

- Roads that self close, (brush in) as described previously, under Existing Conditions, need to be assessed before they "close" so that they are in a "self maintaining" mode, (i.e., have drainage features assessed, and structures such as culverts removed if appropriate and be deemed hydrologically stable).

- Areas of stand replacement would be monitored for natural regeneration to assess and prioritize the areas for additional reforestation efforts.

2.7 Comparison of Alternatives

Table 2-42. Actions by Alternative

Purpose and Need ↓	Alternative 1 No Action – Continuation of Current Management	Alternative 2 Proposed Action	Alternative 3 Additional Watershed Protective	Alternative 4 Matrix Only	Alternative 5 Large Snag Retention
Harvest the dead and dying timber resource before it loses all of its economic value.					
Salvage Harvest					
Matrix	0 acres	1725 acres; 53 units 7.5 MMBF	1643 acres; 47 units 7.3 MMBF	1725 acres; 53 units 7.5 MMBF	1694 acres; 51 units 7.4 MMBF
Ground Yarding	0 acres	1694 acres	1643 acres	1694 acres	1694 acres
Ground Modified Yarding	0 acres	31 acres	0 acres	31 acres	0 acres
Aerial Yarding	0 acres	0 acres	0 acres	0 acres	0 acres
LSR	0 acres	4960 acres; 85 units 21.8 MMBF	2002 acres; 33 units 6.3 MMBF	0 acres; 0 units	2822 acres; 52 units 5.6 MMBF
Ground Yarding	0 acres	3827 acres	2002 acres	0 acres	2822 acres
Ground Modified Yarding	0 acres	178 acres	0 acres	0 acres	0 acres
Aerial Yarding	0 acres	955 acres	0 acres	0 acres	0 acres
AWD	0 acres	117 acres; 3 units 0.4 MMBF	117 acres; 3 units 0.4 MMBF	0 acres; 0 units	117 acres; 3 units 0.4 MMBF
Ground Yarding	0 acres	117 acres	117 acres	0 acres	117 acres
Totals		**6803 acres; 141 units 29.6 MMBF**	**3762 acres; 83 units 14.0 MMBF**	**1725 acres; 53 units 7.5 MMBF**	**4633 acres; 106 units 13.3 MMBF**
Ground Yarding	**0 acres**	**5638 acres**	**3762 acres**	**1694 acres**	**4633 acres**
Ground Modified Yarding	**0 acres**	**210 acres**	**0 acres**	**31 acres**	**0 acres**
Aerial Yarding	**0 acres**	**955 acres**	**0 acres**	**0 acres**	**0 acres**
Biomass Products					
Matrix	0 acres	40 acres; 4 units	0 acres	40 acres; 4 units	40 acres; 4 units
LSR	0 acres	414 acres; 10 units	0 acres	0 acres	414 acres; 10 units
Mixed Mortality white fir units in LSR	0 acres	419 acres; 11 units	0 acres	0 acres	419 acres; 11 units
Potential Sediment Contribution Areas	No Treatment	Treat with Restrictions	No Treatment	Treat with Restrictions	Treat with Restrictions
Snag Retention					
Matrix	All Across Landscape	Retain 2 most likely to persist per acre on average within unit with 15%	Targets from scientific, DecAID and Site Productivity	Retain 2 most likely to persist per acre on average within unit with 15%	Retain 2 most likely to persist per acre on average within unit with 15%

Purpose and Need ↓	Alternative 1 No Action – Continuation of Current Management	Alternative 2 Proposed Action			
		retention patches		retention patches	retention patches
LSR	All Across Landscape	Retain 2 most likely to persist per acre on average within unit with 15% retention patches	LSRA Targets	All Across Landscape	Retain all Douglas-fir and ponderosa pine >20" DBH
Haul Routes	0 miles	146 miles	121 miles	54 miles	122 miles
New Temporary Roads	0 miles	5.1 miles	3.9 miles	1.7 miles	3.7
Road Reconstruction					
Outlets Armored	0	155	109	28	109
Relief Culverts Installed	0	18	16	3	16
Relief Waterbars Installed	0	32	21	7	23
Undersized Culverts Replaced	0	0	30	0	0
Reduce harvest slash and small trees within salvage units to establish fuel conditions that will reduce the potential for future uncharacteristic fire and restore fire as an ecosystem component.					
Fuels Treatments					
Whole-Tree Yard/Machine Pile/Pile Burn Landings	0 acres	2702 acres	1710 acres	270 acres	2091 acres
Whole-Tree Yard/Pile Burn Landings	0 acres	3584 acres	2053 acres	1456 acres	2542 acres
Whip Felling/ Jack Pot Burn/Pile Burn of Landings	0 acres	516 acres	0 acres	0 acres	0 acres
Reforest historically prevalent or common species (where seed sources are lacking) within salvage units to aid in the quicker development of desired forest conditions, including large tree structure.					
Reforestation					
Matrix	0 acres	1725 acres	1643 acres	1725 acres	1694 acres
LSR	0 acres	4960 acres	2002 acres	0 acres	2822 acres
AWD	0 acres	117 acres	117 acres	0 acres	117 acres
Provide for public, administrative and operational safety by removing danger trees along open roads and areas of concentrated use.					
Danger Tree Treatments	0 miles	146 miles	121 miles	54 miles	122 miles
High Use (Round Lake)	0 acres	20 acres	20 acres	20 acres	20 acres
Reduce open road densities, particularly within Late-Successional and Riparian Reserves, to help protect and improve watershed conditions, fisheries, and wildlife habitat.					
Road Closures					
Decommission	0 miles	51 miles	51 miles	51 miles	55 miles

Purpose and Need ↓	Alternative 1 No Action – Continuation of Current Management	Alternative 2 Proposed Action	Alternative 3 Additional Watershed Protective	Alternative 4 Matrix Only	Alternative 5 Large Snag Retention
Inactivate	0 miles	20 miles	20 miles	20 miles	22 miles

Table 2-43. Measures by Alternative

Purpose and Need ↓	Alternative 1 No Action – Continuation of Current Management	Alternative 2 Proposed Action	Alternative 3 Additional Watershed Protective	Alternative 4 Matrix Only	Alternative 5 Large Snag Retention
Harvest fire killed timber that has economic value.					
Board feet of commercial volume proposed for harvest.	0 MMBF	29.7 MMBF	14.0 MMBF	7.5 MMBF	13.3 MMBF
Acres proposed for biomass product sales.	0 acres	Targeted 454 acres Post Harvest 5925 acres	0 acres	Targeted 40 acres Post Harvest 1802 acres	Targeted 454 acres Post Harvest 3760 acres
Reduce fuels within salvage units to establish conditions that will help reduce the potential for future high mortality, rapid spreading or large fires; promote the restoration of fire as a component of healthier ecosystems; increase defensible space and suppression effectiveness and reduce risk to existing and developing spotted owl nesting, roosting and foraging (NRF) habitat.					
Percent of project area where fuels loadings do not exceed 10-35 tons per acre.	0%	9%	5%	3%	6%
Reforest desired species (where natural, on-site, seed sources are lacking) within salvage units to aid in the quicker development of desired forest conditions, including large trees to support silvicultural activities within Matrix and late-successional characteristics within LSR.					
Acres of reforestation within project area by vegetation mortality condition. High Moderate Low	 0 acres 0 acres 0 acres	 4246 acres 1297 acres 1260 acres	 2005 acres 863 acres 895 acres	 450 acres 529 acres 746 acres	 2418 acres 1007 acres 1207 acres
Improve public, administrative and operational safety by removing danger trees along open roads and areas of concentrated use.					
Acres of fuels treatment within defensible space areas.	0 acres	2703 acres	1425 acres	692 acres	1886 acres
Miles of roads treated for public and operational safety hazards.	0 miles	146 miles	121 miles	54 miles	122 miles

Purpose and Need ↓	Alternative 1 No Action – Continuation of Current Management	Alternative 2 Proposed Action	Alternative 3 Additional Watershed Protective	Alternative 4 Matrix Only	Alternative 5 Large Snag Retention
Reduce open road densities, particularly within Late-Successional and Riparian Reserves, to help protect and improve late successional and watershed conditions, and the associated fisheries and wildlife habitat.					
Miles of roads proposed for inactivation and decommissioning.	**Inactivation 0 miles Decommissioning 0 miles**	**Inactivation 50 miles Decommissioning 20 miles**	**Inactivation 50 miles Decommissioning 20 miles**	**Inactivation 50 miles Decommissioning 20 miles**	**Inactivation 55 miles Decommissioning 21 miles**

Issue and Indicators	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Effects to Water Quality from Sedimentation					
Acres of at risk and/or detrimental soil condition in the PSCA	0 acres	33 acres	0 acres	5 acres	12 acres
Effects to Soil Productivity					
Acres and distribution (extent) of detrimental soil disturbance (i.e. total acres of compaction, displacement, burn severity etc.)	0 acres	1349 acres	752 acres	345 acres	926 acres

Amount of nutrients remaining on site – Carbon Nitrogen Phosphorus	96.6 tons/acre 546.8 lbs/acre 61.9 lbs/acre	62.1 tons/acre 384.1 lbs/acre 37.8 lbs/acre	62.1 tons/acre 384.1 lbs/acre 37.8 lbs/acre	62.1 tons/acre 384.1 lbs/acre 37.8 lbs/acre	74.8 tons/acre 441.7 lbs/acre 46.4 lbs/acre
Effects to Wildlife Habitat – Northern Spotted Owl Habitat					
Acres of suitable habitat and dispersal habitat developed within 100 years within Metolius LSR	Suitable Habitat 1794 acres Dispersal Habitat 15,688 acres	1725 acres 16,496 acres	1768 acres 16,028 acres	1783 acres 15,688 acres	1622 acres 17,736 acres
Acres of landscape where risk reduction has occurred	Existing NRF 0 acres Potential NRF 0 acres	324 acres 2,376 acres	178 acres 1,410 acres	152 acres 1,086 acres	257 acres 1,644 acres

The following figures (Figure 2-1 and 2-2) describe the effects to snag and downed wood habitat over time. The eastside mixed conifer plant association group shows the greatest difference between alternatives at the 80 percent tolerance level and so was displayed here for comparison purposes. For more information with regard to other plant association groups and tolerance levels refer to Chapter 3, Section 10 and 11.

Figure 2-1. Snag Levels Over Time within the Eastside Mixed Conifer PAG at the 80% Tolerance Level

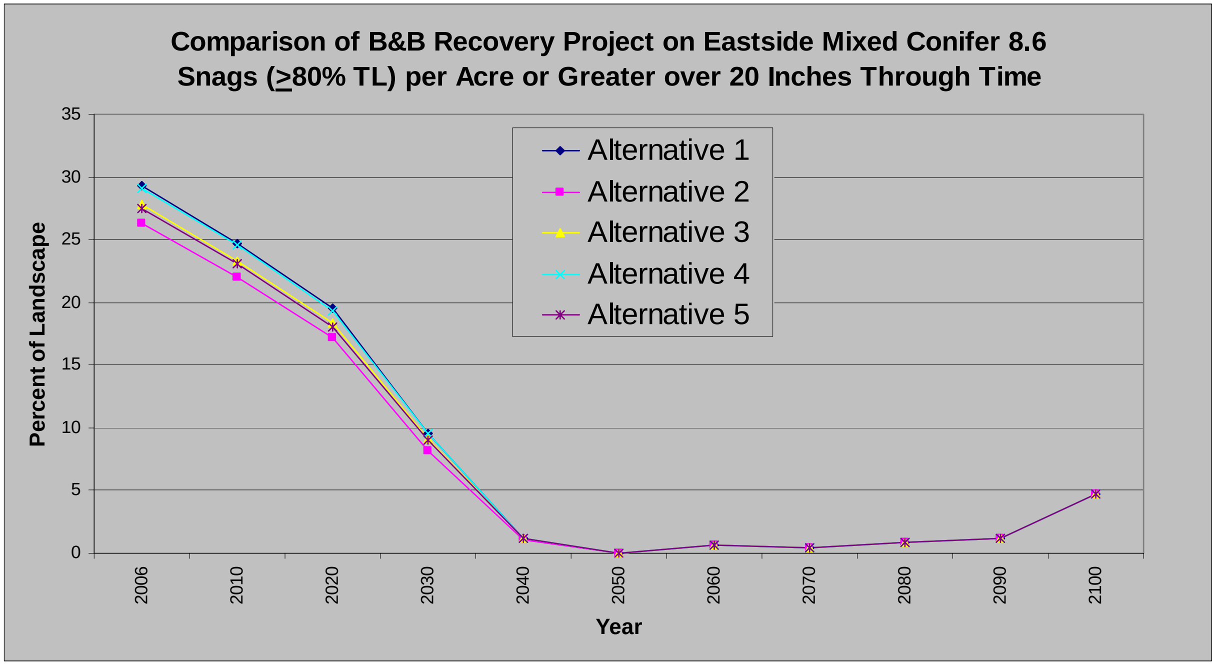
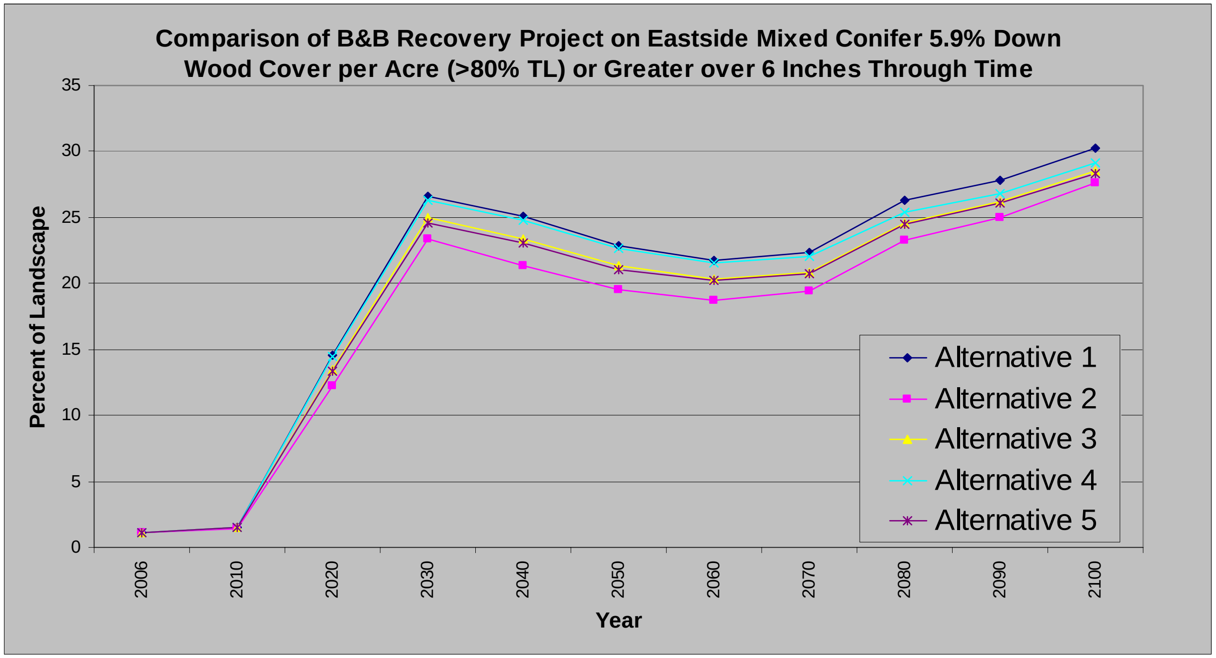


Figure 2-2. Down Wood Levels Over Time within the Eastside Mixed Conifer PAG at the 80% Tolerance Level



Chapter 3

Affected Environment and Environmental Consequences

Affected Environment and Environmental Consequences

3.1 Introduction

This chapter of the EIS describes both the existing conditions of and the environmental consequences that would affect the area and resources, based on the alternatives described in Chapter 2 – Alternatives Including the Proposed Action. For ease in presentation and comparison, the analysis discussions are separated into individual resource areas, such as soil quality, air quality, fish habitat, wildlife habitat, and botany. Although the anticipated environmental effects of alternatives were analyzed for each resource discipline, impact analyses (adverse and beneficial) emphasize those decisions that relate to the key issues and concerns identified in Chapter 1, Purpose and Need for Action. Some impacts are expressed in qualitative terms (e.g. wildlife habitat, scenic resources), others in quantitative terms (e.g. timber salvage, economic).

Effects descriptions under each resource area are divided into the following categories:

- Effects of the no-action alternative
- Effects unique to each action alternative

Effects and Commitments are defined as follows:

- **Effects** – adverse and beneficial direct effects:
    - which occur at the same time and in the same general location as the activity causing the effects.

  And, if applicable, adverse and beneficial indirect effects:
    - which occur at a different time or different location than the activity to which the effects are related.
- **Cumulative Effects**– effects, which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.
- **Irreversible Commitments** – commitments that cannot be reversed, except in perhaps the extreme long-term. A consolidated list of project Irreversible Commitments are contained in section 3.24.3.
- **Irretrievable Commitments** – commitments that are lost for a period of time. A consolidated list of project Irretrievable Commitments are contained in section 3.24.3.

Measures to mitigate or reduce adverse effects caused by the implementation of any of the actions proposed are addressed in Chapter 2, Section 2.5 Project Design Elements. Effective mitigation avoids, minimizes, rectifies, reduces, or compensates for potential impacts. After mitigation is applied, any unavoidable adverse impacts to each resource area are addressed (refer to Section 3.24.2 Other Effects – Unavoidable Adverse Effects).

The temporal and spatial scale of the analysis is variable depending upon the resource concern being evaluated, particularly for cumulative impacts of the proposed action and the impacts of past, present and reasonably foreseeable future actions. The portion of the Link and B&B Complex fires that burned area on the Deschutes National Forest is the focus of this environmental impact statement, though all of the fire area and adjacent lands are considered in the analysis process. The effects on resources included in and adjacent to the Metolius watershed have been considered and included in the project analysis; however, proposed actions within this DEIS would only occur within the boundaries of the 2003 Link and B&B fires.

3.2 Physical Setting

Landscape and Geology

The B&B Fire area covers approximately 94,000 acres on gentle to moderately steep topography with elevations ranging from just over 7,841 feet at the summit of Three Fingered Jack to 2,600 feet along the Metolius river. Slope aspects within the fire area are generally easterly with north and south facing valley slopes along the mid and upper elevations of the west to east oriented Metolius river tributaries. Physiographic areas identified in the Soil Resource Inventory (SRI) for the Deschutes National Forest (Larsen 1976) include the High Flanks and Low Flanks of the Cascades. The High Flanks physiographic area is classified at the landscape level as a landtype of stratovolcanoes that have been deeply eroded by glacial activity, and includes other glacial landforms such as moraines and kettle lakes. The Low Flanks physiographic area covers primarily the mid and lower elevations of the Metolius Basin and is classified at the landscape level as a landtype with gentle slopes on lava fields and glacial outwash dotted with cinder cones.
Primary surficial geologic features within the project area include glacially scoured valleys, lateral and end moraines and a variety of lava flows and cinder cones. Glacial till or outwash from a number of glacial episodes underlies a surface mantle of airfall ash throughout the area. Debris flows have historically released at the subsurface interface of consolidated and unconsolidated glacial tills on steeper slopes located along glacially scoured valley walls. This mechanism is isolated to a relatively small area of the Metolius watershed and not nearly as extensive as those found within more dissected drainages located on the western slopes of the Cascades. The Metolius Watershed Analysis Update identified past debris flows and includes a risk rating of debris flow prone areas across the landscape (Metolius Update, 2004).

The B&B Fire Recovery Project area lies in the Upper Metolius Watershed (HUC 1707030109; total acres: 140,812) within the Upper Deschutes Sub-Basin. The B &B project is within the Sisters Ranger District on the Deschutes National Forest and includes portions of nine subwatersheds (Table 3.1;Map 3.3). The B&B Fire which started on August 19, 2003, and burned approximately 92,000 acres affected some portions of all these subwatersheds. Approximately 50% or more of each subwatershed in the project area, except the Headwaters of the Metolius River subwatershed (includes the upper 10 miles of the Metolius River), was burned by the B&B Fire Complex and Link Fire in the summer of 2003.

Table 3. 1 Area of Subwatersheds (SWS) within the B&B Fire Recovery Analysis Area.

SWS Name (6th Field)	SWS HUC #	SWS Acres	Acres in Project Area Boundary	Percent of SWS burned
Abbot Creek	170703010909	6391	6332	100
Cache Creek	170703010902	11867	362	47
Candle Creek	170703010910	10957	1259	65
Canyon Creek	170703010908	21068	12505	92
First Creek	170703010906	13177	4588	70
Headwaters Metolius R.	170703010905	15501	1160	6
Jack Creek	170703010907	9207	6608	88
Lower Lake Creek	170703010904	10965	6723	64
Upper Lake Creek	170703010903	11136	2460	60
B&B Project WQ analysis area		109969	41997	64

Total of Upper and Lower Metolius 5th field Watersheds	17070301	286308	42143	35

Climate
Much of the precipitation occurs from November to March as large moist air masses accumulate over the Pacific Ocean and move west to east over Oregon, crossing the coast mountain range and the higher Cascade Mountain range before reaching the analysis area. As much as 100 inches a year can fall on the crest of the Cascades as clouds reach their highest elevation. Precipitation rates drop drastically from the crest of the Cascades east into the analysis area and range from 55 inches at the upper project elevations near Round Lake to 20 inches at lower elevations near the 1200 road. Elevations in the analysis area range from approximately 3,000 feet above mean sea level to 5,000 ft. Wet season precipitation falling above 3,500 feet generally accumulates as snowpack that melts off during the spring and early summer months.

Other, less frequent weather patterns are warm air masses in the winter and summer convective storms. Warm "pine apple express" weather systems directed from the central Pacific can produce heavy rainfall for extended periods and produce rain-on-snow events. Summer thunder storms can also produce large amounts of rain but in a short time period. These convective storms are fast moving with average rainfall intensity of 0.5 in/hr for a 2 year-30 min storm. Although both of these events contribute a small percentage of total annual rainfall, their relatively short duration, high intensity rainfalls are important sediment moving mechanisms within the B&B project subwatersheds.

The largest storm in the B&B project area since the fire occurred on August 22, 2004, almost a year after the fire. The summer convective storm resulted between 0.55 inches at Colgate RAWS station and 0.79 inches at the Metolius Arm RAWS station over a 45 min period. Although this was somewhere between a 2 and 25–year, 30 min event, no significant overland flow or rilling was observed in the project area. In fact, only a few short rills (< 20 ft long) were observed in First Creek subwatershed.

3.3 Present, Past and Reasonably Foreseeable Future Actions

The B&B Fire Recovery Project is one of several projects planned or ongoing within the Link and B&B fire areas. Post-fire recovery has become a large part of land stewardship on the Deschutes National Forest in recent years. Immediate and short term activities focus on stabilizing soil, protecting water quality and other special resources, and ensuring public safety in and around wildfire areas. The long-term focus is on ensuring healthy rehabilitation of ecological function, habitat and biological diversity of these areas. Other projects designed to foster the rehabilitation of resources affected by the fires are in various stages of planning or implementation. The effects of all of these projects are disclosed in Chapter 3. The following list of projects includes those projects that are in the planning process or have been wholly or partially implemented for the Link and B&B Complex fire areas.

Fire Suppression Rehabilitation

These actions were completed as part of the fire suppression restoration effort for the Link and B&B fires. The objective is to repair and rehabilitate impacts to resources caused by suppression activities. The following actions have been completed on the Deschutes National Forest as a result of this effort:

- Water barring, ripping, leveling and recontouring of dozer line: 76.8 miles
- Water barring and restoring drainage to hand line: 8.9 miles
- Closing, recontouring and rehabilitating safety zones and drop points: 32 acres
- Sale of suppression related (safety zones, fire line) down timber from decks: 250 mbf

Lower Jack and Coil Fiber Timber Sales

These green tree sales were in process when the B&B Complex fire ignited and halted operations, several units were burned as a result of the fire and a contract modification was completed to allow salvage of these acres under the original contract. These projects were addressed in a separate NEPA processes – the Jack Canyon Environmental Assessment and Santiam LSR Restoration Environmental Assessment respectively. The area and volume salvaged under the contract modification totaled 348 acres and 2,200 mbf (168 acres and 1,700 mbf for Lower Jack and 180 acres and 500 mbf for Coil Fiber).

Danger tree Treatments

During suppression efforts danger trees were felled in association with staging areas, safety zones and fire line. After the fire approximately 120 miles of primary roads have been treated for danger tree removal within the B&B Complex fire area to provide increased safer public and administrative access within the burned areas.

Burned Area Emergency Rehabilitation (BAER)

Numerous actions were identified as part of the BAER process. Following an analysis by resource specialists these actions were identified as being emergency actions needed to reduce fire and suppression effects to water quality and to protect soils from soil erosion. Actions were also identified to prevent the spread of noxious weeds and to improve public safety.

Road Treatments: Most of the critical BAER work has been completed – 12 culverts replaced, road drainage improved (70 water bars, 30 drain dips, 7 rock fords), and 7 large culvert replacements. Undersized road culverts have been replaced with open bottom culverts or bridges to increase capacity to handle water and debris flows. These new structures are also fish friendly with more natural stream bottoms. They also protect roads from washouts which can fill streams with sediment.

Noxious Weed Treatments: Manual, mechanical and seeding control treatments along 30 miles of system roads, trails, campgrounds and administrative sites within the burned area have been completed.

Riparian Rehabilitation: Cottonwood stands in the headwaters of drainages such as First Creek have been fenced to promote reestablishment of woody riparian species and to protect the areas from elk grazing. Approximately 85 acres of riparian areas have been replanted to reestablish streamside forests. Five fences in the headwaters of First, Abbott and Brush Creeks have been erected to protect riparian areas.

Recreation Hazards and Trail Work: Hazard signing has been installed at many popular sites and the fire area has been closed to cross-country or off-road travel to protect soils and prevent noxious weed spread. A public safety road closure system has also been established to protect the public from the potential hazard of fire damaged and unstable trees.

Reforestation: Some reforestation (tree planting) work has been completed in several areas where seeds sources are lacking such as plantations and some riparian areas.

Management activity within the Metolius watershed and the Sisters Ranger District has been occurring for several decades. The following tables (Table 3.2 and 3.3) describe management activities that have occurred in or nearby the B&B Fire Recovery Project Area. Table 3.3 provides an exhaustive list of all the past projects on the Sisters Ranger District which have been reviewed for Heritage resource concerns. These projects are considered when addressing the existing condition and cumulative effects for various resources as they apply through the environmental consequences described in the remaining portions of Chapter 3.

Table 3. 2 Recent past projects and natural events in the B&B project area, water quality analysis area, and Metolius 5th field watersheds.

Past activities in Upper and Lower Metolius 5th field Watersheds	**Acres in B&B project boundary**	**Acres in B&B Water Quality Analysis boundary**	**Acres in Upper and Lower Metolius 5th field Watersheds**
B&B Fire and suppression activities	40,916	70,008	70,775
B&B BAER – replace or remove culverts	21 culverts	21 culverts	21 culverts
B&B BAER – road drainage improvements	35 mi	35 mi	35 mi
B&B BAER – trail drainage improvements	33 mi	33 mi	33 mi
B&B Post Fire Riparian Planting	108	108	108
B&B roadside hazard tree	2,933	3,845	3,847
Big Bear	0	0	695
Brush Creek Channel Restoration Phase I	0.5 miles of channel	0.5 miles of channel	0.5 miles of channel
Bull Trout Streamside Protection Project (road closures)	2.95 mi	5.69 mi	5.69 mi
Bureau of Land Management - activities	0	0	0
Cache Mountain Fire and suppression activities	0	2,816	3,016
Coil Fiber Timber Sale/Salvage	327	630	630
Confederate Tribes of the Warm Springs Reservation activities *	0	0	7,000 – 10,000
Corridor Follow up	314	637	637
Crooked River Grasslands – cattle grazing	0	0	1529
Crooked River Grasslands – juniper thinning (hand-felling)	0	0	1000
Davis Creek Thin	199	199	199
Demo	0	0	103
Eyerly Fire and suppression activities	0	0	23,134
Eyerly BAER – culvert replacements and cleaning	0	0	16 culverts
Eyerly BAER – planting of conifers, aspen and shrubs	0	0	8000 plants
Eyerly BAER – road drainage improvement	0	0	25 mi
Eyerly BAER - seeding, contour felling, log erosion barriers, channel buffer felling	0	0	2500
Eyerly post-fire reforestation and riparian planting (12 ac)	0	0	800
Fuels Treatments	1,212	2,106	2,179
Happy Jack Timber Sale	103	103	103

Past activities in Upper and Lower Metolius 5th field Watersheds	Acres in B&B project boundary	Acres in B&B Water Quality Analysis boundary	Acres in Upper and Lower Metolius 5th field Watersheds
Jack Canyon Timber Sale	731	731	731
Link Fire and suppression activities	557	3,605	3,605
Lower Jack Reoffer Timber Sale/Salvage	737	737	737
North Slope Timber Sale	4	4	4
Other Fires and suppression activities	0	397	2,466
Private Land activity**	660	1160	1160
Road decommissioning	30 mi	33 mi	33 mi
Santiam Corridor Vegetation Management Project	964	1,128	1,128

* Estimated based on photo interpretation, professional knowledge, and a report by Riehle and Brun (1997).
** Estimate based on photo interpretation and professional knowledge

Table 3.3 - Previous Heritage Surveys in the Project Area

Project Title	Year
Wagon Road Timber Sale	1979
Big Bear, Potatoe, and Nine Timber Sale	1981
Upper Canyon Timber Sale	1981
Precommercial Thinning at Round Lake	1981
Rafter Timber Sale	1981
Cold Springs Timber Sale	1983
Little Buck Timber Sale	1984
Scout Timber Sale	1984
North Roaring and Abbot Spring Timber Sales	1985
Scout Lake Restroom Relocation Testing	1985
Brush Commercial Thinning	1986
Bear Valley Timber Sale	1986
Wizard Timber Sale	1986
Highway 20 Relocation	1987
Round Timber Sale	1987
Jack Canyon Timber Sale	1986
Upper Jack Timber Sale	1986
Roaring Creek Fish Habitat Improvement	1987
Wizard Timber Sale Addendum	1988
Jack Canyon Addendum	1988
Key West Timber Sale	1990
Arch. Test Excavations at Jack Canyon Site #1	1990
National Guard Projects 1990	1990
Suttle Timber Salvage Sale	1990
Long Ridge Timber Salvage Sale	1991
Third Base Timber Sale	1990
Upper Canyon Salvage Sale	1990
Suttle Lake Resort Well Installation	1991

Project Title	Year
Suttle Lake Underpass Project	1991
Canyon Creek Trail Relocation	1991
North Slope Timber Sale	1991
Two Springs Tie Trail	1991
Bear Valley Minto Lake Trail	1991
1988 Restroom Vault Replacement	1991
Route 1 Road Hazard Salvage 1989	1989
Metolius Mountain Bike Trail	1992
Archaeological Testing at Suttle Lake Methodist Camp Site (35JE278)	1990
Link Creek Bridge Reconstruction	1991
Link Creek Bridge Logs	1991
Gateway Hazard Trees	1992
Davis Creek Thinning	1992
Forest Health Demonstration Project	1992
Suttle Lake Hazard Tree Removal	1992
Suttle Lake Resort	1992
Blue Lake Nodic Ski and Horse Trail	1992
Cold Bear Timber Sale	1993
Suttle Lake Integrated Resource Analysis	1993
Roaring/Abbot Watershed Improvement	1993
Suttle Start Projects	1993
Metolius Wild and Scenic River Sample Survey	1993
Round Timber Sale Road Closures	1993
Suttle Lake/Lake Creek Watershed Restore	1994
Head of Jack Creek Aquatic Restoration	1996
Jack Canyon Integrated Projects	1996
Santiam Corridor Salvage	1996
Suttle Lake Resort Septic	1996
Santiam LSR Restoration	1997
Route 1 Hazard Tree Treatment 1997	1998
Suttle Lake Resort Development Plan	1998
Canyon Creek Crossing	2001
Abbot Creek Campground Hazard Trees	2001
Camp Tamarack 2001 Hazard Trees	2001
CEC Suttle Lake Regulators Vault	2001
Metolius Vegetation Management	2003
2002 Toilet Replacements	2002
CECI Powerline Relocation	2001
Camp Tamarack Improvements, 2001	2001
Santiam Jct. – Jack Lake Road US Hwy 20	2001
Hazard Tree Treatment 2002 for Rec and Special use	2002
Camp Tamarack Drain Field	2002
Bull Trout Streamside Protection Project	2003
Qwest Phone Line at Lake Creek	2004
CECI Junction Boxes	2004
North Santiam Bridges Project	2003

The following tables and map (Tables 3.4 and 3.5 and Maps 3.1 and 3.2) describe recent past or future foreseeable management activity within the B&B Fire Recovery Project and surrounding areas as they relate to environmental effects for this project. Where the extent of these actions is predictable or known approximate values are displayed where the foreseeable extent of management activity is unpredictable these values are descriped as Unknown (such as future fire suppression – while the area has had significant fire suppression activities in recent years, historic analysis reveals extended periods of little or no extensive fire activity (USDA 2004c), any quantitative measure would be purley speculative).

Table 3.4 Future foreseeable projects in the B&B project area, analysis area, and in the Metolius 5th field watersheds.

Future Foreseeable Projects in the Upper and Lower Metolius 5th field Watersheds	**Acres in B&B project boundary**	**Acres in B&B analysis boundary**	**Acres in Upper and Lower Metolius 5th field Watersheds**
B&B Post Fire Riparian Planting - 2005	200	200	200
Brush Creek Channel Restoration Phase II	1.0 miles of channel	1.0 miles of channel	1.0 miles of channel
Bull Trout Streamside Protection Project (cont.)	2.39 mi	2.39 mi	2.44 mi
Eyerly Fire Salvage	0	0	4,877
McCache Vegetation Management project	1	1,063	2,400
Metolius Basin Road Decommissioning	0	60 mi	60 miles
Metolius Basin Vegetation Management Project	762	12,050	12,050
Fuels reduction based on the fuels strategy and owl strategy	Unknown	Unknown	Unknown
Future Fire Suppression Activities	Unknown	Unknown	Unknown
Future Insect and Disease Outbreaks	Unknown	Unknown	Unknown

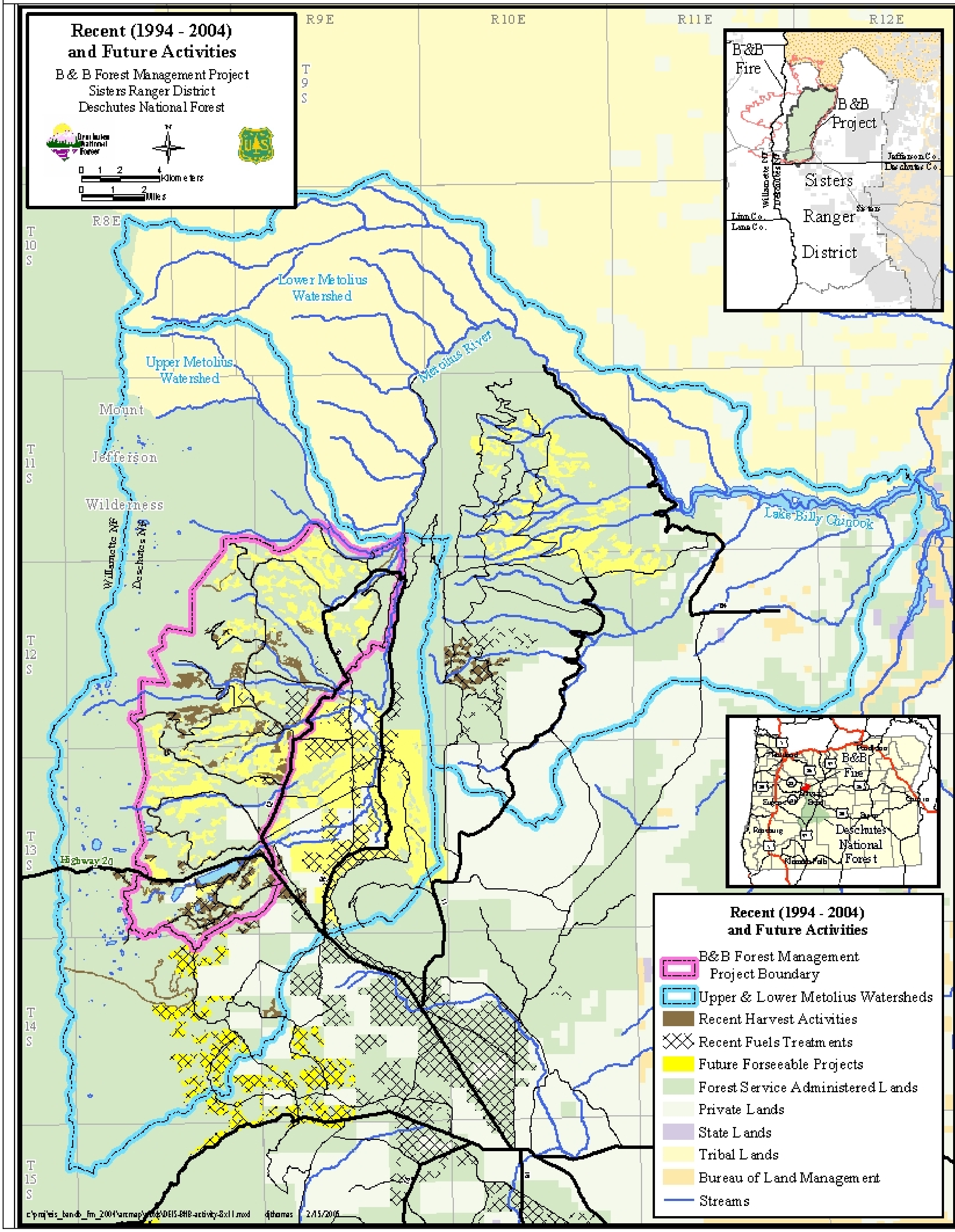
Table 3.5. Past, present, and future foreseeable projects and recent natural events in the subwatersheds of the B&B analysis area.

Past, Present, and Future Foreseeable Projects	**ABBOT CREEK**	**CACHE CREEK**	**CANDLE CREEK**	**CANYON CREEK**	**FIRST CREEK**	**HEADWATERS METOLIUS RIVER**	**JACK CREEK**	**LOWER LAKE CREEK**	**UPPER LAKE CREEK**	**Total acres in B&B Analysis Area**
B&B Fire and suppression activities	6,357	254	7,021	19,179	9,059	764	8,020	6,363	5,021	62,039
B&B BAER – replace or remove culverts										21 culverts
B&B BAER – road drainage improvements										35 mi
B&B BAER – trail drainage improvements										33 mi
B&B Fire Recovery Project	1982	13	316	910	1131	134	1430	673	212	6803
B&B Post Fire Riparian Planting	36		36	36						108
B&B roadside hazard tree	367	526	94	671	373	76	485	798	452	3,841
Brush Creek Channel Restoration Phase I&II				1.5 mi						1.5 mi
Bull Trout Streamside Protection Project	0.64 mi		0.83 mi	3.25 mi			1.36 mi	2.0 mi		8.1 mi
Cache Mountain Fire and suppression activities		2,816						1		2,816
Coil Fiber Timber Sale/Salvage		2			93			535		630
Corridor Follow up		101						235	301	637
Davis Creek Thin					142		57			199
Fuels Treatments		187		357	148	221	295	898		2,106
Happy Jack Timber Sale				103						103
Jack Canyon Timber Sale				228			503			731
Link Fire and suppression activities		1,648						494	1,462	3,605
Lower Jack Reoffer Timber Sale/Salvage	37			446	6		248			737
McCache Vegetation Management project		1,063						0		1,063
Metolius Basin Vegetation Management Project		934		2	3,033	5,457	1,087	1,538		12,050
North Slope Timber Sale								4		4

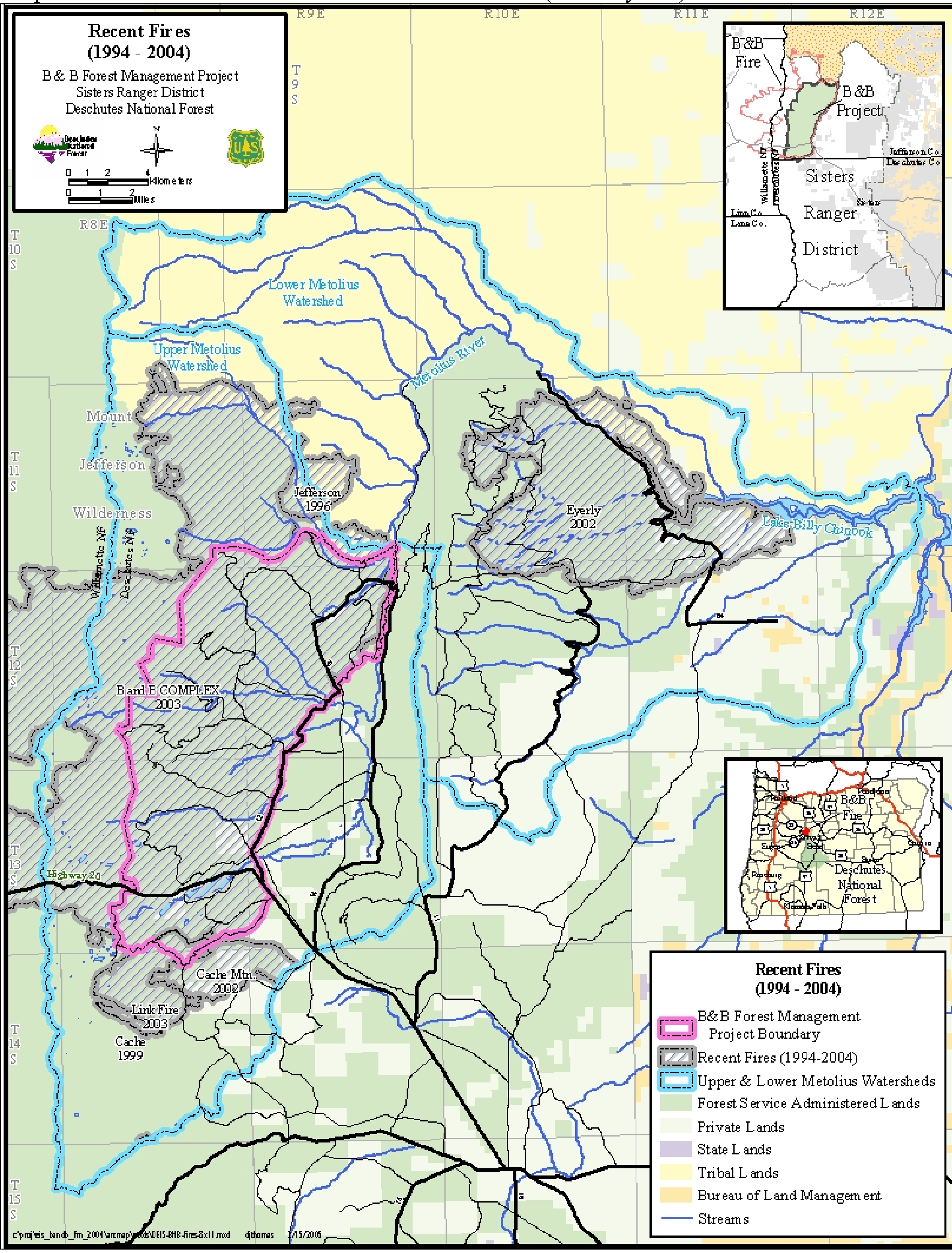
Past, Present, and Future Foreseeable Projects	**ABBOT CREEK**	**CACHE CREEK**	**CANDLE CREEK**	**CANYON CREEK**	**FIRST CREEK**	**HEADWATERS METOLIUS RIVER**	**JACK CREEK**	**LOWER LAKE CREEK**	**UPPER LAKE CREEK**	**Total acres in B&B Analysis Area**
Other Fires and suppression activities		397								397
Private Land timber activities**	100	500			400				160	1160
Road decommissioning	10.4 mi			7.4 mi	5.4 mi	1.3 mi	6.4 mi	2.2 mi		33.1 mi
Santiam Corridor Vegetation Management		141						580	407	1,128
Total Treatment Acres	**2,486**	**2,404**	**410**	**2,717**	**5,326**	**5,888**	**4,104**	**5,261**	**1,371**	**29,967**

** Estimate based on photo interpretation and professional knowledge

Map 3.1 Metolius 5th field watersheds and all recent (last 10 years) past, present and future foreseeable activities.



Map 3.2 Metolius 5th field watersheds and all recent (last 10 years) fires



3.4 Soils Resource

Introduction

Soils

The soil resource has been previously analyzed at the 5th field Metolius watershed scale within the project area under the Metolius Watershed Analysis (Metolius WA) and the Metolius WA Update (WA Update) (USDA, 1996b; USDA, 2004c). These documents include broad scale summaries of the inherent and soil quality of the soil resource across the watershed and the existing condition as a result of impacts incurred by management activities. The WA Update amended the existing condition class layer of the soil resource as a result of the multiple fires and other management activities that have occurred since 1996. Other analysis of the soil resource within the Metolius 5th field watershed has been done under the Santiam Restoration, Jack Canyon, Big Bear and McCache Environmental Assessments and the Metolius Basin Environmental Impact Statement. These projects included analysis of activity units within the Upper and Lower Lake, Jack Creek, First Creek, and Canyon Creek 6th field subwatersheds.

Soil types within the project area are primarily comprised of a moderately deep to deep mantle of airfall ash from Sand Mountain, overlain in some areas by a moderately deep layer of ashy cinders from a vent near Blue Lake. A thin layer of rhyolitic ash from Mt. Mazama lies underneath these two substrates in some areas of the basin (Deschutes Soil Resource Inventory (SRI) (Larsen 1976) and the Soil Survey of the Upper Deschutes River Area (NRCS 2000). Both of these air-fall parent materials are relatively coarse textured and undeveloped due to their young ages. The Sand Mountain ash is approximately 3,000 years old with surface and subsurface textures of loamy sands and sandy loams. The Blue lake cinders are approximately 1,500 years old, coarse textured and classified as cindery sands.

Representative profiles of these soil types include surface mineral A horizons generally less than 2 inches thick with a pH ranging from 6.2 to 6.8. An A/C horizon between 10 to 20 inches in thickness is underlain by C horizon material varying in thickness from 20 to 40 inches before glacial till, outwash or bedrock is reached. Soil moisture regimes are Xeric in the lower elevations of the basin and Ustic in the higher elevations. Soil temperature regimes are primarily cryic west of road 12 (approximately 3,300 ft) and frigid in the lower elevations of the basin to the east.

Sensitive soils

Soil Resource Inventory (SRI) map unit descriptions are used to identify sensitive soils under criteria listed in the Deschutes National Forest Land and Resource Management Plan (LRMP), Appendix 14, Objective 5. Areas with sensitive soils have management limitations associated with physical or hydrologic characteristics that need to be addressed during the planning of vegetation management activities. Limitations can include restricted periods and/or types of operations in order to prevent or minimize impacts to the soil resource. Soils identified as sensitive within the B&B Fire Recovery Project Area include:

- **Poorly to somewhat poorly drained soils with a seasonal water table at or near the soil surface**. Soils with seasonal or perched water tables (SRI unit 30 and 40; NRCS Wizard series) are primarily found in the mid elevations of the Metolius basin and are often dissected by ephemeral drainages. Seasonal water tables associated with stream channels are mapped as bottomland (SRI unit 8) and are generally included within riparian reserve boundaries.

- **Soils located on slopes exceeding 30 percent that have moderate to high displacement hazard ratings and also have a moderate to high risk of debris flows.** Soils with a moderate to high susceptibility to displacement (SRI units 21 and 22) have slopes exceeding 30 percent that are also at risk for debris flows. The loss of organic surface cover as a result of the fire has elevated the risk of displacement in the short-term. The risk of debris flows on these areas will be elevated during a period between 5 and 20 years following the fire as the root structure of coniferous trees deteriorates.

Environmental Consequences

Scale of Analysis and Types of Effects

The analysis area for determining the effects of the B&B Fire Recovery Project on the soil resource includes the entire project area boundary but is specific to the individual activity unit boundaries when addressing direct, indirect and cumulative effects to the physical, chemical and biological components of the soil resource. **Direct effects** to the soil resource are primarily related to alterations of the physical component of the soil through compaction or displacement by machines utilized for harvest and yarding operations. Direct effects can also include burn damage as a result of pile burning or the removal/combustion of biomass from the site, and the physical disturbance of effective ground cover. Puddling is not identified as a direct effect in the non-cohesive soils present within the project area. **Indirect effects** include changes in the biotic and chemical components integral to soil productivity as a result of physical alterations to the soil resource, changes to the chemical component of the soil resource from the physical removal or treatment of vegetative material during harvest and fuels treatment activities, or erosion of mineral soil due to the reduction of effective cover. **Cumulative effects** are primarily a result of proposed activities occurring directly within areas where previous activities have incurred varying degrees of disturbance and detrimental impacts to the soil resource. They can also be the result of multiple entries needed to harvest, yard and treat activity fuels or additional fuels identified as special forest products under this project.

Detrimental Soil Disturbance

Impacts to the soil resource are considered to be detrimental if they exceed Standards and Guidelines defined in a Regional Supplement to the Forest Service Manual direction for the soil resource (FSM 2500, R6 Supplement 2500-98-1). Soil quality standards under this direction apply to conditions such as compaction, displacement, puddling, burn damage and surface erosion. Puddling is not identified as a concern in the non-cohesive soils present within the project area. Soil quality guidelines included in the supplement describe threshold values for each of these components to be considered detrimental and also address organic matter and moisture regimes related to the soil types on site. Forest Plan Standard and Guidelines require that proposed management activities minimize detrimental disturbance to the soil resource to less than 20 percent of an activity unit area in order to maintain conditions conducive to processes that comprise soil productivity.

Proposed Activity Unit Field Measurements and Observations

Field measurements and observations of existing soil conditions within activity areas proposed for management under this project were conducted during the fall field season of 2004. Measurements include transect point intersects to determine the aerial extent of detrimental compaction and displacement, visual estimates of cover provided by herbaceous re-growth and needle-fall following the fire, and visual estimates of coarse woody debris currently on the soil surface. Detrimental burn damage was also visually assessed at transect points where conditions were still reflective of these characteristics. Table 3.6 is a summary of detrimental disturbance within proposed activity units for the Action Alternatives. Specific unit conditions are summarized in Appendix B.

Table 3.6 Existing Detrimental Disturbance within Proposed Activity Units

% of Activity Area* Detr. Disturbed	0 to 9%	10 to 15%	15 to 20%	>20%
Alt 2 units** (% of total)	88 (62%)	49 (35%)	4 (3%)	0
Alt. 3 units (% of total)	49 (59%)	31 (37%)	3 (4%)	0
Alt. 4 units (% of total)	24 (49%)	22 (45%)	3 (6%)	0
Alt. 5 units (% of total)	48 (59%)	30 (37%)	3 (4%)	0

* Percentage ranges are the aerial extent of activity area considered detrimentally disturbed from compaction, displacement or burn damage.
** Number of units with percent of total units in parenthesis

The extent of detrimental conditions within proposed activity units is moderate to low and currently meets the Regional 20 percent Standard for maintaining soil productivity. Many of the prescriptions implemented in previous entries within proposed activity units were selection cuts that removed relatively few trees per acre and created relatively haphazard machine trails that currently cover between 5 and 10 percent of these unit areas. Some units have had subsequent commercial thinning prescriptions that have incurred detrimental disturbance on an additional acreage within the unit area, pushing detrimental levels to between 10 and 20 percent. Areas with single entry, commercial thinning prescriptions also have relatively low levels of detrimental impact, generally observed to be between 5 to 10 percent of the area.

Suitability

The Deschutes Forest Plan suitable lands database was developed to designate a planning level timber base area at a very broad scale using criteria affecting reforestation to identify areas considered to be suited for timber production (FSH 2409.13). Lands that do not meet these criteria are considered unsuitable or partially suitable for timber harvest due to regeneration difficulties or the potential for irreversible damage from management activities. Planning at the project level requires that lands proposed for harvest have their suitability verified based on the criteria outlined within the handbook (FSH 1909.12). The suitability layer identifies all acres within the B&B Project area as suited for commercial timber production, however, the SRI identifies approximately 139 acres as barren lava flows and 939 acres with very low productivity (FSH 2409.13; FSH 1909.12).

Measurements of Effects Analysis

The environmental consequences of the alternatives are described as effects to the physical, chemical and biological components of the soil resource. Direct effects to the physical component of the soil primarily occur as compaction and displacement incurred by machinery traffic on mineral soil surfaces to harvest, yard or haul salvage material. Compaction and displacement from activities proposed under this EIS are quantified as an aerial extent within an activity area and added to levels documented from past harvest activities and fire suppression operations in order to determine compliance with LRMP Standards.

Direct effects to the chemical and biological components of the soil resource are primarily a result of the manipulation, removal or burning of organic matter on site, but can also be directly or indirectly affected by physical disturbance incurred by management activities. Effects to these components are primarily tracked by describing changes in the composition and quantity of live and dead organic matter on site and predicting levels of detrimental disturbance within activity units.

Existing Condition

Pre-fire Management Activities

The Metolius WA and WA Update summarized past management activities and their associated impacts to the soil resource using records compiled in a GIS Activities Database layer. Soil condition classes A, B, C and D reflect various levels of impacts from past management at the broad watershed scale and were summarized within the primary subwatersheds of the project area (USDA, 2004a). The majority of areas in which past harvest activities occurred prior to the current Forest Plan had high levels of detrimental disturbance (identified as condition class C and D) reflective of intensive harvest prescriptions. Detrimental compaction in these areas was not subsoiled during this period and total detrimental disturbance levels are not reflective of ineffective implementation of this practice. Detrimental soil disturbance measured in past activity areas on the Sisters District and the Deschutes National Forest generally range from 10 to 40 percent, depending on harvest prescriptions, and the number of entries within a given unit area (Deschutes Soil Monitoring Reports, 1993-2001).

Resource trend tables included in the Metolius WA identified the possibility of lowered soil quality in areas where past activities had incurred detrimental soil compaction. Approximately 23 percent of the land base within the 5th field Metolius watershed was identified as having had some change to the quality of the soil resource as a result of past management activities (USDA, 1996a). The summary of soil conditions in the Metolius WA Update includes estimates of the acres of detrimental soil within the 6th field subwatersheds based on monitoring of soil disturbance levels over the past fifteen years for various harvest prescriptions. Existing acres of detrimentally disturbed soil estimated at this broad scale range from 1 to 21 percent of the subwatershed areas within the B&B Fire Recovery analysis area.

Fire Suppression and Rehabilitation Operations

The construction of safety zones, dozer lines and hand lines during fire suppression activities has created detrimental post-fire soil conditions in the form of compaction and displacement within portions of the fire area. Table 3.7 summarizes miles of Dozer and Handline constructed during the B&B and Link fires. Approximately 31.4 miles of dozer line were constructed over previously un-impacted ground, equating to approximately 95 acres of new impact. An additional 35.9 miles of existing roads were widened by dozers and other equipment to create fire lines, equating to an additional 87 acres of impact.[3] An additional 21.9 and 10.2 acres of ground, respectively, were cleared with dozers in the B&B and Link fires to create safety zones for suppression crews. Portions of these zones were created on areas of previously disturbed by past management activities.

[3] Dozer lines varied in width from 10 to 40 feet. An average width of 25 feet for new dozer lines and an average additional width to current road surfaces of 20 feet were used for these acreage calculations.

Dozer lines were observed to have variable conditions of displacement and compaction along their extent, generally averaging detrimental conditions from machine operations on 50% of their surface area. Safety zones were detrimentally impacted to a slightly greater extent. Rehabilitation of all these areas included selectively located water bars and the replacement of coarse woody material to dissipate overland flow energy. Rehabilitation did not include actions to alleviate any compacted conditions. Approximately 7 miles of hand lines averaging 18 to 24 inches in width were constructed during suppression efforts, equating to less than 1.7 acres. Hand lines had water bars installed during suppression rehabilitation operations, with variable amounts of re-contouring or replacement of surface organics.

Table 3.7 Miles of Dozer and Handline for B&B and Link fires

B&B Fire	Dozer Line		Hand line	Total	Link	Dozer Line	Hand line	Total
	Other	Road			Other	Road		
Deschutes	31.4	35.9	7.0	74.3	7.1	2.4	1.9	11.4
Willamette[1]	15.2	.5	2.6	18.3	0	0	0	0
CTWS[2]	16.0	2.6	*	18.6	0	0	0	0
Private	.3	4.8	0	5.1	1.6	.2	.3	2.1
	62.9	43.8	0	106.7	8.7	2.6	2.2	13.5

1-No GPS files were available in the Incident data to reflect the complete set of handlines in Jefferson wilderness area on the Willamette NF side.
2-Fireline on Consolidated Tribes of Warm Springs land not attributed between dozer and handline.

Retardant Drops

A total of 110 loads of retardant were dropped from airtankers within the fire perimeter during the fire period of mid August to early September, 2004 (Redmond Air Center records and VanCurler, personal communication). These drops were comprised of 1 load or 2,053 gallons of Fire-Trol LCG-R (Chemonics Industries), 105 loads or 248,883 gallons of Fire-Trol LCA-R, 1 load or 1,800 gallons of Fire-Trol GTS-R, 1 load or 2,578 gallons of Phos-Chek HV-R (Astaris), and 2 loads or 4,071 gallons of Phos-Chek D75-R. Recommended application rates of fire retardant are 1.5 liters/square meter, although actual drop concentrations vary greatly depending on fuel loads and weather conditions at the time of flight. Assuming no overlap of drops, a maximum of (110 loads)(1.48 acres/load[4]) or 162.8 acres of the project area were covered by retardant from airtanker drops.

Retardant transformations

Changes to the soil resource as a result of the application of fire retardant during the fire are expected to be minimal. Detailed discussion on retardant composition and transformations can be found in the soils specialist report (Sussmann, 2005). The actual amount of nutrient input into the soil system depends primarily on heat-initiated transformations of retardant components, subsequent volatilization of these transformation products, or unheated retardant contributions. Although the majority of the retardant would have been transformed by heat, a small amount could have avoided heat from the fire.

[4] An average of 2,358 gallons per load at the recommended application rate gives an average of 1.48 acres covered per airtanker load.

Unheated ammonium nitrogen could be converted to nitrates that can be leached down through the soil profile and into the groundwater. This mechanism is not likely to have contributed measurable amounts of nutrients to the water system since no well or surface water testing within the Metolius Basin since the fire has indicated elevated levels of nitrates (Cotter, 2004; Oregon Department of Human Services Website).

Inherent Soil Productivity

In general, soils within the B&B Fire Recovery Project Area have a high inherent productivity[5] due to their depth, moisture holding capacity and the lack of coarse fragments within the rooting zone. Although the productivity of these sites is enhanced by the annual precipitation throughout the area, it is offset to some degree by the relatively low organic matter content and young age of the ash and cindery material. Soil productivity classes for the soils within the B&B project area total approximately 30,229 acres of high (72%), 9,941 acres of moderate (24%), 479 of low (1%), and 939 acres of very low (2%) productivity. Approximately 139 acres (<1%) are classified as barren and are rocky lava flows located on the northern boundary of the project area.

Post-Fire Stand and Soil Conditions

The behavior of the B&B Complex fire varied from rapidly spreading crown fires to slower moving underburns resulting in a range of post-fire stand mortality and soil conditions[6] across the project area. The heating and consumptive characteristics of the fire were observed to vary within the same stand mortality class due to fire behavior, herbaceous composition and fuel loads. As a result, the mortality class and associated intensity do not always accurately describe the impacts of the fire to both the productivity and the hydrologic response of the soil resource.

In general, the effects of the fire on the soil productivity were negligible due to relatively short durations of elevated soil heating. The fire altered the chemical and biological components of the soil resource to varying degrees as a result of the direct combustion of organics and heat generated during the burn. The effects on hydrologic response were moderate to high in the short-term as a result of the loss of effective-ground cover capable of intercepting raindrop impacts and/or reducing overland flow energies. A relatively small area of the soil resource within the project area was also physically altered as a result of fire suppression activities. The rehabilitation of dozer lines and safety areas has occurred to offset some of these suppression impacts.

Soil Productivity

Areas with soil heating high enough to detrimentally limit or alter soil productivity are generally associated with the complete consumption of down wood or stumps where mineral soil color changes and below ground char are readily apparent. These conditions are limited to areas where long durations of elevated temperatures occurred at the soil surface or within the top 10 cm of mineral soil and meet the detrimental burn conditions outlined in Regional Standards and Guidelines (FSM-2500, R6 Supplement 2500-98-1). Transect observations throughout the B&B fire indicate that these characteristics averaged less than 2 percent of areas monitored and were not contiguous across the fire area. Herbaceous vegetative re-growth has been observed to varying degrees within these small areas and more extensively across all mortality classes mapped in the fire boundary.

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[5]Inherent productivity is based on the Cubic Foot Site Class (Mean Annual Increment in cubic feet/year) or the Site Index (Mean 100 year height) of primary tree species located on sites considered to be undisturbed or in low disturbance conditions. (Larsen, 1976)

[6] Stand mortality classes and post-fire soil conditions were summarized in Table 4 of the Vegetation section and Tables 3 and 4 of the Soils section, respectively, of the Metolius WA Update (USDA, 2004a). Stand mortality was compiled using field reconnaissance and satellite imagery and soil conditions are summarized in terms of the fire effects on soil productivity and hydrologic response.

Chemical and Biotic Components

Changes to on-site pools of the chemical and biological components of the soil resource are obvious within the above ground portions of the system but less apparent or not reasonably measured within the mineral soil portions of the system. Further discussion on pre and post-fire levels can be found in the soils specialist report (Sussmann, 2005). Components include:

1) **Below-ground nutrients:** the pool of nutrients contained within the mineral soil matrix and soil organic matter, primarily carbon and nitrogen. The extent of mineral soil discoloration and the depth of below ground charring following the fire were both observed to be relatively low in the majority of the fire area, indicating that temperatures within the soil profile were well below those capable of volatilizing significant amounts of nutrients. Although volatilization of nutrients likely occurred in areas where mineral soil discoloration was observed under down logs or old stumps, the poor conductance characteristics of soils derived from ash and cinders under low moisture conditions limited these effects where large fuels were not in direct contact with the ground. A post-fire flush of nitrogen documented by research (Clark 2001) has resulted in significant herbaceous re-growth throughout the different mortality areas within the fire.
2) **Soil biota:** bacterial and fungal microbial populations within the soil profile are susceptible to losses from heat pulses. Studies at the Awbrey Hall and Mt. Lassen fire sites showed minimal short and long-term effects on bacterial populations and only short-term declines in fungal populations following wildfire (Busse, personal communication). Losses of microbial and fungal populations from direct consumption or heat-induced mortality are likely to have occurred to some degree within the first five centimeters of the mineral soil where complete consumption of the forest floor litter and duff occurred. The post-fire soil environment is likely to have maintained a level and diversity of soil biota capable of utilizing dead organic matter as saprophytes and re-colonizing live root systems associated with vegetation re-sprouts or seedling germinations on site (Smith, personal communication).
3) **Above-ground nutrients:** primary nutrients such as carbon, nitrogen, phosphorus and sulfur contained in above ground organics and vegetation within the forest system. The largest and most quantifiable nutrient losses from the fire are those contained within the biomass of above ground vegetation, woody residues, litter and duff. Losses are calculated to be approximately 31 percent of total carbon (C) and 59 percent of above ground C, and 11 percent of total nitrogen (N) and 82 percent of above ground N on site. Fire losses at these consumption rates account for less than 1 percent total phosphorus (P) and less than 3 percent of total sulphur (S) on site. Measured and estimated losses or transformations of primary nutrients as a result of the fire, as well as post-fire inputs into the system are discussed under Long-term Site Productivity and summarized in Table 3.8 under the No-Action Alternative.

Hydrologic response (Erosion Susceptibility)

The effect of fire on the hydrologic response of the soil resource is directly related to changes of effective ground cover[7] values. The loss of surface litter and duff, down woody debris and herbaceous vegetation capable of impeding overland flows by providing rain drop interception and surface roughness were interpolated directly from the stand mortality layer.[8] The fire reduced effective

[7]Effective ground cover is defined as including all living or dead herbaceous or woody materials and rock fragments greater than three-fourths of an inch in diameter in contact with the ground surface. This includes tree or shrub seedlings, grass, forbs, litter, woody biomass, chips and so forth (Deschutes LRMP, Table 4-30, footnote 3).

[8] Stand replacement acres generally have complete consumption of the surface litter and duff, mixed mortality acres have variable consumption and the low mortality acres have very low consumption of this component. The variable consumption of 100 hr and 1,000 hr fuels and post-fire needlefall contributions to the soil surface in

ground cover in the short term and elevated erosion risks from wind and water mechanisms until cover values return to pre-fire conditions. The short-term loss of effective cover has quickly been reversed toward pre-fire levels by the re-growth of herbaceous vegetation.[9] The extent of germination and re-sprouting of herbaceous species after one full growing season varies throughout the fire but has been observed on all classes of burn severity identified within the fire area. Determinations of erosion rates or watershed susceptibility to erosion under immediate post-fire cover conditions are tempered by the increase of effective cover provided by herbaceous re-growth during the first two growing seasons following the fire.

Alternative 1 – No Action

Direct Effects

The No Action alternative would incur no direct effects in the form of additional compaction or displacement to the soil resource beyond current levels that exist following fire suppression operations and subsequent rehabilitation efforts. Existing levels of impact within activity areas proposed under the action alternatives were measured in the field during the fall of 2004 and are summarized in Appendix B.

All areas proposed for salvage activities under the action alternatives of this DEIS would remain in compliance with the LRMP Standard for maintaining soil productivity and would continue to support vegetation on site. Existing levels of impact within areas not proposed for activity under the action alternatives are more broadly summarized as condition classes A, B, C or D within the soils section of the Metolius WA Update (USDA, 2004a). Areas classified as condition class C or D may have reduced productivity over the course of time as a result of detrimental conditions incurred by past activities.

This alternative would result in the largest accumulation of coarse woody fuel loads over the next few decades on acres proposed for treatment under the action alternatives and may elevate the risk of further impacts from machinery involved in fire suppression efforts due to altered fire behavior of future fires burning through these loads.

Effective ground cover[10]

There would be no direct effects in the form of physical disturbance to effective ground cover under the No Action alternative. Fire intensity did not incur detrimental damage extensive enough to limit vegetative re-establishment and cover is already provided in some areas by litter fall from dead but unconsumed conifer needles and down wood recruitment. Effective ground cover provided by herbaceous vegetative re-growth since the fire has already been estimated at between 40 and 60 percent in some areas after only one growing season (Sussmann, 2004). Re-growth of herbaceous vegetation after two full growing seasons on drier sites in the watershed previously burned in another fire (Eyerly fire 2002) meets or exceeds these values on sites seeded with wheat and rye, and visually appears to exceed 40 percent on sites that were not seeded (Suna, 2004). These levels meet those recommended under the LRMP Standard SL-6 within some areas and would be expected to return to

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many of the mixed severity acres offset, to some degree, the loss of effective cover resulting from the consumption of surface litter and duff and herbaceous vegetation.

[9] Cover values of herbaceous vegetation measured in the project area during the summer of 2004 range from 10 to 70% (Stand Exam data, 2004). Values on the Eyerly fire of 2002 exceeded 50% on many areas after the first full growing season and up to 90% after two growing seasons (Suna, 2004). Initial growth rates on the B&B fire exceed this trend in many areas.

[10] Effective ground cover is defined as including all living or dead herbaceous or woody materials and rock fragments greater than three-fourths of an inch in diameter in contact with the ground surface. This includes tree or shrub seedlings, grass, forbs, litter, woody biomass, chips and so forth (Deschutes LRMP, Table 4-30, footnote 3)

or above these levels for all soil types over the next few years. This alternative would also generate the highest levels of effective cover provided by down wood in areas proposed for activity under the action alternatives.

Chemical and Biological Components

The No Action alternative would preclude the physical removal of any additional organic matter on site and would have minimal direct effects to the chemical and biotic components of the soil resource. These components would recover in the post-fire environment under conditions that exclude the physical disturbance of the mineral soil and biota by ground-based machinery. The risk of future disturbance from machinery used for fire suppression efforts, as well as the consumption of organics, soil heating and nutrient losses during future fires, could be elevated compared to the action alternatives in areas where significant loading of coarse woody debris occurred over the next few decades.

Carbon to Nitrogen ratios

The No Action alternative would be expected to have minimal direct effects to the C:N ratio of the mineral soil in the fire area. The soil C:N ratio would be expected to return to pre-fire levels within a few growing seasons as the system adjusts to the short-term alteration of rates of input to the soil for carbon and nitrogen. Re-growth of herbaceous vegetation would provide a photosynthesized source of carbon to the mineral soil from the utilization of nitrogen made available by the fire. Inputs of nitrogen and carbon would shift toward pre-fire rates and mechanisms as vegetative succession proceeds on these sites, with the input of carbon driven by the fixation of atmospheric nitrogen associated with ceanothus species after the post-fire nitrogen flush is complete. Although coarse woody debris levels on the surface would increase above-ground carbon levels located on the soil surface to very high levels after 20 to 40 years (Evans, 2004), effective C:N ratios in the majority of the mineral soil are unlikely to be altered to levels capable of diverting portions of microbial activity from nutrient cycling to the breakdown of lignin.

Soil Biota

The No Action alternative is likely to have no direct effects on the short-term recovery of soil biota, including fungal and bacterial species. The immediate recovery of microbial populations would likely be focused on species specific to inanimate hosts such as coarse woody debris and dead organic matter. The diversity and number of microbes are likely to increase as vegetative hosts return and provide live roots to colonize within the soil matrix. Long-term recovery or maintenance of this component could be directly influenced by the excessive levels of large woody debris that would accumulate over the next few decades, either by favoring species tied to lignin decomposition or from direct mortality due to excessive soil heating during a future fire event.

The return of ectomycorrhizae in the post-fire environment has been documented by a number of means, including spore releases from compact propagules of mycelium called sclerotia, mycelial growth from populations located far enough below the soil surface to resist combustion or heat pulses from a fire, and re-colonization as a result of mammal ingestion of truffle species off site and subsequent defecation within the fire perimeter (Molina and Smith, personal communication). The loss of live root hosts for conifer specific ectomycorrhizae species may initially reduce populations that cannot morph into a saprophytic stage and will tend to support species and life-cycle stages capable of obtaining nutrition from dead organic matter. The recovery of various ectomycorrhizal species and mycelial stages within the fire perimeter is expected to occur steadily as vegetative re-growth, especially conifer seedlings, begins to function as hosts for these fungi.

Other fungal populations are also likely to rebound in subsequent years following the fire. Morels returned within the project area during the spring of 2004 at variable levels throughout the Mixed Conifer and ponderosa pine PAGs. Morel life cycles appear to include both saprotrophic and mycorrhizal phases, both of which can produce the ascocarp fruiting bodies for which they are prized. Dead roots in the post-fire environment are conducive to the saprophytic form of morels, during which nutrition is obtained from dead organic matter (Dahlstrom, et al. 2000). Post-fire recovery is likely to occur from spores released in response to heat generated during the fire from compact pellets of mycelium called sclerotia that were not consumed by the fire (Smith, personal communication).

Surface Organics (litter and duff)

The No Action Alternative would have no direct effects on the recovery of surface organics (litter and duff). Areas where unconsumed needles on burned trees have fallen to the soil surface and formed a substantial litter layer would not be disturbed by machine traffic. Significant amounts of herbaceous annuals, perennials and shrubs, especially ceanothus species, have already returned to the fire area after one full growing season and would continue to grow and contribute litter fall without any additional physical disturbance. Future inputs of conifer needles will depend on the rate at which conifer seedlings are naturally regenerated on site. Conifer seeds produced the year of the fire had matured at the time of the burn and significant seedlings have been observed in many areas of the fire.

Although Forest Vegetation Simulator (FVS) runs predict high numbers of seedlings within white fir dominated stands, the rate at which conifer seedlings would grow and contribute organic litter in stand replacement areas is likely to be reduced to some degree when compared to the action alternatives. Naturally regenerated seedlings in mixed mortality and underburned areas are likely to be more densely spaced and slower to release than sites planted at greater spacing with bare root, 2-0 stock under the action alternatives. Despite a comparative delay in rates of litter production from conifers between this alternative and the action alternatives, soil functions such as moisture retention, microbial nutrient cycling, and surface stabilization would have sufficient inputs of organic carbon to the surface and mineral soil to maintain site productivity.

Indirect Effects

Erosion Risks

Erosion risks under the No Action alternative would not be indirectly affected by any additional soil disturbances from management activities. While erosion rates and associated sediment yields can increase significantly following the loss of effective cover, measured rates and yields decreased significantly after two to four years in numerous studies of unharvested areas following wildfires, primarily as a result of re-vegetation (Robichaud 1999; Radek 2001). Vegetative recovery to pre-fire cover values occurred after three to six years for similar fire intensities on the Okanogan National Forest (Radek 2001). Field observations of the B&B fire area during the fall of 2004 have shown considerable re-growth of native herbaceous forbs, grasses and shrubs throughout all soil types and stand mortalities. Annuals, perennials, and herbaceous shrubs are expected to return at successional rates observed in other fires on the Deschutes, including McKay, Pringle, and Eyerly.

Water Erosion: Predicted increases in immediate, post-fire upland erosion rates for the low, moderate and high hydrologic response severity classes are approximately 2, 9, and 18 times greater respectively than under pre-fire cover conditions[11] (Sussmann, 2003a). Erosion rates as a result of raindrop impact and overland flows are expected to decrease steadily over time as effective cover (herbaceous vegetation, snag fall and conifer re-generation) increases on site. Although the recovery of coniferous vegetation and the cover that it provides could be the slowest under this alternative, additional cover would be provided by the highest levels of down wood in areas proposed for salvage under the action alternatives. The B&B fire intensity does not appear to have incurred hydrophobic conditions extensive enough to alter the high infiltration rates of the Sand Mountain ash and Blue Lake cinders over contiguous areas.

Wind Erosion: Under the No Action alternative the risk and rate of soil loss from wind would decrease steadily over time as vegetative re-growth and organic accumulation on the soil surface continues to increase effective ground cover. Although dust devils comprised of surface ash and mineral soil have been readily observed since the fire, the return of herbaceous vegetation has substantially reduced this risk after just one growing season.

Coarse Woody Debris (CWD)

The No Action alternative would have indirect effects to coarse woody debris levels on site by leaving all surviving or dead standing trees on site. Although coarse woody debris levels on the surface in some areas of the fire are initially deficit of recommended levels associated with mycorrhizal colonization in respective PAGs (Graham, 1994), snag fall rates informally measured on the Lone Pine Fire[12] and predicted by the Forest Vegetation Simulator (FVS) would contribute significant amounts of CWD to the soil surface over the next three decades (FVS, 2004). Total levels of large coarse wood (>12" dbh) on the ground could range up to 20 tons per acre within 15 years and up to 40 tons per acre after 35 years as root rot reduces resistance to wind events (Evans, 2004). Levels exceeding optimal levels for mycorrhizal colonization[13] could increase the risk of intense fire behavior capable of elevating the level and extent of soil heating and associated biotic losses during subsequent fire events, or possibly alter microbial and nutrient cycling mechanisms on site even before such a fire occurred.

Productivity

The No Action alternative would likely have no indirect effects on productivity as a result of physical disturbances, and only minimal productivity losses resulting from water or wind erosion. Water erosion rates from raindrop impacts and overland flows for a 2yr recurrence interval storm calculated for immediate post-fire cover conditions are within the Natural Resource Conservation Service (NRCS) T-values[14] for representative soil map units in the project area (Sussmann, 2003a). Although predicted rates of erosion as a result of 25year (yr) and 100yr events exceed these values under immediate post-fire cover conditions, the increase of effective ground cover provided by herbaceous vegetation and down wood would reduce erosion rates below these values within the next few years.

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[11] Erosion rates were calculated for slopes of 20% during 2yr and 25yr recurrence interval storm types.

[12] Approximately 90% of standing dead under 14" dbh and 50% of material over 14"dbh was measured to have fallen to the ground ten years following the Lone Pine Fire on the Winema National Forest in two unlogged stand replacement mortality ponderosa pine sites (Winema Monitoring, 2002).

[13] These levels would exceed those identified for optimal mycorrhizal colonization as 7 to 14 tons per acre in a ponderosa pine/Arizona fescue association and 10 to 25 tons per acre in a Douglas fir/mixed conifer type (Graham et al. 1994).

[14] T-values express allowable annual losses (tons/acre) for a soil before productivity would be negatively affected. T-values are 3 tons/acre for the Belrick and Wizard series, and 2 tons/acre for the Douthit and Kweo series under current cover conditions following the fire.

The loss of ash and mineral soil from wind erosion is estimated from the NRCS wind erodibility groups[15] and short-term annual losses are not expected to exceed allowable T-values identified in the NRCS survey. Although cations such as calcium, magnesium and potassium contained in ash deposited as a result of the fire (Busse, personal communication) could be transported off site, the amount of loss is not expected to significantly reduce the productivity of the soils present in the project area.

Long-term Site Productivity

The direct effects of the No Action alternative on the physical, chemical and biologic components of the soil resource are described previously to be negligible in the absence of any further physical activity or removal of biomass from within the fire. As a result, indirect effects of the No Action alternative on long-term site productivity are expected to be negligible.

The No Action alternative would have no additional short-term effect on existing levels or inputs of nutrients on site. Nutrient availability and replenishment as they relate to long-term site productivity have not been compromised by the fire. Carbon, nitrogen, sulfur and phosphorus, as well as exchangeable bases such as potassium, sodium, calcium and magnesium, are all still present on site at levels sufficient to support vegetative re-growth and the return of a forested stand via natural succession pathways. Table 3.8 summarizes the estimated above ground losses and annual inputs of the primary nutrients via photosynthetic processes in a forested system. Detailed discussions on the losses of soil borne nutrients incurred by the fire and subsequent replenishment pathways for each nutrient are included in the soils specialist report (Sussmann, 2005).

Table 3.8 Estimated Above Ground Nutrient Losses within Stand Replacement Mortality Areas and Annual, Post-fire Nutrient Input

Above Ground Nutrient Budgets			
Nutrient	**Pre-fire amounts**	**Post-fire amounts***	**Annual input from photosynthesis**
carbon	138.4 tons/acre	96.6 tons/acre	.24 tons/acre**
nitrogen	1,356 lbs/acre	546.8 lbs/acre	0.17 lbs/acre
phosphorus	145.7 lbs/acre	61.89 lbs/acre	0.02***

* Amount lost was calculated based on the combustion of the entire vegetative and organic component associated with herbaceous shrubs, wood residues, and surface litter and duff, as well as 60% combustion in weight of the crowns of trees and 20% in weight of the bark component. Site budgets of the primary nutrients contained in the crown, bark, litter and duff, wood residues and shrubs of a fully stocked Ponderosa Pine forest containing 90 ft2/acre of basal area were used as a basis for estimating levels in a representative mixed conifer stand containing 260 ft2/acre of basal area to calculate this loss (Little and Shainsky 1995).

** The annual input of photosynthesized carbon into a fully stocked forestland system (Busse, 1994; Little and Shainsky 1995). Annual input of a post-fire, shrub/grass/forb dominated community is estimated to be at or above these rates when fully stocked (Busse, personal

[15] NRCS wind erodibility groups indicate the susceptibility of soil to wind erosion, with those assigned to group 1, 2, or 3 the most susceptible to this mechanism. The majority of the soil surface following the fire is comprised of a mixture of ash from the fire and mineral sandy loam or cindery sand volcanic depositions. Ash material is included in erodibility group 2 and mineral sandy loams or cindery sands are included in erodibility group 1.

communication). Movement of carbon contained in standing trees to the ground would occur as fire killed trees rotted and were windthrown over the next twenty years.

*** Inputs from new organic matter produced on site would occur over the course of the next few decades that would slowly replenish the above ground amounts lost from the fire. The majority of annual input to the soil system comes from the weathering of parent material and soil in place. Measured concentrations of this nutrient in the soil profile are relatively high and contain upwards of 98% of the total P stored on site (Little and Shainsky 1995).

Cumulative effects

There would be no cumulative effects to the soil resource from the No Action alternative, primarily since no management activities would occur within the project area.

Effects Common to all Action Alternatives

Danger Tree Removal (see effects under Alternative 2)

Machine operations for felling would be limited to out and back passes only, while machines used for yarding would be restricted to a designated skid trail in order to limit the extent of area on which multiple trips of machinery occurred. Impacts to the soil resource would include detrimental compaction and some displacement on skid trail and landing areas, as well as some displacement and compaction of the soil in areas where machine feller-bunchers traveled. Impacts would also be incurred to varying degrees where fuels were piled and burned. Hand piles would be smaller and less compacted than machine piles and would incur shorter durations and lower levels of heat to the mineral soil during burning. Both types of piles would be burned under prescriptions when soil moistures were at sufficient levels to minimize the transport of heat down into the soil profile. Detrimental burn conditions are likely to be generated under machine piles and less likely to be created under hand piles. The amount of area affected by piles along the danger tree haul road miles is expected to be less than 5% of the area, with the amount detrimentally impacted likely to be less than 2%. Total detrimental impacts to the soil resource are expected to be within LRMP standards for maintaining soil productivity on these sites.

Danger trees would also be cut and removed from approximately 30 acres of riparian reserves identified as defensible space or along Highway Safety Act roads under all action alternatives (Pods). These include pods along haul roads, areas near and around Round Lake and a section of Highway 20 along Suttle Lake. All material would be hand-felled or cut with machinery from existing roads. No additional off road traffic would occur in these areas. Material removed would be reached from the road by a boom mounted grapple or pulled with line from a high arch support or mobile yarder. Additional non-merchantable material would be hand-felled and piled in these areas in order to reduce fuel loads to levels meeting defensible space criteria. Fuels would be machine piled from the road or hand piled off of the road. Effects to the soil resource would be minimal and would include minor amounts of displacement from the unsuspended end of tree boles yarded to the road or burn damage underneath machine or hand piles. Total detrimental impacts in these areas are likely to be less than 5%.

Subsoiling

Subsoiling of compacted areas utilizing a self drafting, winged subsoiler would occur in all action alternatives within proposed units having greater than 20% of their surface area in detrimental compaction following proposed activities. Subsoiling would be necessary to meet LRMP soil standards within approximately 49 treatment units utilizing ground-based harvest and yarding systems under Alternative 2. Predicted unit acres requiring subsoiling to meet LRMP Standards and Guidelines are 117 acres for Alternative 2, 77 acres for Alternative 3, 46 acres for Alternative 4 and 20 acres for Alternative 5. Specific unit estimates, including acreage in temporary roads, for the action alternatives are included in Appendix B.

Subsoiling would have a direct effect on the soil resource by pulling the subsoiling implement through the profile to shatter compaction incurred by proposed activities. Subsoiling is very effective in reducing soil strengths incurred by the compression and vibration effects of machine traffic. This operation directly fractures compacted soil particles and increases macro pore space within the soil profile (Craigg, 2000, Froelich, 1995), both of which contribute to increased water infiltration and enhanced vegetative root development. Soil probes taken before and after subsoiling operations show reductions of soil strength to or below natural levels after a single pass of the implement (Bend/Ft. Rock District Subsoiling Monitoring).

Although subsoiling does not completely return all soil components altered by management impacts to pre-impact conditions, it does significantly rectify physical properties to a condition where other soil processes can recover on site. Soil conditions following subsoiling can be fluffed in nature but are observed to return to natural bulk density levels after physical settling and a season of moisture percolation through the soil profile. Although vegetation on skid trails is generally physically crushed and uprooted, the recovery of this component is primarily affected by a severely compacted rooting zone. Subsoiling the compacted mineral soil would return natural macro pore space and infiltration throughout the profile to natural levels and create conditions more conducive to the re-establishment and productive growth of herbaceous annuals, perennials and shrubs, as well as planted conifers. The return of physical conditions more conducive to growth appears to offset the displaced or mixed mineral surface soil and organics. These areas would subsequently start to receive organic litter input from the vegetation established on and immediately adjacent to these areas over the following years.

Road Decommissioning

Approximately 51 miles of road would be decommissioned[16] and 20 miles would be inactivated[17] under alternatives 2, 3 and 4. An additional 4.2 miles of road would be decommissioned and additional 2.1 miles would be inactivated under alternative 5. All road miles are currently detrimentally compacted and support limited amounts of vegetative growth consisting of shrubs, herbaceous annuals and perennials and conifers. The amounts and type of vegetation present primarily depends on the current road surface material and the amount of traffic it has received in recent years. Approximately 27 miles of the roads proposed for decommissioning and 10 miles of the roads proposed for closure are identified as adversely affecting aquatic resources by reducing infiltration and/or directly transporting sediment to streams (McCown, 2004).

Subsoiling of roads proposed for decommissioning would relieve compaction throughout the mineral soil profile and restore infiltration rates to natural levels. These areas would have decreased overland flow energies and volumes and would see reduced erosion rates. These effects would continue to decrease as herbaceous vegetation continued to re-establish cover on these sites.

Alternative 2 – Proposed Action

Effects

[16] Decommissioning hydraulically closes, potentially subsoils and removes a road from the Forest system.
[17] Inactivation repairs any drainage problems, possibly removes culverts from stream crossings, and prevents public access from a road.

Alternative 2 would have a variety of direct, indirect, and cumulative effects from proposed salvage, danger tree and fuels treatment activities on the soil resource in a post-fire environment. These effects are applicable to the other action alternatives, although differing in extent due to changes in the amount of acres proposed for commercial salvage and the location of some of the proposed activities. Under the effects analysis, proposed activity units using ground-based systems for either commercial salvage or biomass product removal are treated as equal prescriptions since either activity involves the harvest and yarding of a comparable number of trees per acre. Helicopter units would have lesser effects on the soil resource since merchantable material would be hand-felled and yarded by helicopter. Areas along haul roads treated for danger trees or those areas treated for defensible space are likely to have a wider range of effects due to the variability of the number of trees per acre proposed for removal and the location both inside and outside of riparian reserves.

Direct effects

Detrimental Disturbance

Direct effects to the soil resource would occur under the Proposed Action as detrimental disturbance in the form of compaction, displacement, or burn damage from ground-based machine traffic and fuels treatments. Definitions of these disturbances as detrimental to the soil resource are found in the Regional supplement to the Forest Manual (FSM 2500, R-6 supplement 2500-98-1). The proposed activities would incur detrimental impacts for each of these disturbance types in the following manner:

Compaction in coarse textured, volcanic ash soils occurs primarily as a result of vibrational and compressional forces from machinery used for harvest and yarding operations. The level of compaction incurred by machine traffic varies according to the soil moisture levels at the time of operation (Chitwood, personal communication) and generally requires multiple passes before soil strengths are increased sufficiently to meet the definition of detrimental.[18]

Displacement of soil occurs primarily when ground-based machinery pivots quickly on a slope with exposed or loose mineral soil. Mineral soil exposed by the fire and limited slash on the soil surface raises the risk of displacement from machine traffic off of established skid trails and landings. Although displacement of mineral soil may readily occur from the maneuvering of machinery used to harvest and yard material, the extent of this disturbance off of skid trails and landings would be relatively minimal and infrequently large enough where it did occur to meet the definition of detrimental.[19] Detrimental displacement was identified on less than 2 percent of the unit areas in the Lower Jack Contract Modification salvage on similar soils within the B&B fire boundary.

Burn damage would be expected to occur where machine piles of fuels on landings or grapple piles elsewhere in the units were burned. The burning of slash piles has the potential to volatilize nutrients and soil organisms contained in the soil beneath them. Oxidized soils resulting from extended durations of elevated temperatures underneath burn piles meet definitions of detrimental burn damage.

Unit Impacts

Proposed activities have the potential to affect soil productivity if the sum total of detrimental disturbance exceeds 20 percent of the aerial extent of an activity area. The Deschutes LRMP directs management activities to leave a minimum of 80 percent of an activity area in a condition of acceptable productivity and rehabilitate areas where this direction cannot be met (LRMP Standards

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[18] Detrimental compaction requires bulk density increases of 20% or greater over natural, undisturbed levels in ash and pumice soils (FSM 2500, R6 Supplement). Levels exceeding a 20% increase in bulk density have been measured on ash soils after four or more passes by ground-based tracked and rubber tired machinery used for similar harvest operations (Deschutes Monitoring).

[19] Detrimental displacement requires the removal of greater than 50% of the mineral A horizon over an area of 100 square feet or greater (FSM 2500, R6 Supplement).

SL-3 & SL-4). These standards would be met or followed under this DEIS on a unit basis through the use of BMPs and administration of the sale contract language intended to minimize detrimental impacts from proposed activities. Subsoiling mitigation would be utilized in ground-based units to rectify detrimental impacts incurred by the proposed activities where they exceeded 20 percent after harvest, yarding and fuels treatments were completed.

Appendix B summarizes existing and estimated detrimental conditions for each individual activity unit. Predicted levels of detrimental impact within proposed activity units include all detrimental disturbance types described in the Regional Supplement to the Forest Service Manual (FSM 2500, R-6 supplement 2500-98-1). Table 3.9 summarizes proposed unit acres and predicted detrimental unit acres by 6th field subwatershed for this alternative.

Ground-based units: Predicted levels[20] of detrimental impact in ground-based commercial salvage units are based on monitoring of similar fire salvage units in the Lower Jack Contract Modification sale within the B&B fire area that measured a range of detrimental impacts from 18 to 26 percent following harvest and yarding operations (Sussmann, 2004). Ground-based units with existing impacts of less than 10 percent are expected to meet LRMP Standards after felling, yarding and fuels treatment activities. Ground-based units with existing detrimental conditions of greater than 10 percent are likely to have total detrimental conditions on 20 to 25 percent of their unit area and exceed Deschutes LRMP standards following all harvest and fuels treatment activities. These unit areas would utilize mitigation subsoiling to rectify detrimental impacts incurred by the proposed activities in order to comply with the LRMP Standard.

Approximately 166 acres of ground-based units are within the Potential Sediment Contribution Area (PSCA).[21] Disturbance within these areas would include compaction on designated skid trails and some displacement or disturbance of surface mineral soil and effective ground cover from the winching of material. Project design for these areas was developed to minimize the extent of compaction and disturbance to effective ground-cover, including designated skid trails spaced at least 120 ft apart, restricted machine traffic, hand-felling and winching material removed, and no new landings (DEIS, Chapter 2). As a result of this design, the direct effects of ground-based operations on effective ground cover and compaction within the PSCA are estimated to occur on less than 10 percent of these areas. Subsoiling and/or waterbarring of compacted skid trails within the PSCA would be prioritized in order to further reduce the extent of compacted area capable of creating sediment carrying overland flows.

[20] Estimations of the extent of detrimental soil conditions in ground-based activity units account for the high number of trees per acre proposed for removal and the additional fuels treatments necessary to reduce fuels loads. Approximately 10 to 15% of proposed unit areas would be committed to skid trails and landings in order to harvest and yard material. All skid trails and landings are assumed to be detrimentally compacted following operations for this analysis. An additional 5% of the unit areas could incur detrimental conditions from traffic between skid trails by harvest machinery over existing areas of impact without sufficient frozen ground or snow cover conditions to mitigate compression or vibration forces. Actual spacing of skid trails and the number of landings would be variable across the units, dependent primarily on the topography and the distribution of the trees intended for harvest within the unit.

[21] The potential sediment contribution area is the area most likely to contribute sediment and overland flow to waterbodies. The amount of sediment transported to waterbodies is inversely proportional to the distance from a waterbody and directly proportional to the angle of slope. The PSCA was created in the B&B project area based on the proximity to riparian reserves, loss of effective ground cover as a result of fire mortality, slope, and hydrologic connectivity.

Table 3.9 Predicted detrimental acres by logging system following implementation of proposed activities and mitigations within commercial salvage units.

Alternative 2 Commercial salvage unit acres							
Sub_watershed	% sub_shed proposed harvest	Proposed Salvage acres		Miles of Danger tree removal	Detr. Acres from ground-based *	Detr. acres from heli **	Total acres detr. ***
		ground	heli				
Abbot Creek	25	1,912	70	25	382	4	386
Cache Creek	0	13	0	0	3	0	3
Candle Creek	4	237	79	4	47	16	63
Canyon Creek	17	875	35	17	175	7	182
First Creek	8	584	547	8	117	109	226
Headwaters Metolius River	1	134	0	1	27	0	27
Jack Creek	15	1,430	0	15	286	0	286
Lower Lake Creek	11	577	96	11	115	19	134
Upper Lake Creek	1	86	126	1	17	25	42

* Detrimental acres are calculated as 20% of the proposed Ground-based Harvest unit acres utilizing machine feller-bunchers and skidders or forwarders and grapple machine piling.
** Detrimental acres from Helicopter Systems are calculated as a maximum amount of 5% of unit acreage in Helicopter units.
*** Total acres detrimental summarizes acres predicted to be detrimental following proposed harvest, fuels and subsoiling treatments within all treatment units, including temporary roads. This also includes acres along haul roads and in areas identified as defensible space treated for danger tree removal.

Fuels piling treatments would incur low amounts of additional impact since machinery used to pile material would be restricted to skid trails and landings created during the commercial salvage activities or existing prior to these operations. Although some areas of displacement or compaction could occur from machine piling, these restrictions would conservatively limit additional detrimental disturbance to the soil resource to less than 2 percent of the unit area. Possible re-entry into some activity units to remove non-merchantable material as biomass products could incur additional detrimental disturbance as a result of traffic used to cut and yard this material, although these operations would also be restricted to existing areas of impact.

Piles on landings are estimated to cover approximately 250 square feet (ft^{2}), totaling less than 1 percent of the unit area. The burning of landing piles within ground-based units would incur detrimental damage on these areas. Temperatures exceeding 200 degrees C have been measured 2-5 cm below the soil surface for greater than 4 hours during active pile burns, while soil pH levels were shown to increase dramatically for 0-2.5 cm and 2.5-10 cm soil horizons following these burns. However, measured soil nitrogen concentrations in these horizons were not reduced due to the downward distillation of organic N from the burn piles and the possible oxidation of N from roots in the top horizons (Sheay 1993). Although few studies have monitored the long-term recovery of soil underneath pile burns, these operations likely inhibit the productivity of these areas for a number of years.

Grapple piles within units identified as needing additional fuels treatments after commercial salvage was completed (see Appendix B – Alternative Tables) would also be burned and may incur detrimental burn damage. These piles would be located primarily on skid trails and average approximately 50 ft^2 in size, totaling up to 2 percent of the unit area. The majority of detrimental burn damage for either landing or grapple piles would occur on areas already detrimentally compacted or displaced and would contribute very little additional acreage to overall detrimental condition levels. Although subsoiling through these areas would relieve detrimental compaction, the burn damage would not be mitigated.

Helicopter units: Detrimental soil disturbance within helicopter units would be expected to meet LRMP standards following harvest and fuels treatment activities. Isolated areas of gouging and displacement from the initial lifting of hand-felled trees during helicopter yarding could occur. Landings required to handle yarded material are conservatively estimated to be a maximum of 5 percent of the unit area harvested and would primarily be located along wide spots of the 1210 road for the First Creek units in this alternative. Some clearing of standing material up or down slope of the road bed landing areas may occur to create safe and operable conditions at these landings.

Approximately 250 acres of helicopter units are located on slopes identified as having a risk for debris flow (USDA 2004c). Recent releases on slopes within the Canyon Creek subwatershed that are included in this proposal slid along the subsurface interface of consolidated and unconsolidated glacial tills that is located well below the rooting zone of coniferous trees (Chitwood, 1998). The removal of tree boles via hand-felling and helicopter yarding is not expected to increase this risk on slopes within the First Creek subwatershed proposed for this activity. The decay of coniferous roots will decrease the physical integrity of the mineral soil layer regardless of whether the tree boles remain on site. The susceptibility of these slopes from super saturation would not be further exacerbated by the removal of dead tree boles since the reduction of evapotranspirative losses has already occurred as a result of the fire.

Approximately 167 acres of helicopter units are located within the PSCA, primarily as slopes above hydrologically connected road ditches, or adjacent to steep ephemeral or intermittent draws. Disturbance within these areas would be minimized by hand-felling and helicopter yarding prescriptions and design that excludes the removal of standing or down wood within steep, well defined draws (DEIS Chapter 2).

Jackpot burning would occur within helicopter units to reduce fuel loads comprised of tops and hand felled whips. Jackpot burning would run a prescribed ground fire through areas of slash accumulated, but not piled, from these operations. Jackpot burns would incur detrimental burn damage on less than 1 percent of the area burned since they would be implemented under a prescriptive Burn Plan with fuel and soil moisture guidelines intended to minimize the intensity and duration of heat generated during the burn period. Burning of some hand piles in either ground-based or helicopter units may occur. These piles would be expected to incur low levels of detrimental burn damage when compared to the larger, more compact machine piles since they are more loosely bunched and smaller in size. Additional detrimental burn damage from these piles would be less than 1 percent of the unit area.

Temporary Roads: Approximately 5.1 miles, or 7.4 acres, of temporary road are proposed under Alternative 2 to access ground-based activity units or landings within them. Units which need temporary road segments for access are identified in Appendix B. The proposed temporary road segments would be located on currently un-impacted ground, although in some cases they would utilize skid trails created by harvest and yarding operations to access internal landings.

The construction of temporary roads would have direct effects to the soil resource in the form of compaction or displacement. All temporary roads would have some level of improvement involving smoothing or widening with a dozer or grapple blade. Very little, if any, cut and fill disturbance would be required for the development of these road surfaces. The soil resource would incur some displacement from blading and temporary detrimental compaction as a result of multiple passes of haul trucks and logging machinery. This impact would be additional in extent to that incurred by the harvest and yarding operations where proposed temporary road locations did not overlay skid trails or landings created by the salvage activities. All areas disturbed for temporary roads are accounted for in the estimate of detrimental soil conditions prior to mitigation subsoiling included in Appendix B and are prioritized for subsoiling to relieve compaction and return hydrologic function to the soil profile.

Road Decommissioning: Road segments were identified for decommissioning or inactivation under the B&B Area Roads Analysis for removal from the system, conversion to trails or closure to public access due to various resource concerns. Approximately 37 of the 48 road segment miles are proposed for removal from the system because of aquatic concerns and were prioritized for subsoiling using a winged subsoiler based on field reconnaissance for the B&B DEIS. The additional miles are located on uplands without aquatic concerns and would be subsoiled in the future as funding becomes available. Table 3.10 summarizes the miles of roads proposed for decommissioning and the total number of acres subsoiled if all miles were rehabilitated with this method. Proposed miles are the same for alternatives 2, 3 and 4. Alternative 5 has additional miles within four subwatersheds to address wildlife concerns.

Table 3.10. Miles of proposed road decommissioning and acres of associated subsoiling rehabilitation by subwatershed for all action alternatives.

Road decommissioning for Alternatives 2, 3, 4 and 5			
Subwatersheds	**Miles of Road Proposed Decommission (Alt 2, 3, 4 & 5)**	**Miles of Road Proposed Decommission Wildlife (Alt 5 Only)**	**Acres restored by subsoiling (additional Alt 5)**
ABBOT CREEK	6.3	0.5	7.6 (0.6)
CACHE CREEK			
CANDLE CREEK	1.4		1.7
CANYON CREEK	20.4	2.2	24.7 (2.7)
FIRST CREEK	7.9	0.1	9.6 (0.1)
HEADWATERS METOLIUS RIVER	1.2		1.5
JACK CREEK	4.2		5.1
JEFFERSON CREEK			
LOWER LAKE CREEK	3.9	1.1	4.7 (1.3)
UPPER LAKE CREEK	2.5		3.0
TOTAL MILES	**47.7**	**3.9**	**19.7**

Danger tree removal: Impacts to the soil resource from harvest, yarding and fuels treatments would be similar to those described previously for ground-based units. The amount of area affected by piles is expected to be less than 5 percent of the area, with the amount detrimentally burned likely to be less than 2 percent. Total detrimental impacts, including compaction and displacement are expected to be within LRMP standards for maintaining soil productivity on these sites.

Approximately 3.1 miles of haul or high use public access roads within riparian reserves would be treated for danger trees in excess of instream wood and down log guidelines. Impacts to the soil resource would include minor amounts of gouging from winching operations and light burn damage underneath handpiles.

Defensible Space: Approximately 20 acres identified as defensible space around the Round Lake Christian Camp would be treated with ground-based machinery. The acres outside of riparian reserves would incur detrimental disturbance where multiple passes of machinery occurred over currently unimpacted ground. Many existing trails and pathways within this area are available for use and would minimize the extent of additional damage as a result of these activities.

Effective ground cover[22]

Proposed activities in ground-based units would have direct effects to the vegetative or organic components of effective cover. Vegetation on skid trails and landings would be crushed or uprooted from multiple machine passes and the yarding of material behind grapple skidders. A small portion of vegetation off of these areas would be disturbed by only one or two passes of the machine harvester, while the majority of the unit areas would have no traffic and little disturbance of vegetation. Reductions in effective cover values by denuding areas of vegetation would be offset to some degree by woody debris contributed to the ground from breakage and knockdown.

LRMP SL-6 states that effective ground cover for a range of low to severe surface soil erosion potentials should be met within the first two years after an activity is completed. The majority of soils within the project have low potentials for surface soil erosion and require 20-30 percent minimum effective ground cover the 1st year after management activity and 31-45 percent after the 2nd year in order to meet LRMP SL-6. Based on the observations of the Lower Jack Contract Modification units within the B&B Complex fire area, past salvage areas on the Deschutes National Forest, and information from the Lone Pine study on the Winema National Forest[23], effective cover values on acres proposed for treatment would be of sufficient levels to meet SL-6 within the first two years following implementation of activities.

Proposed activity areas located on steep slopes with moderate to high potentials for surface erosion (SRI soil types 21, 22, and 79) require slightly higher percentages of aerial cover to meet LRMP SL-6. Proposed activities on these soils utilize hand felling and helicopter yarding to minimize physical disturbance to the soil surface. The disturbance of effective ground cover from helicopter systems would be less than that predicted for ground-based activities and would also be expected to meet SL-6 within two years following the implementation of proposed activities.

[22] Effective ground cover is defined as including all living or dead herbaceous or woody materials and rock fragments greater than three-fourths of an inch in diameter in contact with the ground surface. This includes tree or shrub seedlings, grass, forbs, litter, woody biomass, chips and so forth (Deschutes LRMP, Table 4-30, footnote 3).

[23] Disturbance resulting from the implementation of ground based harvest and yarding systems is not expected to slow the growth or overall recovery of vegetation established on the site over the next decade. Salvaged units that utilized ground-based harvest systems within the McKay and Pringle fires on the Bend/Ft. Rock district of the Deschutes are observed to have significant cover values provided by ceanothus shrubs and various perennials within five years after salvage activities occurred. Although vegetative recovery would be slower to occur on skid trails and landings that were not subsoiled, recovery between skid trails and on subsoiled areas would contribute to effective cover values. Cover values of shrubs and biomass production on salvaged areas in the Lone Pine fire after five years were not statistically significantly different than un-salvaged controls. These areas also had additional cover provided by planted and naturally regenerated conifers that would also be a contributor within these treated stands (Mallaby, 2000).

Chemical and Biological Components

Direct effects to the chemical and biotic components of the soil resource include the removal or burning of biomass from the site and the physical impact or alteration of soil biota as the soil profile is compacted. Changes to the chemical component for this discussion, including site budgets of carbon and nitrogen, are based on the removal of approximately 80 percent of merchantable trees less than 12 inches DBH from proposed salvage units and the treatment of up to 60 percent of the 3 to 12 inch DBH non-merchantable material on site.

Coarse woody debris (CWD)

Alternative 2 would have direct effects on CWD levels within treated unit areas. Implementation of proposed activities could increase existing levels of CWD by knocking non-merchantable tree boles to the ground and leaving all material on the ground prior to the fire within Matrix and LSR stands intact (NWFP ROD, 1994). Existing levels within proposed activity units located in dry ponderosa and mixed conifer sites generally range from 3 to 20 tons/acre (Stand Exams, 2004). The short-term supply of CWD would be decreased by removing commercial tree boles from the site (FVS runs, 2004), although this would be offset to some degree by an additional number of snags less than 16 inches DBH left untreated by harvest operations, additional fuels treatments or biomass product removals within the unit areas.

Long-term supplies of CWD would be decreased when compared to the No Action and Action Alternatives 3 and 5 by leaving two of the largest snags per acre most likely to persist for wildlife needs. Although some activity areas are currently below levels recommended for optimum ectomychorrizal activity and associated soil productivity (Graham et al.1994; Brown et. al. 2003), variable amounts of currently standing, non-merchantable coarse wood in the 3 to 12 inch DBH and 12 to 16 inch DBH size classes would be contributed to the soil surface during salvage harvest and yarding operations and in subsequent years as snags left standing begin to wind throw to the ground. Acceptable coarse woody debris levels identified by the fuels, soils and wildlife specialists for this project meet recommendations for soil productivity and are included in Chapter 2 of the DEIS. These levels are tiered to Table 12 in the Metolius LSR Assessment (USDA 1996a).

Below-ground Nutrient Pools

Below ground nutrient pools would not be directly affected by the removal of above ground material and would be enhanced in some areas by the movement of organic material to the soil surface. Speculated losses and transformations of below-ground nutrient pools are based on research from other fires and were discussed under the Existing Condition and No-Action Alternative of the Soils section.

Soil levels of phosphorus and nitrogen are far greater than those stored in above ground material and should provide sufficient amounts for site productivity to be maintained until vegetative re-growth of perennial shrubs, planted conifers and herbaceous forbs and grasses begins to provide organic input on the soil surface and into the mineral soil A horizon. Much of the vegetative and organic woody material remaining on site after proposed harvest and fuels treatment activities would be on the soil surface and would be a source of mineralizable nutrients and microbial habitat during this period.

Surface Organics and Above–ground Nutrient Pools

Levels of surface organics and above-ground nutrients following proposed harvest and fuels treatments are expected to be sufficient to provide moisture retention, nutrient storage and microbial habitat on site. It is noteworthy that the consumption of litter, duff, or crown needles during the fire removed the highest percentage of mineralizable forms of nutrients from these sites. Although proposed harvest and fuels treatments would remove or burn bole wood, limbs and tops yarded to the landings, or branches of non-merchantable material piled within units, the above-ground storage of nitrogen and phosphorus contained in this material is a small percentage of the total amounts of these nutrients stored on site (Little and Shainsky 1995), the decay of bole wood loses much of the carbon from the system as carbon dioxide, and this material provides very few directly mineralizable nutrients to the soil in east-side forest systems (Prescott, 2002). Full implementation of the harvest and fuels strategy would leave 40 percent of non-merchantable material and up to 10 percent of the commercial material as snags or down wood on site. Recommendations under the B&B Fuels Strategy (Appendix A) for further fuels treatment within units would only occur if total fuel loads exceeded 40 tons/acre across all size classes or 10 tons/acre of material less than 3 inch DBH.

Table 3.11 summarizes the estimated calculations of the amounts of nutrients that would be lost from harvest removal or fuels treatments within units proposed under Alternative 2. Assumptions used for calculating changes in nutrient budgets are included in footnotes to the table.

Carbon to Nitrogen ratios

Although the removal and burning of tree boles, branches and tops would reduce the amount of carbon and nitrogen on site, there would be no direct effects to the C:N ratio of the mineral soil in areas treated under this alternative.

Soil Biota

The removal of tree boles, branches and tops would have no direct effects to soil biota within treated areas. The burning of tops, branches and non-merchantable boles would directly consume or alter soil biota beneath piles as discussed previously. Although compaction of the soil resource can physically reduce or inhibit biotic populations within the soil profile, these effects are likely to be localized to areas committed to landings and skid trails and should not be detrimental to overall populations and site productivity if limited to less than 20 percent of the activity area.

Table 3.11 Alternative 2 Nutrient Removal from Proposed Harvest within Stand Replacement Activity Units

Estimated Above Ground Nutrient Levels Remaining or Removed Per Activity (weight/acre)								
Nutrient	**Pre-fire amounts onsite @ 260 ft2/acre of basal area***	**Post-fire amounts onsite****	**Amount lost with l.t.a. yarding *****	**Amount lost with no tops yarding (heli-units) *******	**Amount in bolewood of tops**	**Post-fire amount contained in non-merchantable 3 to 12" dbh material (90 ft2/acre of basal area)**	**Amount remaining in 3 to 12" material after fuels treatment**	**Amount remaining after harvest (lta) and fuels treatments**
carbon	138.4 tons/ac	96.6 tons/ac	21.08 tons/ac	20.94 tons/ac	0.14 tons/ac	22.41 tons/ac	8.96 tons/ac	62.1 tons/ac
nitrogen	1,356 lbs/ac	546.8 lbs/ac	96.0 lbs/ac	106.25 lbs/ac	0.45 lbs/ac	111.12 lbs/ac	44.45 lbs/ac	384.1 lbs/ac
phosphorus	145.7 lbs/ac	61.89 lbs/ac	14.39 lbs/ac	15.73 lbs/ac	.07 lbs/ac	16.2 lbs/ac	6.48 lbs/ac	37.8 lbs/ac

* Pre-fire levels of above ground nutrients include that stored in all tree components, shrubs, forest floor litter and duff, and wood residues on site. Numbers were converted from those destructively sampled for a second growth Ponderosa Pine stand averaging 112 trees per acre and a basal area of 90.2 ft2/acre (Little and Shainsky 1995) to reflect a mixed conifer dry stand averaging 70 trees per acre >12" dbh and 750 trees per acre <12" dbh totaling a basal area of 260 ft2/acre.

**Assumes stand replacement conditions in which above ground nutrient amounts consumed by the fire were calculated as the loss of 60% of the crown weight and 20% of the bark weight of nutrients contained in pre-fire tree volumes, 30% of residue weight, and 100% of shrub and forest floor litter and duff weights estimated to be on site.

*** Maximum amounts lost from harvest operations utilizing "leave tops attached" fuels treatments. Amounts lost on acres proposed for salvage are based on the physical removal of 80% of merchantable trees >12" dbh from within activity units. Totals calculated include 80% of the nutrient budget contained in bolewood, plus 35% of the crown by weight (50% considered to be de-limbed or broken off during yarding) and 70% of the bark by weight (10% considered to slough off during yarding operations) contained in the same amount of bolewood. Helicopter units would remove lesser amounts due to the lopping of most limbs before yarding operations.

Site budgets of the primary nutrients contained in the crown, bolewood and bark of a fully stocked, live Ponderosa Pine forest with 112 trees per acre (90.2 ft2/acre of basal area) have been measured to be 24 T/acre C, 175 lb/acre N, 24 lb/acre P and approximately 10 lb/acre S (Little and Shainsky 1995). Site budgets of these nutrients were proportionally adjusted to represent the removal of approximately 152 ft2/acre of basal area for this project area. Primary nutrient totals contained in this material pre-fire would be approximately 40.3 T/acre C 294 lb/acre N, 40 lb/acre P and approximately 17 lb/acre S. Post-fire amounts contained in this material are approximately 32 T/acre C, 175 lb/acre N, 25 lb/acre P and 10 lb/acre S.

**** Maximum amounts lost from Helicopter units if tops were removed before yarding. Amounts lost on acres proposed for salvage are based on the physical removal of 80% of merchantable trees >12" dbh from within activity units. Totals calculated subtract the nutrients contained in the bolewood of tops assumed to be 25 feet in length above a 6 inch diameter, which calculate to be 0.21 metric tonnes per top (Little and Shainsky 1995).

Indirect Effects

Erosion Risks

Indirect effects of disturbance from proposed activities include a short-term increase in erosion rates from areas of exposed and/or compacted mineral soil. Alternative 2 would enter approximately 5 percent of the Upper Metolius 5th Field watershed area and could detrimentally disturb up to 1 percent of this watershed area, the largest total area of all the alternatives analyzed in this EIS. This alternative would also disturb the largest amount of acreage within areas capable of contributing sediment to streams. Refer to the Water Quality section for a discussion of delivery risks of eroded soil to streams.

Water Erosion Rates

Disturbance from proposed activities on soil would indirectly affect water erosion rates by compacting or exposing mineral soil within activity areas. Although erosion rates as a result of the fire increased significantly over pre-fire rates,[24] they will have decreased slightly by the time of entry due to nearly two full growing seasons of herbaceous vegetative re-growth. Proposed activities would indirectly increase these rates by crushing or uprooting ground vegetation on portions of the activity areas and/or exposing and compacting mineral soil. The exposure of mineral soil would increase the susceptibility of the soil to detachment from rain drop impacts.

The extent of effective ground cover reduction would be minimized due to the implementation of designated skid trails and restricted skidding patterns intended to reduce the percentage of an activity area disturbed by machine traffic. The effectiveness of these implementation criteria on minimizing effects to effective ground cover are supported by monitoring within salvage units of the Lower Jack Contract Modification Sale[25] implemented within the B&B fire boundary during the spring/early summer of 2004 (Sussmann, 2004). Although this alternative would provide additional organic cover in the form of activity fuels, it would remove the largest amount of bolewood that could provide effective ground cover after it fell to the ground. The largest contributor to effective ground cover on these sites would be in the form of herbaceous vegetation within treatment areas, the recovery of which is not expected to be significantly slowed following the disturbance from proposed salvage activities (Malaby, 2000). As a result, erosion rates on disturbed areas would be expected to decrease steadily over time. Predicted upland erosion rates for the low, moderate and high hydrologic response severity classes on 20 percent slopes during 2yr and 25yr recurrence interval storm types would meet pre-fire cover rates within 3 to 6 years as effective cover values steadily increase.

Although areas compacted by machine operations are likely to increase overland flow volumes and energies during storm events to levels that could detach and/or transport soil particles, many of these areas in skid trails would be subsoiled or water barred within the first year following detrimental disturbance. Infiltration rates and herbaceous recovery on these areas would increase following subsoiling operations, while flow energies would be diverted by water bars constructed during and after yarding operations.

Wind Erosion

Erosion rates from wind could increase indirectly as a result of the short-term loss of effective ground cover from proposed activities. These rates would decrease steadily as vegetative re-growth and organic accumulation on the soil surface continues to increase effective ground cover.

Productivity

Indirect effects to the soil resource as a result of physical alterations to mineral soil or the removal of biomass could include the reduction of site productivity if the extent of detrimental disturbance is large enough. Detrimentally compacted soils may reduce tree growth and soil productivity by limiting root establishment and growth of trees (Gomez, et al, 2002), changing soil porosity by converting

[24] See discussion of erosion rates in the immediate post-fire environment under the Existing Condition section of this report.

[25] Changes to effective cover values from the creation and use of landings and skid trails is estimated to be a fraction of the 15% of an activity unit that their aerial extent covers. Estimated vegetative cover values following ground based salvage in the Lower Jack Contract Modification units exceed 50% on a high productivity site and 30% on a moderate productivity site. The discrepancy in cover between sites is primarily a result of the soil moisture conditions and associated herbaceous species composition of the site, with a thick cover of Epilobium on the moist, higher productivity site and a smaller cover of ceanothus seedlings and Bracken fern on the moderate productivity site.

macropore space to micropores, and/or physically impacting mycorrhizal microbial populations integral to nutrient availability and uptake. Detrimentally displaced or burned soil can also reduce nutrient or water availability on site, as can the removal or burning of biomass on site.

The productivity of the soils present within proposed activity areas is not expected to be altered significantly as a result of the implementation of this alternative. Units proposed for ground-based operations would have the greatest amount of detrimental disturbance, although design criteria and mitigation measures would limit the aerial extent of this disturbance to less than 20% of any activity area. Total detrimental disturbance within all proposed activity units is expected to meet LRMP standards for maintaining or enhancing soil productivity (LRMP SL-3) or will be rehabilitated with subsoiling back to 20% where detrimental compaction contributes a significant component of a total detrimental disturbance level that exceeds 20%. Other measurements of productivity such as a functional, soil borne C:N ratio, nutrient inputs to the soil, or current site budgets of primary nutrients are unlikely to be affected by proposed activities to a degree significant enough to limit the productivity of the site.

Cumulative Effects

The implementation of Alternative 2 would have cumulative effects on the soil resource within proposed activity areas with existing detrimental disturbance. The incremental increase of detrimental disturbance as a result of these activities would be greatest within units proposed for ground-based activities. Entry into units with impacts from previous activities exceeding 10 percent could cause detrimental soil disturbance in excess of LRMP standards prior to subsoiling mitigations despite limitations to machine traffic. Approximately 275 acres harvested under the Lower Jack or Coil Fiber EA's would be re-entered under this proposal. A number of other activity areas proposed under this DEIS were entered under a variety of prescriptions over the past twenty to fifty years, primarily as selection cuts incurring relatively low levels of disturbance. Subsoiling mitigation to rectify compaction incurred by proposed activities in excess of the LRMP standard would leave these areas in a condition of acceptable soil productivity in terms of the aerial extent of detrimental disturbance. The cumulative effects of proposed salvage activities in areas with existing levels of impact from past projects is not expected to negatively affect long-term site productivity.

The cumulative effects of implementing the B&B project with reasonably foreseeable projects within the Upper and Lower Metolius 5th field watershed on the soil resource would be minimal. Although the B&B project would add additional acres of activity within the 5th field watershed, very few of these actually overlap projects recently implemented. Proposed activities do not directly overlay unit areas proposed for implementation under the Metolius Basin project or any other reasonably foreseeable projects. Additional entries into commercial salvage units could occur to remove biomass products if markets permitted, although these operations would limit machine traffic to skid trails and landings created by the commercial salvage entry or existing prior to this entry. Incremental increases in detrimental disturbance would be less than 5 percent under this restriction and should maintain disturbance levels within acceptable levels.

Analysis summary: Alternatives 3, 4 and 5

Direct, indirect and cumulative effects to the physical, chemical and biological components of the soil resource for alternatives 3, 4 and 5 would be similar in type but different in extent than those described for Alternative 2. The chemical pathways and input rates of the primary nutrients described under Alternative 2 are also applicable for these action alternatives.

Alternative 3

Direct effects

Direct effects to the physical characteristics, effective ground-cover and biota of the soil resource for acres treated by ground-based operations under this alternative would be the same as those described for Alternative 2. The extent of ground-based activity acres in which direct effects could occur to the soil resource would be reduced by approximately 2,085 acres from Alternative 2. Table 3.12 summarizes acres of proposed activities and estimated detrimental disturbance by subwatershed for Alternative 3.

All units proposed under this alternative would meet LRMP Standards for detrimental disturbance following the implementation of all proposed harvest, fuels and mitigation treatments. Reductions in the extent of ground-based salvage activity would lower the amount of detrimental soil disturbance incurred under this alternative within the Upper Metolius 5th field watershed by less than 1% compared to Alternative 2. Detrimental soil disturbance within the 5th field watershed could be reduced by up to 287 acres, assuming an average of 20% detrimental disturbance in ground-based units following the implementation of all proposed activities and mitigations (Table 3.11). This alternative would need approximately 77 acres of subsoiling to rectify detrimental impacts incurred by proposed activities in excess of the LRMP soil standard SL-3.

Table 3.12 Predicted detrimental acres by logging system following implementation of proposed activities and mitigations within commercial salvage units.

Alternative 3 Commercial salvage unit acres							
Sub_watershed	% sub_shed proposed harvest	Proposed Salvage acres		Miles of Danger tree removal	Detr. Acres from ground-based *	Detr. acres from heli **	Total acres detr. ***
		ground	heli				
Abbot Creek	13	848	0	14	170	0	170
Cache Creek	0	0	0	0	0	0	0
Candle Creek	2	201	0	3	40	0	40
Canyon Creek	4	755	0	15	151	0	151
First Creek	2	296	0	5	59	0	59
Headwaters Metolius River	0	0	0	0	0	0	0
Jack Creek	14	1251	0	14	250	0	250
Lower Lake Creek	3	342	0	9	68	0	68
Upper Lake Creek	1	68	0	1	14	0	14

Detrimental disturbance incurred under this alternative would be located primarily on upland versions of the Sand Mountain ash or Blue Lake cinder soils that are not hydraulically connected to streams. This alternative would reduce the amount of disturbance on sensitive soils when compared to Alternative 2 by removing approximately 185 unit acres (Units 73 and 140) containing seasonal high water tables (sensitive soil SRI map unit 30) and all of the helicopter unit acres (sensitive soil SRI map units 21 and 22). All of the helicopter unit acres removed are located on slopes susceptible to displacement and have some risk of debris flows. Approximately 168 acres of ground-based units and 165 acres of helicopter units removed under this alternative were located within areas capable of contributing sediment to stream channels.

Chemical and Biological Components

Direct effects to the chemical and biotic components of the soil resource from the removal or burning of biomass from the site would be slightly less than under Alternative 2. Changes to the nutrient site budgets are based on the removal of approximately 60% of merchantable trees >12" from proposed salvage units and the treatment of up to 60% of the 3 to 12" non-merchantable material on site. Table 3.13 summarizes the estimated calculations of the amounts of nutrients that would be lost from harvest removal or fuels treatments within units proposed under Alternative 3. Assumptions used for calculating changes in nutrient budgets are included in footnotes to the table 3.11 under Alternative 2.

Table 3.13 Alternative 3 Nutrient Removal from Proposed Harvest within Stand Replacement Activity Units

Estimated Above Ground Nutrient Levels Remaining or Removed Per Activity (weight/acre)							
Nutrient	**Pre-fire amounts onsite @ 260 ft2/acre of basal area***	**Post-fire amounts onsite****	**Amount lost with l.t.a. yarding *****	**Amount in bolewood of tops**	**Post-fire amount contained in non-merchantable 3 to 12" dbh material (90 ft2/acre of basal area)**	**Amount remaining in 3 to 12" material after fuels treatment**	**Amount remaining after harvest (lta) and fuels treatments**
carbon	138.4 tons/ac	96.6 tons/ac	12.64 tons/ac	0.14 tons/ac	22.41 tons/ac	8.96 tons/ac	70.6 tons/ac
nitrogen	1,356 lbs/ac	546.8 lbs/ac	57.6 lbs/ac	0.45 lbs/ac	111.12 lbs/ac	44.45 lbs/ac	422.5 lbs/ac
phosphorus	145.7 lbs/ac	61.89 lbs/ac	8.6 lbs/ac	.07 lbs/ac	16.2 lbs/ac	6.48 lbs/ac	43.6 lbs/ac

Danger tree removal: Ground-based harvest and yarding of danger trees would occur under the same guidelines as Alternative 2. There would also be a reduction in the extent of impacts from danger tree removal operations due to the change in haul road miles compared to the other action alternatives. This alternative would remove danger trees from approximately 60 miles of haul road using ground-based harvest systems, approximately 66% of Alternative 2.

Indirect effects

Alternative 3 would have similar indirect effects to the soil resource within proposed activity unit areas as those described for erosion and productivity for unit acres under Alternative 2 within the Matrix. Prescriptions for unit acres in the LSR under this alternative would remove lesser amounts of biomass and leave higher levels of snags[26] than under Alternative 2. These changes would indirectly reduce the risk of erosion losses by providing higher levels of down wood to intercept rain drops and dissipate overland flow energies during storm events in the LSR unit areas when compared to Alternative 2. Indirect effects to productivity of all activity areas would not be expected to be different than those described for Alternative 2 in the Matrix units and only slightly different for the LSR units since the increase in coarse wood biomass left on site would not alter the availability or levels of below ground nutrient pools.

Cumulative effects

Alternative 3 would have cumulative effects similar to those described for Alternative 2.

Alternative 4

Direct effects

Direct effects to the soil resource for acres treated by ground-based operations under this alternative would be the same as those described for Alternative 2. This alternative would detrimentally disturb the least amount of total acreage of any of the action alternatives, reducing the extent of acres on which direct effects could occur by approximately 4,122 acres from Alternative 2 and 2,037 acres from Alternative 3. Table 3.14 summarizes acres of proposed activities and estimated detrimental disturbance by subwatershed for Alternative 4.

Ground-based salvage units dropped from Alternative 2 are all located within LSR and primarily located on upland versions of the Sand Mountain ash or Blue Lake cinders. Potential impacts to sensitive soils would be reduced when compared to Alternative 2 since approximately 280 acres dropped from Alternative 2 are located on soils with seasonal high water tables (sensitive soil SRI map unit 30) and all helicopter units have been removed (sensitive soil SRI map unit 21 and 22). When compared to Alternative 2, total detrimental soil disturbance from commercial salvage operations would be up to 558 fewer acres, assuming an average of 20% detrimental disturbance in ground-based units following the implementation of all proposed activities and mitigations under all alternatives (Table 3.11). This alternative would need approximately 46 acres of subsoiling to rectify detrimental impacts incurred by proposed activities in excess of the LRMP soil standard SL-3.

[26] LSRA snag retention guidelines range from 3 to 12 per acre for the Ponderosa Pine and Mixed Conifer PAGs, respectively.

Table 3.14 Predicted detrimental acres by logging system following implementation of proposed activities and mitigations within commercial salvage units.

Alternative 4 Commercial salvage unit acres							
Sub_watershed	% sub_shed proposed harvest	Proposed Salvage acres		Miles of Danger tree removal	Detr. Acres from ground-based *	Detr. acres from heli **	Total acres detr. ***
		ground	heli				
Abbot Creek	1	34	0	1	7	0	7
Cache Creek	0	0	0	0	0	0	0
Candle Creek	0	0	0	0	0	0	0
Canyon Creek	3	720	0	12	144	0	144
First Creek	0	47	0	0	9	0	9
Headwaters Metolius River	0	0	0	0	0	0	0
Jack Creek	10	907	0	7	181	0	181
Lower Lake Creek	0	0	0	0	0	0	0
Upper Lake Creek	0	18	0	0	4	0	4

Chemical and Biological Components

Direct effects to the chemical and biotic components of the soil resource from the removal or burning of biomass from the site would be equal to those under Alternative 2. Changes to the chemical component for this discussion, including site budgets of carbon and nitrogen, are based on the removal of approximately 80% of merchantable trees >12" from proposed salvage units and the treatment of up to 60% of the 3 to 12" non-merchantable material on site. Table 3.15 summarizes the estimated calculations of the amounts of nutrients that would be lost from harvest removal or fuels treatments within units proposed under Alternative 4. Assumptions used for calculating changes in nutrient budgets are included in footnotes to the table 3.6 under Alternative 2.

Table 3.15 Alternative 4 Nutrient Removal from Proposed Harvest within Stand Replacement Activity Units

Estimated Above Ground Nutrient Levels Remaining or Removed Per Activity (weight/acre)							
Nutrient	Pre-fire amounts onsite @ 260 ft2/acre of basal area*	Post-fire amounts onsite**	Amount lost with l.t.a. yarding ***	Amount in bolewood of tops	Post-fire amount contained in non-merchantable 3 to 12” dbh material (90 ft2/acre of basal area)	Amount remaining in 3 to 12” material after fuels treatment	Amount remaining after harvest (lta) and fuels treatments
carbon	138.4 tons/ac	96.6 tons/ac	21.08 tons/ac	0.14 tons/ac	22.41 tons/ac	8.96 tons/ac	62.1 tons/ac
nitrogen	1,356 lbs/ac	546.8 lbs/ac	96.0 lbs/ac	0.45 lbs/ac	111.12 lbs/ac	44.45 lbs/ac	384.1 lbs/ac
phosphorus	145.7 lbs/ac	61.89 lbs/ac	14.39 lbs/ac	.07 lbs/ac	16.2 lbs/ac	6.48 lbs/ac	37.8 lbs/ac

Danger tree removal: Ground-based harvest and yarding of danger trees would occur under the same guidelines as Alternative 2. There would also be a reduction in the extent of impacts from danger tree removal operations due to the change in haul road miles compared to the other action alternatives. This alternative would remove danger trees from approximately 20 miles of haul road using ground-based harvest systems, approximately 25% of Alternative 2 and 33% of alternatives 3 and 5.

Indirect effects

Alternative 4 would have similar indirect effects to the soil resource within proposed activity unit areas as those described for Alternative 2. Prescriptions for unit acres in the in the Matrix would have the same number of snags retained as under Alternative 2. Acres dropped from the LSR would have significantly higher levels of large coarse wood when compared to Alternative 2 and would could have changes in productivity associated with alterations of microbial activity or increased nutrient volatilization from soil heating during a future fire event.

Cumulative effects

Alternative 4 would have cumulative effects similar to those described for Alternative 2 within proposed activity unit areas. Prescriptions within proposed activity areas would be the same as those included in Alternative 2.

Alternative 5

Direct effects

Direct effects to the soil resource on acres treated by ground-based operations under this alternative would be the same as those described for Alternative 2. Detrimental soil disturbance would be reduced by approximately 303 acres when compared to Alternative 2, assuming an average of 20% detrimental disturbance in ground-based units under all alternatives (Table 3.12; Table 3.9). Table 3.16 summarizes acres of proposed activities and estimated detrimental disturbance by subwatershed for Alternative 5. This alternative would need approximately 76 acres of subsoiling to rectify detrimental impacts incurred by proposed activities in excess of the LRMP soil standard SL-3.

Although the majority of acres dropped under this alternative are located on upland versions of the Sand Mountain ash, this alternative would reduce the amount of disturbance on sensitive soils when compared to Alternative 2 by removing approximately 100 unit acres (Unit 73) containing seasonal high water tables (sensitive soil SRI map unit 30) and all of the helicopter unit acres (sensitive soil SRI map units 21 and 22). All of the helicopter unit acres removed are located on slopes susceptible to displacement and have some risk of debris flows. Approximately 165 acres of helicopter units removed under this alternative were located within areas capable of contributing sediment to stream channels.

Danger tree removal: Ground-based harvest and yarding of danger trees would occur under the same guidelines as Alternative 2. There would also be a reduction in the extent of impacts from danger tree removal operations due to the change in haul road miles compared to the other action alternatives. This alternative would remove danger trees from approximately 60 miles of haul road using ground-based harvest systems, approximately 66% of Alternative 2.

Table 3.16 Predicted detrimental acres by logging system following implementation of proposed activities and mitigations within commercial salvage units.

Alternative 5 Commercial salvage unit acres							
Sub_watershed	% sub_shed proposed harvest	Proposed Salvage acres		Miles of Danger tree removal	Detr. Acres from ground-based *	Detr. acres from heli **	Total acres detr. ***
		ground	heli				
Abbot Creek	17	1062	0	14	212	0	212
Cache Creek	0	13	0	0	3	0	3
Candle Creek	2	221	0	3	44	0	44
Canyon Creek	4	796	0	15	159	0	159
First Creek	3	443	0	7	89	0	89
Headwaters Metolius River	1	115	0	0	23	0	23
Jack Creek	15	1420	0	14	284	0	284
Lower Lake Creek	4	477	0	9	95	0	95
Upper Lake Creek	1	86	0	1	17	0	17

Chemical and Biological Components

Direct effects to the chemical and biotic components of the soil resource from the removal or burning of biomass from the site would be the lowest of any action alternatives under Alternative 5. Changes to the chemical component for this discussion, including site budgets of carbon and nitrogen, are based on the removal of approximately 40% of merchantable trees >12” from proposed salvage units and the treatment of up to 60% of the 3 to 12” non-merchantable material on site. Table 3.17 summarizes the estimated calculations of the amounts of nutrients that would be lost from harvest removal or fuels treatments within units proposed under Alternative 2. Assumptions used for calculating changes in nutrient budgets are included in footnotes to the table 3.11 under Alternative 2.

Table 3.17 Alternative 5 Nutrient Removal from Proposed Harvest within Stand Replacement Activity Units

Estimated Above Ground Nutrient Levels Remaining or Removed Per Activity (weight/acre)							
Nutrient	**Pre-fire amounts onsite @ 260 ft2/acre of basal area***	**Post-fire amounts onsite****	**Amount lost with l.t.a. yarding *****	**Amount in bolewood of tops**	**Post-fire amount contained in non-merchantable 3 to 12" dbh material (90 ft2/acre of basal area)**	**Amount remaining in 3 to 12" material after fuels treatment**	**Amount remaining after harvest (lta) and fuels treatments**
carbon	138.4 tons/ac	96.6 tons/ac	8.4 tons/ac	0.14 tons/ac	22.41 tons/ac	8.96 tons/ac	74.8 tons/ac
nitrogen	1,356 lbs/ac	546.8 lbs/ac	38.4 lbs/ac	0.45 lbs/ac	111.12 lbs/ac	44.45 lbs/ac	441.7 lbs/ac
phosphorus	145.7 lbs/ac	61.89 lbs/ac	5.75 lbs/ac	.07 lbs/ac	16.2 lbs/ac	6.48 lbs/ac	46.4 lbs/ac

Indirect effects

Alternative 5 would have similar indirect effects to the soil resource within proposed activity unit areas as those described for erosion and productivity for unit acres under Alternative 2 within the Matrix. Coarse wood level within units located in the Matrix would be the same as those described for Alternative 2. Alternative 5 would have similar indirect effects to the soil resource within proposed activity unit areas as those described for erosion and productivity for unit acres under Alternative 2 within the Matrix.

Coarse wood levels within treated units located in the LSR would be higher than under the other action alternatives, although substantially less than the No Action alternative. Prescriptions for unit acres in the LSR under this alternative would remove lesser amounts of biomass and leave higher levels of snags[27] than under the other action alternatives. Higher snag levels in the LSR unit areas would indirectly reduce the risk of erosion losses by providing higher levels of down wood to intercept rain drops and dissipate overland flow energies during storm events when compared to Alternative 2.

Indirect effects to productivity of activity areas would not be expected to be different than those described for Alternative 2 in the Matrix units and only slightly different for the LSR units since the increase in coarse wood biomass left on site would not alter the availability or levels of below ground nutrient pools. These levels are likely to exceed those necessary for site productivity and may elevate the risk of soil heating in the event of a wildfire in the next twenty to seventy years.

Cumulative effects

Alternative 5 would have cumulative effects similar to those described for Alternative 2 within proposed activity unit areas. Prescriptions within proposed activity areas would be the same as those included in Alternative 2.

[27] Alternative 5 snag retention guidelines include all trees greater than 20" dbh.

3.5 Water Quality

Introduction
The water quality analysis area for this project is 109,969 acres and includes the entire subwatershed area for each of the nine subwatersheds that are within or partially within the B&B project boundary (Map 3.3). Although 146 acres of Jefferson Creek subwatershed are technically in the project boundary, this subwatershed is not included in the water quality analysis area because no proposed actions would occur in it. The existing condition and environmental effects for the water quality analysis area are described in this document. In addition, all these subwatersheds were analyzed in the Metolius Watershed Analysis and Update (USDA Forest Service 1996 and 2004).

Existing Condition

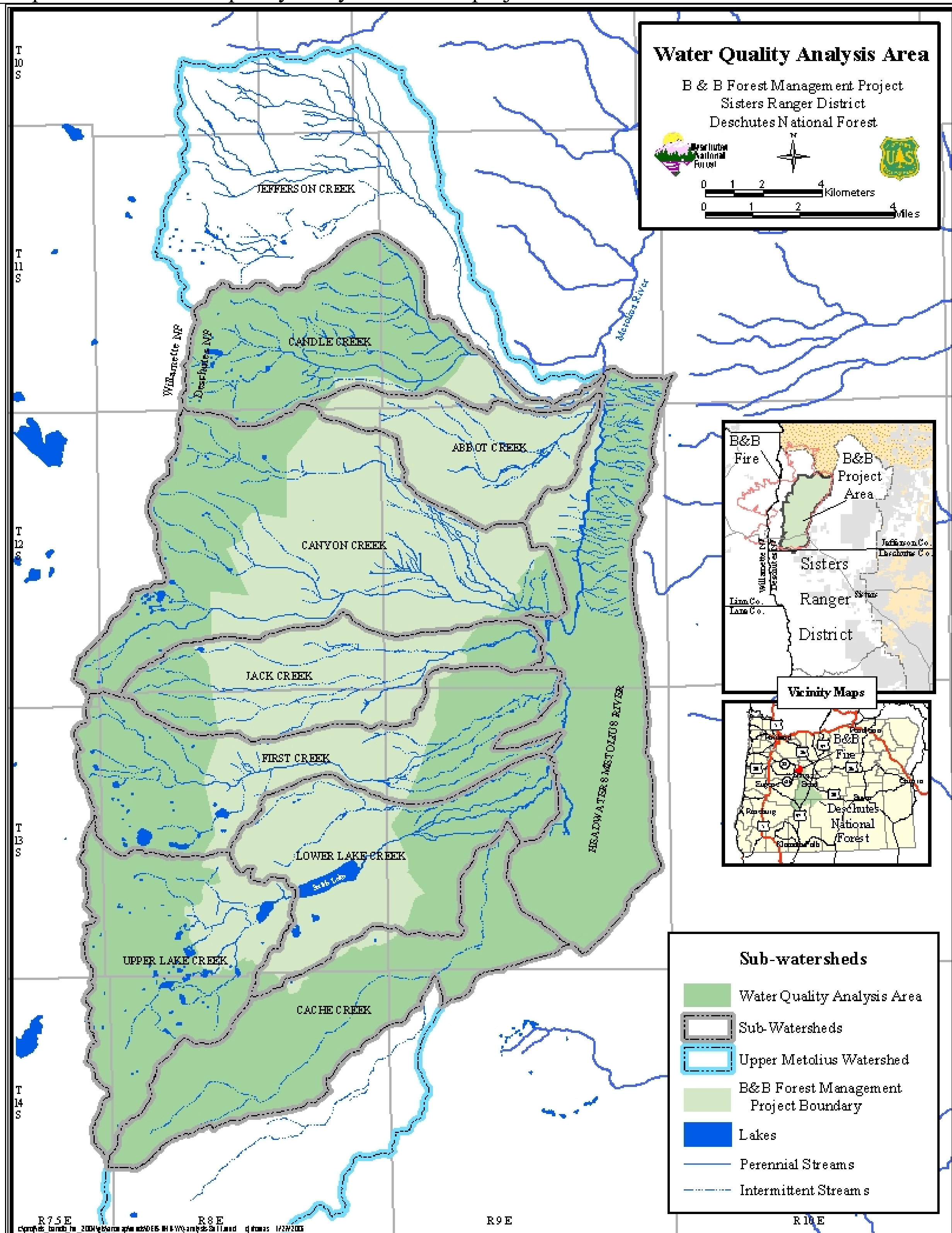
Streamflow
Streamflow can be affected by changes in precipitation input and by altering the mechanism by which the precipitation reaches the stream. Precipitation input can be increased by the loss of vegetation. This results in a reduction in transpiration and canopy interception of rainfall/snowfall, which increases the amount of precipitation available for stream flow. Mechanisms for transporting water to the streams can be altered by creating impermeable surfaces and/or rerouting overland flow. Overland flow can increase when rain falls on frozen or snow-covered ground; thus creating a process called rain-on-snow. Activities that increase the amount or size of vegetative openings may increase the risk of streamflow effects given a rain-on-snow event because studies have shown that snow-water-equivalent and snow melt rates are higher in open areas (both burned and natural) than in forested areas (McCaughey and Farnes 2001; Skidmore et al. 1994).

Roads can also alter surface hydrology through several mechanisms including interception of subsurface runoff (through compaction), concentrating surface runoff, and extending channel networks which increases overland flow transport to the streams. In addition, past harvest or fire suppression equipment (usually in skid trails, bulldozer lines, and landings) can cause compaction (represented as a portion of detrimental soil condition[28]) and associated hydrologic impacts. However, compaction in skid trails is considerable less than roads and compaction in bulldozer lines is even less than skid trails because there are fewer passes by heavy equipment. Roads or skid trails on slopes adjacent to streams, crossing streams, and hydrologically connected to streams are the most likely to transport overland flow to the stream. Studies have shown that roads can increase high flows but results are variable (King and Tennyson 1984, Wemple et al. 1996, Harr et al. 1975).

The flow of the Deschutes River, which the Metolius River contributes to, is "more remarkably uniform than that of any other river in the United States comparable with it in size" (cited in O'Conner 2002). This same unique flow regime is also seen in the smaller Metolius River. Although precipitation varies considerable with seasonal changes and snow can melt rapidly, the river volume remains relatively constant. In the Metolius watershed, "much of the seasonal precipitation and snow melt infiltrates into extensive groundwater systems within the highly permeable young volcanic fields and basin fill deposits, emerging months to years later in large springs at the headwaters of the Metolius River …" (cited in O'Conner et al 2002).

[28] The amount of area compacted from harvest activities constitutes a majority of the overall detrimental soil condition estimate, which can also include detrimental soil displacement and burn damage (refer to Soils Report).

Map 3.3 - B&B water quality analysis area and project area.



The U.S. Geological Survey measures stream flows on the Metolius River near Grandview, OR, one mile upsteam of LBC Reservoir at river mile 13.6 (14091500). Drainage area at this gage is 316 mi^2 and the period of record is from 1922 to the present. Average monthly flow only range from 1348 cfs in October to 1631 cfs in June. Mean annual discharge is 1497 cfs and the maximum discharge ever recorded is 8430 (Feb. 7, 1996).

The stable flow of the Metolius River is due to the deep high porosity soils (Blue Lake cinders near Suttle Lake area and Sand Mountain ash in the remaining project area) and a substratum of underlying glacial outwash/till and the highly permeable volcanics. As a result of these watershed characteristics, topography in the Upper Metolius watershed is not very dissected and stream density is low. In fact, there are only 90 miles (0.2 mi/mi^2) of perennial water in the analysis area (Table 3.18). Streams in the B&B Fire Recovery analysis area flow east from the crest of the Cascade Mountains into the upper Metolius River.

Many streams in the analysis area are fed or partially fed by seasonal or perennial springs that emerge in their intermediate reaches around 3500 ft. There are no other published streamflow records for any of the streams in the analysis area; however, the Jefferson Creek gage which is one drainage to the north of the analysis area, generally represents the flow regime in these primarily spring dominated tributaries to the Metolius River. Peak flow in Jefferson Creek usually occurs during snow-melt between May and early July or occasionally during rain-on-snow events that mostly occur between November and February. In addition, streams that are mostly fed by springs are generally more stable with minimal bank erosion. Conversely, streams that are more responsive to rainfall events are "flashier" and tend to be less stable and have more bank erosion.

Table 3.18 Streams and their flow regime in the B&B Fire Recovery Analysis Area.

2003 SWS	Named streams	Perennial (mi)	Intermittent (mi)	Spring-fed	Flashy
Abbot Creek	Abbot Creek	5.9	21.6	Intermediate and lower reaches	
Cache Creek	Cache Creek	0.0	14.0		All
Candle Creek	Candle and Cabot Creeks	12.2	41.2	Candle and Cabot Creeks	
Canyon Creek	Canyon, Bear Valley, Roaring, and Brush Creeks	25.6	55.6	Roaring Ck. and intermediate and lower reaches of Brush Ck.	Upper Brush Creek
First Creek	First Creek	6.5	35.2		All
Jack Creek	Jack Creek	6.6	22.0	Intermediate and lower reaches	
Headwaters Metolius River	Metolius River	16.2	43.6	Large spring at headwaters	
Upper Lake Creek	Link Creek	3.3	14.5	Lake controlled and spring-fed	
Lower Lake Creek	Lake and Davis Creeks	13.2	12.4	Lake Creek is controlled by Suttle Lake	
Total Upper and Lower Metolius Watersheds		300.8	560.3		

Recent harvest activity and fire severity/mortality[29] could have an effect on water yield and streamflow response in the B&B analysis area that has not yet been observed. Approximately 64% of the B&B Fire Salvage analysis area was burned in 2002 and 2003 (
Table 3.19), most of which overlaps recent past harvest acres[30]. Therefore, the existing reduction in tree density is primarily a result of the recent fires. In addition, studies have shown that fire effects to peak flow timing and magnitude can be exacerbated by roads, skid trails, landings, and firelines (Lotspeich et al 1970, DeByle and Packer 1972). If increases in water yield are concentrated during peakflows then they can affect channel stability. Watersheds exhibit great natural variability in flow, and can accommodate some increase in peak flows without damage to stream channels and aquatic organisms. However, shifts in the frequency of channel-forming flows will result in physical adjustment of the channel such as increases in channel width, depth, erosion, and sediment deposition.

Table 3.19 Total acres and percent of subwatersheds (SWS) burned since 1994. Acres in the mortality classes refer to fires since 2002. Mortality was not classified before 2001, therefore, the unknown mortality class refers to fires between 1994 and 2001.

2003 SWS	Total Burned	Stand Replacement		Mixed Mortality		Under Burned or Unburned		Unknown Mortality	
	%	Acres	%	Acres	%	Acres	%	Acres	%
Abbot Creek	100	3336	52	1517	24	1524	24	0	0
Cache Creek	47	1385	12	3076	26	731	6	326	3
Candle Creek	65	2438	22	1886	17	2814	26	17	0
Canyon Creek	92	7502	36	4590	22	7191	34	0	0
First Creek	70	2715	21	3047	23	3415	26	0	0
Jack Creek	88	1335	15	1691	18	5033	55	0	0
Headwaters Metolius River	6	199	1	109	1	592	4	0	0
Upper Lake Creek	60	2555	23	2740	25	1326	12	12	0
Lower Lake Creek	64	2006	18	2269	21	2719	25	0	0
B&B Fire Recovery analysis area	64	23471	21	20925	19	25345	23	355	< 1
Total Upper and Lower Metolius 5th field Watersheds	35	40056	14	26988	9	31968	11	2353	1

[29] Burn severity describes the effects of the fire on the soil hydrologic function (amount of surface litter, erodibility, infiltration rate, runoff response) and productivity. The vegetation mortality classes in the B&B fire represent the burn severity as it relates to hydrologic response (see Soils Report). The stand burn mortality classes are: stand replacing (> 75% stand mortality), mixed mortality (between 25% and 74% stand mortality), and underburned/unburned (< 24% stand mortality). No needles or duff remain in stand replacing burn areas and only 1000 hour fuels are left. In mixed mortality areas, the duff is mostly consumed but needles and 1000 and 100 hour fuels remain. In underburned areas, most of the duff remains and needles and branches cover the ground.

[30] Only approximately 300 acres of timber harvest has occurred in the last 10 years outside of the burn area within the B&B analysis area.

The risk of negative water quantity effects due to wildfire and the interaction between fire effects and anthropogenic effects was evaluated in the Metolius Watershed Analysis Update (USDA Forest Service 2004a). The risk of increased peak flows (represented as the streamflow risk factor) for the first year following the fire was determined for each subwatershed and for the Metolius 5th field watersheds based on the subwatersheds natural sensitivity and estimated changes to evapotranspiration and impermeable surfaces.

The Metolius Watershed Analysis Update identified Candle Creek, Canyon Creek, First Creek, and Headwaters of the Metolius River subwatersheds as having the highest risk of increased streamflows in the analysis area (USDA Forest Service 2004a). Each of these subwatersheds, except the Headwaters of the Metolius River subwatershed, experienced a stand replacing fire over more than 20% of the subwatershed area with much of it occurring in the rain-on-snow zone, and showed a substantial reduction in estimated evapotranspiration. Although the Headwaters of the Metolius River subwatershed was almost unaffected by the fire and is generally not very hydrologically responsive, the upper Metolius River was considered to have a high streamflow risk as a result of streamflow inputs from tributaries with high streamflow risk. Conversely, Abbot Creek was not considered at high risk of streamflow increase even though more than 50% of Abbot Creek subwatershed was burned by a stand replacing fire it had the largest reduction in estimated evapotranspiration because the natural hydrologic response of the subwateshed is relatively low (Aq. Table 8 in the Metolius Watershed Analysis Update).

All subwatersheds have high road densities and Candle Creek, Canyon Creek, and the Headwaters of the Metolius subwatersheds have more than 10 miles of road within the Riparian Reserves and Canyon Creek and the Headwaters of the Metolius subwatersheds have over 100 stream crossings (USDA Forest Service 2004a). Although many projects have been implemented to reduce road-stream interactions such as decommissioning or inactivating roads, improving stream crossings, and implementing restorations projects to get water off roads, there are still over 88 road segments in the B&B project area that are hydrologically connected to streams[31].

The streamflow risks identified in the Metolius Watershed Analysis Update have decreased since the fire because the potential for overland flow has decreased. Ground vegetation, which evapotranspires and helps slow overland flow, has greatly recovered since the fire. Stand exam data, research, and observation data in the project area shows herbaceous ground cover in the summer of 2004 (1 year after the fire) ranged from 10 to 70% (Stand Exam data 2004; Fields data 2004; Sussmann 2004, personal observation). Also, dead trees and branches continue to fall and provide ground roughness for slowing overland flow and reducing the erosive effects of rainfall. In addition, field observations of overland flow on steep, south facing slopes have shown that neither the spring melt nor the summer convective storms, including a 2 to 25-year, 30 min event that occurred one year after the fire, produced much rilling or any rilling that reached a stream. Overall, the risk of streamflow increase, especially in the form of peakflow increase, in these subwatersheds is much less than other regional subwatersheds due to the naturally low hydrologic responsiveness of the Metolius watersheds, as seen by it’s usually stable flow.

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[31] Hydrologically connected road segments drain directly into a stream. They are identified by the hydrologist and are defined as:

41. the road segment or ditch between the stream crossing and the last drainage structure (i.e. relief culvert, waterbar, etc…)
41. roads in Riparian Reserves with drainage structures that feed directly into streams (i.e. segments of the north loop of 1210 road)

Water Quality

Temperature

The Metolius Watershed Analysis Update analyzed stream temperature data in the B&B analysis area (USDA Forest Service 2004a). The long term analysis of water temperature has showed no significant trends over time of any streams in the Metolius Watershed (USDA Forest Service 2004a). Some variation could be attributed to water years and drought cycles, although water discharge data were not available for comparison. Lower Brush Creek, Canyon Creek (part of which is downstream from Brush Creek), First Creek, and Lake Creek are streams in the B&B analysis area that were listed on the 2002 303(d) list as “Water Quality Limited” by the State of Oregon for water temperature exceedances over the standard (ODEQ 2002). Water temperatures in Lake Creek are consistently higher than the State Standards and water temperatures in other streams in the B &B analysis area because water feeding Lake Creek flows out of Blue Lake and Suttle Lake. The State water temperature criteria was updated in 2003, and the maximum 7-day average maximum stream temperature for Canyon Creek no longer exceeds the standard.

Stream shade has been significantly denuded in riparian areas classified as stand replacing burn in the B&B Fire Recovery analysis area (

Table 3. 20) (USDA Forest Service 2004a). Riparian areas in Abbot Creek, Brush Creek, Cabot Creek, Candle Creek, First Creek, and upper Link Creek were the most severely impacted. Stream temperature monitoring showed that the maximum 7-day average maximum stream temperature in 2004 exceeded the maximum temperatures for all other years on record in all these streams just mentioned, except Link Creek and First Creek (Table 3.21). The maximum 7-day average maximum stream temperature has exceeded the 2003 standard in Brush Creek, Lake Creek, and Link Creek.

Table 3. 20 Percent of riparian reserves (RRs) within the Lower and Upper Metolius watersheds that were burned since 1994 by mortality class and subwatershed (SWS). Percent by mortality class refer to fires between 2002 and 2003. Unknown mortality refers to fires between 1994 and 2002. SR = stand replacement; M = mixed mortality; UB = underburned or unburned; UK = unknown mortality.

2003 SWS	**Percent of RR Burned**	**Percent of RR burned by mortality class**			
		SR	**M**	**UB**	**UK**
Abbot Creek	100	54	25	20	0
Cache Creek	37	7	19	5	6
Candle Creek	68	23	20	25	0
Canyon Creek	92	35	25	32	0
First Creek	67	22	23	22	0
Jack Creek	87	13	19	55	0
Headwaters Metolius River	4	0	0	4	0
Upper Lake Creek	67	30	26	12	0
Lower Lake Creek	40	11	12	17	0
Total Upper and Lower Metolius 5th field Watersheds	**39**	**15**	**10**	**13**	**0**

Table 3.21 Water temperature monitoring in the B&B Fire Recovery Analysis Area.

Stream	**Pre-fire Max 7-day ave. max. temperature**	**Post-fire Max 7-day ave. max. temperature (2004)**	**2003 Water Temperature standard**
Abbot Creek @ lower 1200 rd	8.9 – 9.3 ºC	11.3 ºC	12 ºC
Brush Creek @ 1200 rd	9.9 - 10.6 ºC	13.4 ºC	12 ºC
Cabot Creek @ Jefferson trailhead	9.4 ºC	11.3 ºC	12 ºC
Candle Creek @ 1290 rd	4.1 - 6.9 ºC	7.2 ºC	12 ºC
Canyon Creek @ 1200 rd	6.6 - 11.2 ºC	10.2 ºC	12 ºC
First Creek @ mouth	12.7 ºC	NA	12 ºC
Jack Creek @ 1420 rd	8.7 – 11.1 ºC	9.8 ºC	12 ºC
Lake Creek @ trail 99	20.9 – 24.9 ºC	22.7 ºC	12 ºC
Link Creek @ lower 2070 rd	14.4 - 16.4 ºC	16.4 ºC	12 ºC
Metolius River @ bridge 99	8.9 – 10.2 ºC	10.2 ºC	12 ºC
Roaring Creek @ 1260	6.9 – 8.2 ºC	8.2 ºC	12 ºC

As the fire killed trees fall into the channel they will provide some shade, but large tree (> 21” dbh) recovery is not expected for another 150 years. Approximately 100 acres were planted with conifers to enhance the speed of shade recovery in stand replacement burn areas along Abbot Creek, Brush Creek, and Candle Creek. In addition, the recovery of riparian shrubs are expected to rapidly recover over the next few years and provide some cover especially on the smaller drainages.

Sedimentation

The amount of sediment transported to or eroded within a stream channel can affect the beneficial uses of water, and is frequently used as a measure of overall water quality. Oregon administration rules states, “No more than 10 percent cumulative increases in natural streams turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity-causing activity” (OAR 340-041-0336; ODEQ 2003; USDA Forest Service 2004a). The Sisters Ranger District monitors fine sediment in spawning gravels in lieu of turbidity monitoring. As stream channel size and shape have evolved to carry the historical sediment load, large increases in sediment yielded to a stream may exceed the stream's ability to transport the load (Dunne and Leopold 1978). As a result, sediment deposition will occur in the stream channel, especially in low-gradient sections of a stream, as point bars and mid-channel bars. Bank erosion may also be increased, thus adding even more sediment to the load in the stream.

For this report, sedimentation refers to the amount of fine sediment in the streams. It can be affected by changes in overland sediment input to streams and by instream channel erosion. The location in which erosion occurs is the most important factor in determining potential overland sediment input to streams. Areas adjacent to streams are the most likely to contribute sediment to streams; however, upland areas maybe hydrologically connected to streams via the road network. Various federal plans identify riparian buffers in order to protect water quality, channel stability, and large wood debris recruitment (NWFP, DLRMP, PACFISH). A compilation of studies on effectiveness of riparian buffers (Belt et al. 1992) concluded that non-channelized sediment rarely travels more than 300 feet, and that 200-300 foot riparian “filter strips” are generally effective at protecting streams from sediment from non-channelized flow (USDA and USDI 1995).

Overland sediment input can be altered by management activities or events occurring in areas that contribute to the streams and that disturb the soil and/or cause soil compaction. Activities or events that disturb the soil are usually a result of a loss of ground vegetation that helps stabilize the soil. These effects are usually short-term and return to pre-disturbance levels once ground vegetation reestablishes. Past activities or events that have disturbed the soil in the B&B analysis area include timber harvesting, road construction, fuels reduction, and wildfire (Section 3.3). In managed forested areas, the main source of direct sediment is from road construction associated with timber harvest (Helvey and Fowler 1979). Tree felling is not usually considered a major cause of increased sediment; however, methods for removing harvested timber (such as tractor and cable yarding) can cause remove ground vegetation and cause erosion.

Soil compaction in areas that contribute to streams can alter overland sediment input by concentrating overland flows, which causes erosion that may be transported to streams. The negative effects of soil compaction are usually a long-term effect unless infiltration is restored or improved through subsoiling (refer to Soils Report). Soil compaction in the B&B analysis area is often caused by roads, skid trails, landings, and firelines. Roads within riparian areas, especially on steep slopes, have the most direct effect on streams and riparian areas by accelerating erosion, reducing streamside shade, decreasing floodplain area, and increasing the number of stream crossings (Megahan 1983).

Instream channel erosion can be altered by management activities or events that affect overland sediment input, streamflow, and/or channel morphology. Increased sediment load in a stream can change the channel shape and profile which can put additional pressure on the streambanks. Also, increased peakflows can be very erosive and can cause streambanks to unravel, especially if riparian vegetation or other natural armoring is lacking. Likewise, changes to channel morphology such as a reduction in the number of energy dissipating pools or a shortening of stream length can add stress to the streambanks.

Activities and events that could alter overland sedimentation input were analyzed in the Metolius Watershed Analysis Update (USDA Forest Service 2004a). The percent of the subwatersheds in potential detrimental soil condition**Error! Bookmark not defined.**, as a result of harvest activity, in the B&B analysis area ranges from 6 to 21 percent. Road densities in all the subwatersheds in the B&B analysis area are high and in most subwatersheds there are over 5 miles of road within Riparian Reserves, over 1 mile of road in RRs on slopes greater than 30%, and over 20 stream crossings. In the

B&B analysis area there are 78 miles of road within RRs, approximately 20 miles of road in RRs on slopes greater than 30%, and over 500 stream crossings (USDA Forest Service 2004a).

Effects to water quality from sedimentation have been monitored since 1988 at 10 sites in the Metolius River and it's tributaries using a modified McNeil core sampling technique. These results are discussed in detail in the Metolius Watershed Analysis Update (USDA Forest Service 2004a). Average fine sediment (< 6.4 mm) in riffles is 29% (range from 17 to 44%), and approximately 28% in the Metolius River above Lake Creek. Prior to the 1996 flood, fine sediment (< 6.4 mm) slightly decreased at all the sites that were monitored (5 sites), and statistically decreased in Roaring Creek. Following the 1996 flood, fine sediment significantly decreased in Roaring Creek, Jefferson Creek, Abbot Creek and Jack Creek. The South Fork Lake Creek declined in fine sediment after the 1996 flood, but is now similar to pre-flood conditions. Since the 1996 flood, fine sediment significantly increased only at the Metolius River site upstream of Lake Creek. Average post-flood percent fines < 6.5 mm in the Metolius Basin are 26% and range between 19 and 31%.

Streambank instability was monitored during stream surveys of the following streams Cabot Creek, Candle Creek, Jack Creek, Link Creek, and the Metolius River between 1996 and 2001. The percent unstable banks in these streams before the fires was low, generally less than 2 percent. Some bank erosion has been observed in the streams with a “flashy” flow regime such as Brush Creek and First Creek.

Results indicate that past management activities were not causing sedimentation to increase at the subwatershed and watershed scale during the period from 1988 to 1996. The fine sediment was flushed out of the streams in 1996 by the flood and since then has not significantly redeposited (statistically speaking), except in the Metolius River upstream of Lake Creek (USDA Forest Service 2004a). It is difficult to determine if fine sediment levels have reached pre-flood levels in the Metolius River because no pre-flood data is available for these sites.

Regardless of these management activities, the Metolius Watershed does not appear to contribute a substantial amount of sediment, as was shown in a recent study (O'Connor et al. 2003). The study evaluated sediments accumulated in the Metolius Arm of Lake Billy Chinook reservoir from 1964 to 1998. The report states that there is no detectable delta and that sediment yields for the 34-year period between 1964 and 1998 are remarkably low and possibly the lowest in the region. This is especially notable because the 34-year period includes the two largest flow events in the last 140 years.

Recent harvest activity, recent fires, and the combined effects of the fire and existing roads and skids trails could have an effect on sedimentation that has not yet been observed. Studies have shown that the combined effects of the fire and the existing roads and skids trails can exacerbate sedimentation effects (Lotspeich et al 1970, DeByle and Packer 1972). For example, increases in peakflow could increase the risk of water eroding roads or stream-crossings if ditches and/or culverts are overtopped or blocked. Many undersized culverts were replaced during Burned Area Emergency Response (BAER) implementation; however, a few crossings and relief culverts remain at risk in the B&B project area (Section 3.3). In addition, further analysis of the roads recommended for decommissioning, inactivating, and potential inactivating or decommissioning during the B&B Roads Analysis indicates that approximately 37 of the road miles within the B&B project boundary recommended for one of these actions are at high risk of contributing sediment to streams.

Table 3.22. Culverts or fords in the Upper and Lower Metolius watersheds that are undersized or at risk of failing.

Road	**MP**	**Stream Crossing**	**Predicted 100-yr discharge (cfs) prior to fire**	**Discharge capacity of culvert (cfs)**	**Bankfull width (ft)**	**Pre-fire culvert span (ft)**
1230-500	1.2	Bear Valley Ck.	213	75	17	5
1210	0.5	Davis Ck. (Private)		22	11	4
1210	7.0 to 9.4	North loop of 1210 parallels First Creek and relief culverts are hydrologically connected to the stream	Stormflow – ditch relief	3	NA – gullies have formed at the outlets	1.25
1200	north	Davis Ck.		57	11	4.7
1200	south	Davis Ck.		57	11	4.7
1200		Lake Ck.		410	22	12.5
1232	1.0 to 2.3	Segment of road parallels an intermittent tributary to Jack Creek and relief culverts are hydrologically connected to the stream	Stormflow – ditch relief	3	NA – gullies have formed at the outlets	1.25
1260	1.2	Roaring Ck.		150	17	10.5
1270	0.5 to 1.7	Segment of road parallels Abbot Creek and relief culverts are hydrologically connected to the stream	Stormflow – ditch relief	3	NA – gullies have formed at the outlets	1.25

Approximately 64 % of the B&B analysis area was burned by the 2002 and 2003 fires; therefore, risk of sedimentation has significantly increased, especially in subwatersheds with substantial stand replacement burn areas. Studies of large fires have shown a significant increase in erosion and sedimentation in the first five years following fires (Beaty 1994; Ewing 1996; Helvey 1980; Minshall et. al 1997). The have also shown large increases in sedimentation, from 200 to 1000% (Hauer and Spenser 1998; Helvey 1980), which are generally a result of intense rainfalls occurring within the short-term period before the re-establishment of effective ground cover.

Sediment monitoring and observation after fires in the Metolius watershed have not shown large increases in sedimentation. Monitoring of fine sediment in Jefferson Creek before and after the Jefferson Creek Fire in 1996 showed no significant change in fine sediment in riffles due to the fire, even after a rain-on-snow event 6 months later (1997) (Houslet and others 1999; USDA Forest Service 2004a). Likewise, preliminary monitoring of silt fences in steep high burn severity slopes in the Eyerly Fire (2002) area show that erosion in the burn area has been minimal. Less than 0.1 ton per acre of sediment was eroded from these areas during the first year following the Eyerly Fire; however, this area has not experienced a significant rain event. Although one rainstorm greater than a 2-year event occurred on August 22, 2004, in the B&B Fire (2003) area, only minimal, short rills were observed on steep, south facing slopes and none ran into streams (Sussmann personal communication 2004).

The Metolius Watershed Analysis Update evaluated the effects of the recent fires (i.e. B&B Fire Complex, Link Fire, Cache Moutain Fire, and Eyerly Fire) on water quality (USDA Forest Service 2004a). Although soil infiltration rates remained high after the fire in the B&B analysis area, the reduction in ground cover in stand replacement burn areas has increased the risk of upland erosion from rainsplash and rilling during convective storms. All fire suppression activities associated with the recent fires have been rehabilitated by dragging slash over the trails; however, approximately 70 miles of bulldozer line were created as fire breaks and 20 acres were used as safety zones which may have caused some compaction. In addition, the risk of debris slides in the upper drainages of Brush Creek, Cabot Creek, Canyon Creek and First Creek have been elevated since the fire and will remain so until root strength reestablishes (USDA Forest Service 2004a).

In addition, the filtering effect of riparian vegetation has been reduced in these areas over the short-term because 65% of the Riparian Reserves in the B&B analysis area were burned, and 23 % were burned by a stand replacing fire (

Table 3. 20). The area most likely to contribute sediment to the stream, now referred to as the potential sediment contribution area (PSCA), has expanded in some areas because the Riparian Reserves may not be as effective at filtering sediment due to the loss of vegetative cover and surface roughness. The PSCA varies by slope, burn severity, and hydrologic connectivity. In addition, it includes areas at risk of eroding (i.e. rilling, gullying) and reaching the stream such as steep slopes (> 30%) burned by a stand replacing fire or altered by timber harvest or road building.

The risk of negative sedimentation effects due to wildfire and the interaction between fire effects and anthropogenic effects was also evaluated in the Metolius Watershed Analysis Update (USDA Forest Service 2004a). The risk of increased sedimentation (represented as the sedimentation risk factor) for the first year following the fire was determined for each subwatershed and for the Metolius 5th field watersheds based on the percent of Riparian Reserves burned and road locations.

The Metolius Watershed Analysis Update identified all subwatersheds in the B&B analysis area as having a high risk of increased sedimentation except Cache Creek and Jack Creek subwatersheds (Aq. Table 23 in USDA Forest Service 2004a). All these subwatersheds, except the Headwaters of the Metolius River subwatershed, had more than 30% of their Riparian Reserves burned, and more than 20% in many of these RRs experience a stand replacing burn. In addition, all these subwatersheds still have a number of road/trail and stream interactions even though numerous restoration projects have been implemented such as diverting water off a road bed back into Brush Creek and improving over 30 stream crossings by upsizing culverts, pulling culverts, or installing bridges.

Although the Headwaters of the Metolius River subwatershed was almost unaffected by the fire, the upper Metolius River was considered to have a high sedimentation risk as a result of sediment inputs from tributaries with high sedimentation risk. Jack Creek and Cache Creek were not considered at high risk of sedimentation increase even though more than 85% of Riparian Reserves in Jack Creek subwatershed and 37% in Cache Creek subwatershed burned because very little was burned by a stand replacing or mixed mortality fire (

Table 3. 20).

The sedimentation risks identified in the Metolius Watershed Analysis Update have decreased since the fire for the same reason the streamflow risks decreased, which is that the potential for overland flow has been reduced. The risk of sedimentation from the fire continues to lessen as ground vegetation in the B&B Fire area reestablishes and as dead trees and branches fall, all of which helps trap overland sediment. As mentioned earlier, monitoring results have shown that herbaceous ground cover, only 1 year after the fire, on average was 40% (Stand Exam data 2004; Fields preliminary data 2004; Sussmann 2004, personal observation). Other studies have shown this same rapid reestablishment (2-6 years) of ground vegetation following fires and have also shown a subsequent reduction in sediment yields (Robichaud 1999; and Radek 2001; Hauer and Spencer 1998). Overall, the risk of sedimentation increase in these subwatersheds is much lower than other regional subwatersheds due to the naturally low sediment yield of the Metolius watersheds, as seen by it's usually small delta.

Chemical Contaminants/Nutrients

Fire Retardant From airtanker records, it was determined that 110 drops of retardant during fire suppression activities on the B&B Fire occurred within or near the fire perimeter, and only a portion of this occurred within the B&B analysis area (Refer to Soils Report). Approximately 163 acres of the project boundary may have been covered by retardant from the B&B Fire suppression efforts. In addition, fire retardant was dropped on a portion of the 1448 acres of the Link Fire (summer 2003) that are in the Upper Lake subwatershed.

Some fire retardant chemicals used during fire suppression may be affect water quality and can be toxic to aquatic animals if transported (NWCG 2001). No retardant was dropped into streams or lakes in the B&B project boundary; however, some retardant was dropped into the intermittent stream that flows from Hortense Lake to Meadow Lake (Upper Lake SWS) during the Link Fire. There were no significant rainstorms for many months after the fire; therefore, it was assumed that the retardant broke down and was absorbed into the soil before seasonal streamflows began.

Nutrients Nutrient monitoring by the Deschutes National Forest in the upper Metolius River began in 1996 and is ongoing (USDA Forest Service 2004a). Water quality monitoring results from the 1996-2003 in the Upper Metolius River show that orthophosphorus levels continue to be high in the Metolius basin, ranging from 0.05 to 0.08 mg/L (USDA Forest Service 2004a). Although no standards are established for phosphorus, MacDonald et al. (1991) suggests streams entering lakes or reservoirs should not exceed 0.05 mg PO_4-P/L. High phosphorus concentration is natural in the Metolius basin due to the interaction of phosphorus rich volcanic rock and ground water (CTWSR and PGE 2002). Chitwood (1997) found natural amounts as high as 2.3 mg/L total phosphorus discharging from the Metolius River springs. Once these waters enter the reservoir concentrations drop to 0.03 to 0.06 mg/L (Johnson 1985), within the range suggested by MacDonald and others (1991).

Nitrate data was collected at Link Creek, Lake Creek, and at five Metolius River sampling sites between 1996 and 2003 (USDA Forest Service 2004a). Levels were below the 0.1 mg/L reporting level at all sites except for the Metolius River springs, where levels averaged 0.108 mg/L. There are no national standards for nitrate concentrations but a concentration < 0.3 mg/L would likely prevent eutrophication (MacDonald et al. 1991). Results indicate that the Metolius River is still nitrogen limited. It appears that nitrogen decreases downstream as algae and bacteria absorb it (Codder and Riehle 2001).

Fire may induce sudden changes in water chemistry. When a fire burns through down fuels there is an oxidation of many elements that then become available for leaching and/or aerial deposition into running or standing surface water. Also, nutrients ionically attached to soil sediments can be transported into streams. The low burn severity sites have virtually no effect on the soil's physical or chemical properties. Although relatively small proportions of the entire Metolius Watersheds burned with high severity (as it relates to soil productivity, see Soils Report), some increases in stream nutrient concentrations may occur. Studies have shown that water chemistry is most often altered during the first few storms following fire and typically returns to pre-burn levels within one to five years (Spencer and Hauer 1991; Debano et al. 1998; Gresswell 1999).

Channel Condition

Channel condition can be determined by evaluating variables that affect channel morphology such as stream bank stability and stream bed stability. Many streams in the B&B analysis area, including the Metolius River, are spring-fed and prior to the fire had well vegetated, stable stream banks. Streams with flasher flow regimes, such as Brush Creek and First Creek, are more dynamic and had some reaches with unstable stream banks. Stream survey reports from 1996 to 2001, further analyzed in the Metolius Watershed Analysis Update, showed that unstable streambanks were less than 2% on all the streams surveyed in the B&B analysis area (i.e. Cabot, Candle, Jack, Link, and the Metolius River) (USDA Forest Service 2004a). In addition, other indicators of stream condition such as large wood debris (LWD) and pool features, both of which help dissipate stream energy, are present, and in the case of LWD, abundant (**Table 3.23**). Although channel spanning pool frequency appears low, many streams are spring-fed and tend to have fewer pools per mile because stream energies are less. In addition, these streams have abundant wood, which often creates pocket pools that are not recorded in the stream survey.

Table 3.23 Average large wood per mile, pools per mile, percent unstable banks, and Rosgen stream types[32] for perennial stream reaches in the B&B Fire Recovery analysis area. u/s = upstream; d/s = downstream

STREAM	Average large wood/mi	Pools/mile	Percent unstable banks	Rosgen stream type (u/s to d/s)
Abbot Creek	253	1	NA	E/C
Bear Valley Creek	183	34	NA	A/B
Brush Creek	177	5	NA	B/E
Cabot Creek	94	18	0.2	B
Candle Creek	135	27	0.1	B/C
Canyon Creek	378	19	Some observed in intermediate type B reach	A/B/A/B/C
First Creek	150	18	NA	B/C
Heising Spring Creek	15	0	0.0	C
Jack Creek	577	24	0.0	B/C
Lake Creek	199	9	NA	C
Link Creek	45	20	1.6	B
Metolius River	50	4	1.3	B/C/B/F/B -mostly

[32] Type A = relatively steep, entrenched, straight, low width-to-depth ratio ; Type B = moderately steep, entrenched, and straight with a moderate width-to-depth ratio; Type C = relatively flat, not entrenched, and moderately sinuous with a moderate width-to-depth ratio; Type D = flat, braided channel; Type E = flat, not entrenched, very sinuous, low width-to-depth ratio; Type F = flat, entrenched, sinuous, high width-to-depth ratio, Type G = moderately steep and straight, entrenched, and a low width-to-depth ratio.

STREAM	Average large wood/mi	Pools/mile	Percent unstable banks	Rosgen stream type (u/s to d/s)
Roaring Creek	226	7	Low (estimate)	C - mostly
South Fork Link Creek	47	50	0.9	A
Upper Link Creek	54	40	0.1	A/B

Changes in streamflow, sedimentation, riparian vegetation, and LWD recruitment can affect stream bank and bed stability. Increases in streamflows, especially peak flows, add stress to the streambanks and can transport instream wood and substrate. In addition, increases in sedimentation can lead to deposition in low gradient reaches, which may result in channel widening (bank erosion) to accommodate the reduction in cross-sectional area (i.e. increase in width-to-depth ratios). Both of these increases can cause channel morphological changes that may affect stream bank and bed stability. Certain channel types are more susceptible to morphological change such as Rosgen type C and E channels (Rosgen 1996). Likewise, Rosgen type D, G and F channels are already unstable and, in the case of the type G and F channels, no longer connected to their floodplain. Rosgen type A and B channels are the most stable. Channel types in the B&B analysis area are generally steep, straight, and confined (Rosgen B) in the upper subwatersheds and flatter, more sinuous, and more connected with the floodplain in the lower subwatersheds (Rosgen C).

Reductions in riparian vegetation root strength can lead to increased bank instability. In addition, the loss of riparian and nearby trees may reduce long-term instream large woody debris recruitment and associated pool formation. Large wood debris is an important component in streams in the Metolius Watershed because it helps stabilize stream banks and beds. It dissipates stream energy by deflecting flow or by scouring pools. However, large, localized increases in LWD, such as new log jams, could increase short-term, localized bank erosion.

Recent harvest activity, recent fires, and the combined effects of the fire and harvest activities could have an effect on channel condition that has not yet been observed. This risk to channel morphology was assessed in the Metolius Watershed Analysis Update by integrating streamflow and sedimentation concerns for streams already known to be unstable, have flashy flow regimes, or be more susceptible to morphological changes (i.e. Rosgen C and E channels or channels lacking LWD or pools) (USDA Forest Service 2004a). This document and further analysis shows that the only stream reaches with high risk of morphological change are the type B intermediate reach in Canyon Creek and the type B intermediate reach of Brush Creek, both of which already had unstable banks. In addition, moderate risk of morphological change is predicted in the type C reaches in Candle Creek, Canyon Creek, and First Creek and the type E reach in Brush Creek.

The recent fires burned more than 50% of Riparian Reserves in all subwatersheds except Cache Creek, Headwaters of the Metolius, and Lower Lake Creek subwatersheds (

Table 3. 20). Abbot Creek, Canyon Creek, and Upper Lake subwatershed had more than 30% of their Riparian Reserves burned by a stand replacement fire. Streambank instability in the B&B analysis area is likely to increase if peakflow and sedimentation increase and streamside root structures decay. Significant channel change is not expected on the Metolius River, since the majority of flow is from spring sources and only 2 mile of the river was burn with low intensity.

According to the Metolius Watershed Analysis Update, many trees were killed in the Riparian Reserves, but much of the larger instream wood remains (USDA Forest Service 2004a). Only the smaller diameter material was consumed, thereby, not significantly affecting pools associated with wood. In some cases, log jams have become unstable from the fire consumption of the anchor log. This process was most prevalent along smaller stream channels with low summer flows during the fire such as upper Brush Creek, Bear Valley Creek, upper First Creek and Upper Link Creek. Instream wood and log jams appear stable on perennial spring-fed streams (USDA Forest Service 2004a). Overall, large woody debris is predicted to significantly increase in the next 10 to 15 years in streams in the B&B Fire area. This influx of wood may cause some channel adjustment such as scouring new pools or eroding banks but overall is predicted to provide longer-term stability.

Environmental Consequences

Summary of Effects

Alternative 1

Alternative 1 (No Action) may pose a long-term risk to water quality resources even though no harvest would occur. Road decommissioning and inactivation proposed in the action alternatives of roads associated with water quality concerns would not occur. In addition, road improvements associated with the haul routes, which offer long-term water quality protection, would not occur. Therefore, the risk of increased sedimentation and streamflow from roads, which was exacerbated by the fire, would remain elevated. Conditions and hydrologic function would continue as described in the Existing Condition section. Shade and woody material recruitment along streams would continue to recover at natural rates. Hydrologic recovery from revegetation of the upland areas would continue at natural rates, but slower than Alternatives 2, 3, 4, and 5.

Alternatives 2, 3, 4, and 5

Salvage of burned timber and fuels treatments are proposed in all action alternatives, although at varying degrees. Planting conifers in salvage units and decommissioning/inactivating roads are proposed actions common to all action alternatives. None of the activities proposed in the B&B Fire Recovery Project would have a direct effect on hydrology, and they would only have a negligible indirect effect on hydrology. The conditions that reduce the likelihood that proposed activities are capable of exacerbating watershed conditions include:

- No ground-based equipment in Riparian Reserves,
- No harvest within 100 ft of streams,
- No harvest activities on slopes that have a high risk of debris slides reaching a stream (i.e. upper Canyon Creek and slopes above Suttle Lake – refer to Soils Report)
- Limited increase of detrimental soil**Error! Bookmark not defined.** acres in the potential sediment contribution area,

- Road closures and decommissions of roads at risk of affecting water quality,
- Extensive drainage improvements associated with haul roads in or near PSCA s
- Watershed is naturally not very hydrologically responsive,
- Implementation of Soil and Water Design Elements and Best Management Practices, and
- Compliance with Deschutes LRMP Standards and Guidelines, as amended by the NWFP.

Based on the amount of ground-disturbance in each alternative, Alternative 2 has the highest potential to negatively affect water quality; Alternative 5 has the second highest; Alternative 3 is the second least ground-disturbing; and Alternative 4 has the lowest potential to negatively affect water quality (see Tables 3.24 and 3.25). Although Alternative 3 may have a slightly higher risk than Alternative 4 of negatively affecting water quality, it also has the most long-term benefits to water quality (i.e. more haul road improvements, culvert replacements). However, in all action alternatives, the predicted increase in sedimentation, streamflow, water temperature, nutrients or negative channel conditions from proposed actions would be negligible due to the project conditions listed above.

Table 3. 2. Comparison of proposed activities / effects negatively affecting water quantity and quality in the B&B project boundary.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Total acres salvaged	0	6802	3762	1725	4633
Acres of ground-based salvage	0	5848	3762	1725	4633
Salvage acres within the potential sediment contribution area	0	333	0	27	63
Ground-based salvage acres within the potential sediment contribution area	0	168	0	27	63
Increase in detrimental soil condition acres within harvest units after mitigation	0	711	424	153	408
Maximum increase in potential detrimental soil condition acres in units in the PSCA after mitigation	0	33	0	5	12
Miles of danger tree treatment	0	88	68	28	68
Miles of danger trees removed	0	82	63	21	63
Miles of danger trees removed in PSCA	0	6	5	3	5
Miles of danger trees removed in RR	0	3	3	1	3
Haul miles in the PSCA	0	29	25	11	25
Temporary road miles	0	5.1	3.9	1.7	3.7
Temporary road miles in Riparian Reserve	0	0.40	0.40	0.38	0.40

Table 3. 25 Comparison of proposed activities / effects benificially affecting water quantity and quality in the B&B project boundary.

Potential Beneficial Impacts	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Miles of decommissioned/inactivated roads	0	70	70	70	77
Miles of decommissioned / inactivated roads associated with aquatic concerns	0	37	37	37	37
Miles of road drainage improvements / additions	0	93	71	38	71
Number of small culvert replacements and improvements	0	0	30	0	0

Cumulative Effects

Cumulative effects as a result of the added effect of the B&B Fire Recovery Project would be negligible at the subwatershed and watershed scale, as a result of:

- Proposed salvage acres would be less than 4 % of the area that drains into the free-flowing reaches of the Metolius River,
- No proposed activities are within a half mile of the mainstem Metolius River,
- Additional detrimental soil**Error! Bookmark not defined.** acres in the potential sediment contribution area would be less than 35 acres and other mitigations would apply,
- No ground-based equipment would go off-road in Riparian Reseves, and
- Proposed activities would maintain the 5th field watershed over the long-term.

The recent past, present and future foreseeable activities in the the B&B analysis area or at the 5th field watershed scale with the greatest sedimentation effects are the recent fires (**Map 3.1**;Table **3.4**; Table 3.5). Approximately 99 % of the project area, 64% of the analysis area, and 34 % of the watershed area (5th fields) was burned by the recent fires.

Sedimentation
Measure: Acres of soil detrimentally impacted in the PSCA, haul road miles within the PSCA, haul road drainage improvement miles, miles of decommissioning/inactivation of roads affecting aquatic resources

Activities Influencing Sedimentation in Action Alternatives

Activities that disturb the soil have the potential to increase sedimentation in the streams by causing erosion and creating conduits for overland flow and sediment. Action alternative activities which would cause ground disturbance and could increase sediment production in the short-term include: salvage of dead trees, danger tree removal, hauling trees, planting of trees, road decommissioning and closure, subsoiling, and prescribed burning of fuels (Beschta 1995). No harvest activities would occur in high risk debris slide areas that could reach the stream and only limited activities would occur in the Riparian Reserves and they include: hand-felling and winching of danger trees on haul routes (between 1 and 3 miles), hauling of logs on existing roads (between 7 and 21 miles), construction of 0.40 miles of temporary road, using a minimal portion as a landing (< 1 ac in units 34, 45, an 136), decommissioning and inactivating of 16 miles of road, and planting of conifers on 10 acres around Round Lake.

Design Elements and mitigations to limit the amount of sediment increase are listed in Chapter 2, Project Design Elements for Soil and Water. Some of the BMP's recommended for implementation under the Action Alternatives include protecting riparian buffers, limiting activities in the potential sediment contribution areas (PSCA), and subsoiling the primary skid trails and landings. Activities which would reduce overall sediment yields in the long-term include road decommissioning/closure and revegetation.

All action alternatives propose some amount of fire salvage. **Salvaging of fire killed trees** increases the risk of erosion by disturbing ground vegetation that stabilizes or traps soil, and by compacting the soil, which concentrates runoff. Aerial methods of harvest have little effect on the rate of soil erosion because there is little ground disturbance. Ground-based salvage methods would detrimentally**Error! Bookmark not defined.** disturb the soil on approximately 10 to 20% of an activity unit area after all proposed activities and mitigation measures are implemented. Although vegetation on skid trails and landings would be completely removed, disturbance on nearly 80% of the unit area would be relatively minimal and not preclude the recovery of trampled or re-sprouting plants (Malaby 2000). The recovery of shrub and other herbaceous vegetation within activity units is not likely to be inhibited significantly in the short-term following harvest activities and would be expected to provide cover capable of reducing raindrop impacts at levels similar to areas left unsalvaged within 3 to 4 years (Chou et al. 1994).

Soil compaction incurred by harvest activities could increase runoff from units in which skid trails and landings were not subsoiled if surface roughness was insufficient to offset slope concentration of storm water. The action alternatives could increase the total amount of compaction, especially in units that have had little to no previous disturbance. Although soil disturbance effects of ground-based timber harvesting are assumed to last for about 3 to 4 years (Chou et al. 1994) and less for helicopter units, the compaction effects in units not subsoiled may last decades.

Rainfall capable of dislodging soil particles and creating overland flows could transport sediment to waterbodies from disturbed areas adjacent to waterbodies. The amount of sediment transported to the stream decreases the further the activity is from the stream and the flatter the slope. Only about 1% of the sediment generated outside the potential sediment contribution area is assumed to be transported to the stream, based on sediment transport models (USDA Forest Service 2001; presumably based on the PSWHR I model from Region 5, Leven 1971).

Harvest, especially ground-based within the potential sediment contribution area (Appendix A), could increase detrimental soil**Error! Bookmark not defined.** condition, and potentially sediment delivery, especially during the first few years before riparian vegetation has completely reestablished. In order to reduce sedimentation from salvage activities, only limited activity would occur within the area most likely to contribute sediment to the streams, the PSCA, in all action alternatives (Table 3. 28). Project design elements specific to units within and adjacent to the PSCA and hydrologically connected road segments (HCRS) would be applied (refer to Ch. 2, Soil and Water Project Design Elements). In all action alternatives no salvage activities or off-road machine traffic would occur within the Riparian Reserves, with the exception of less than an acre in unit 34[33] (refer to Chapter 2 for a detailed description of activities in Riparian Reserves).

The soil and water project design elements would designate skid trail spacing, limit activity in ephemeral draws and areas adjacent to hydrologically connected road segments (HCRS), and add slash or waterbars to skid trails before subsequent wet season. Sedimentation is most likely to occur from compacted surfaces, ephemeral draws, or HCRSs; therefore, excluding machine traffic in RRs, limiting the amount of skid trails, and restricting machine traffic in ephemeral draws and HCRSs to designated crossings would reduce sedimentation. By adding slash to skid trails, raindrop impact would be reduced and surface roughness would be increased, thereby reducing overland flow energies and trapping sediment. Adding waterbars to skid trails that drain into hydrologically connected road segments would also help disconnect these skid trails from the stream network by shedding water from the skid trail before it reaches the ditch and by reducing trail erosion.

Removal of **danger trees** along haul routes in action alternatives would not cause as much soil displacement or compaction as salvage units because less volume would be harvested and most danger trees could be harvested from the road. In most cases, danger trees would be removed from within 150 feet of roadways. Activity fuels in these areas would be machine piled and burned in the landings. Most trees would be felled and gathered from the road; however, in some cases a skid trail parallel to the road or hand-felling and cabling may be used to access taller trees too far from the road for the machinery to reach. Regardless, machinery would not be used on slopes greater than 30% and no new roads would be constructed.

Danger trees in Riparian Reserves (RRs) along haul routes would be hand-felled and left, except around RRs within the defensible space strategy. Only danger trees determined by the fish biologist and soil scientist to be in excess of soil and water needs would be harvested using low impact logging methods such as hand felling and winching, horse logging, or ATV logging. Danger trees

[33] The eastern unit boundary would follow the 1230 road and would include the outer 100 ft of the Riparian Reserve. Within the RR in the unit boundary, equipment would only be allowed on the existing skid trail (located approximately 250 ft from Brush Creek and 50 ft from the 1230 road) during the dry season (June 15 to Oct 15). Only harvest of danger trees would be allowed within the RR in the unit boundary, and it would be done so by hand-felling and winching.

Table 3. 3. **Proposed** harvest by logging system within each subwatershed (SWS).
S-G = salvage ground-based; S-H = salvage helicopter-based; Sal = salvaged; Haz-G = danger tree removal ground-based

	Alt. 2				**Alt. 3**			**Alt. 4**			**Alt. 5**		
	S-G	**S-H**	**% of SWS Sal-vaged**	**Haz-G**	**S-G**	**% of SWS Sal-vaged**	**Haz-G**	**S-G**	**% of SWS Sal-vaged**	**Haz-G**	**S-G**	**% of SWS Sal-vaged**	**Haz-G**
	acres	acres	%	miles	acres	%	miles	acres	%	miles	acres	%	miles
Abbot Creek	1912	70	31	25	848	13	14	34	1	1	1062	17	14
Cache Creek	13	0	0	0	0	0	0	0	0	0	13	0	0
Candle Creek	237	79	3	4	201	2	3	0	0	0	221	2	3
Canyon Creek	875	35	4	17	755	4	15	720	3	12	796	4	15
First Creek	584	547	9	7	296	2	5	47	0	0	443	3	7
Headwaters Metolius River	134	0	1	1	0	0	0	0	0	0	115	1	0
Jack Creek	1430	0	16	15	1251	14	14	907	10	7	1420	15	14
Lower Lake Creek	577	96	6	11	342	3	9	0	0	0	477	4	9
Upper Lake Creek	86	126	2	1	68	1	1	18	0	0	86	1	1
Analysis Area	5848	955	6	82	3762	3	61	1725	2	21	4633	4	64
Area draining to Metolius River	5848	955	3	82	3762	2	61	1725	1	21	4633	2	64

Table 3. 4. Proposed ground-based harvest in the potential sediment contribution area (PSCA), including salvage harvest acres and miles of haul road treated for danger tree removal for each subwatershed.
S-G = salvage ground-based; Haz-G = danger tree removal ground-based

SWS Name	Alt. 2 in PSCA		Alt. 3 in PSCA		Alt. 4 in PSCA		Alt. 5 in PSCA	
	S-G	Haz-G	S-G	Haz-G	S-G	Haz-G	S-G	Haz-G
	acres	miles	acres	miles	acres	miles	acres	miles
Abbot Creek	26	1.2	0	0.4	3	0.4	4	0.4
Cache Creek	0	0.0	0	0.0	0	0.0	0	0.0
Candle Creek	19	0.6	0	0.6	0	0.3	19	0.6
Canyon Creek	34	1.1	0	0.8	15	0.8	24	0.8
First Creek	69	2.5	0	2.5	0	1.0	2	2.5
Headwaters Metolius River	3	0.0	0	0.0		0.0	3	0.0
Jack Creek	10	0.6	0	0.6	9	0.6	3	0.6
Lower Lake Creek	6	0.3	0	0.3	0	0.3	6	0.3
Upper Lake Creek	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	167	6.3	0	5.2	27	3.4	63	5.2

Table 3. 28. Potential increase in detrimental soil condition acres[34] in the potential sedimentation contribution area (PSCA) from proposed harvest for each subwatershed.

Subwatersheds	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Abbot Creek	5.2	0	0.6	0.8
Cache Creek	0	0	0	0
Candle Creek	3.8	0	0	3.8
Canyon Creek	6.8	0	3	4.8
First Creek	13.8	0	0	0.4
Headwaters Metolius River	0.6	0	0	0.6
Jack Creek	2	0	1.8	0.6
Lower Lake Creek	1.2	0	0	1.2
Upper Lake Creek	0	0	0	0
TOTAL	33.4	0	5.4	12.2

removed from the RR would be at least one potential tree height from the stream and would be hand-felled and winched to the road. Danger trees along the additional 4 miles of haul road within the PSCA but outside RRs would meet the design elements for the PSCA mentioned above.

Downed wood, which is predicted to rapidly increase over pre-fire conditions in the next 10 years (refer to Fuels Report), would provide ground roughness and help trap sediment. Less than 10% of the B&B Fire Complex burn area is proposed for harvest in any action alternative. Within units all trees less than 16 dbh and a specified amount of downed wood and snags (in accordance with the LSRA and Northwest Forest Plan) would be left. As a result, more than 94% of the post-fire down wood in the B&B analysis area would be unaffected and available for slowing overland flow and trapping sediment. In addition, no

[34] These values are over estimates because they assume activities will cause additional detrimental soil conditions over 20% of the acres harvested with ground-based equipment regardless of whether they use some existing compacted surfaces. In addition, these areas are prioritized for subsoiling and may receive more mitigation than assumed for these estimates.

Table 3.29 Miles of danger trees removed Riparian Reserves along haul routes.

SWS	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Abbot Creek	0	0	0	0
Cache Creek	0	0	0	0
Candle Creek	0.3	0.3	0	0.3
Canyon Creek	0.2	0.2	0.2	0.2
First Creek	2.1	2.1	0.6	2.1
Headwaters of the Metolius River	0	0	0	0
Jack Creek	0	0	0	0
Lower Lake Creek	0.1	0.1	0.1	0.1
Upper Lake Creek	0	0	0	0
TOTAL MILES	2.7	2.7	0.9	2.7

machine traffic or removal of trees within the one site-potential tree height is proposed in RRs; therefore, activities would not affect buffer effectiveness or instream sediment storage potential from large wood recruitment.

The action alternatives would also utilize soil restoration mitigations to relieve compaction and return the surface of skid trails, landings and temporary roads to a condition capable of infiltrating rainfall and runoff at natural rates. After the completion of proposed activities and mitigations, 20% or less of the soil in any unit would be in detrimental condition, as per sale contract. Mitigations to help meet these conditions include using existing trails and/or subsoiling new trails. The majority of disturbed areas would be outside the PSCA and would not input sediment directly into the aquatic system. Priority for subsoiling would be given to skid trails and landings located within the PSCA and in units adjacent to HCRSs. Subsoiling would occur in scattered landings and skid trails would not disturb the soil surface more than the proposed harvest activities. Long-term erosion potential would be reduced through improved water infiltration and better vegetation coverage. Monitoring of subsoiling around the Deschutes National Forest has shown this technique to be effective in reducing the effects of excessive soil compaction (refer to Soils Report). Bulk densities were reduced, in many cases, to natural levels.

In all action alternatives trees harvested would be hauled off-site via the existing road network and a few miles of additional temporary roads. Temporary roads that are newly created would increase the drainage network and reduce infiltration in the short term. No road fill or extensive improvements would be necessary on these newly created temporary roads. In addition, only 0.4 miles of temporary roads are in Riparian Reserves. One temporary road could increase short-term sedimentation in an intermittent tributary to Jack Creek in all action alternatives because it would cross it with a ford in order to reach unit 99. To mitigate sedimentation effects from this temporary road, hauling would be restricted to times when the stream is not flowing and the road would be subsoiled before the subsequent wet season.

Overall, sedimentation effects from these newly created surfaces are unlikely because very little of these surfaces are within the PSCA. All temporary roads, including those located on non-system and user-created roads, would be subsoiled after harvest and revegetation activities to help restore infiltration. Also, if units with temporary roads are not complete before the subsequent wet season then waterbars would be installed at every 10 ft drop in elevation along the temporary roads to prevent short-term sedimentation effects from these roads (see soil and water project design elements, Ch. 2).

Hauling on roads, especially roads adjacent to streams or hydrologically connected to streams, increases the risk of sedimentation in the channels (Table 3.30). Driving on wet roads with puddling or dry roads that are dusty can transport sediment to the streams. To reduce sedimentation from haul roads, extensive soil and water design elements would be implemented (see Ch.2, Design Elements). For example, waterbars, dips, and relief culverts within 320 ft of streams and with slopes below the outlet greater than 20% would be armored and drainage structures would be installed at every 10 ft drop in elevation and before stream crossings on haul roads, if not already present. By increasing road drainage the erosive effects of water on the road and water exiting drainage outlets would be reduced. Also, most direct hydrologic connections between roads and streams would be disconnected by shedding road or ditch water before it reaches a stream crossing. To reduce sedimentation from roads that cannot be hydrologically disconnected (i.e. 1210, 1232) due to proximity to streams or effects of winter logging such as reduced drainage effectiveness in snow melt areas from plowing, logging would be restricted to the dry season. In addition contract provisions would be in place to shut down operations if road or soil conditions became too wet. These contract elements, project design elements, and mitigations would reduce the short-term and long-term erosion from roads in general and would minimize the short-term erosion from hauling to a negligible effect.

Table 3.30. Proposed miles of road and stream crossings within PSCA used for timber hauling by subwatershed.

SWS	**Alt. 2**		**Alt. 3**		**Alt. 4**		**Alt. 5**	
	haul in PSCA (mi)	**stream X-ings**	**haul in PSCA (mi)**	**stream X-ings**	**haul in PSCA (mi)**	**stream X-ings**	**haul in PSCA (mi)**	**stream X-ings**
Abbot Creek	5.6	44	2.8	23	0.2	1	2.8	23
Cache Creek	0	0	0	0	0	0	0	0
Candle Creek	1.1	15	1.0	14	0	0	1.0	14
Canyon Creek	4.7	67	4.3	57	3.0	33	4.3	57
First Creek	6.9	19	6.7	18	2.0	6	6.7	18
Headwaters Metolius River	0.1	2	0	0	0	0	0	0
Jack Creek	7.6	34	7.4	33	5.4	27	7.4	33
Lower Lake Creek	2.7	13	2.7	12	0.3	3	2.7	12
Upper Lake Creek	0	0	0	0	0	0	0	0
TOTAL	28.7	194	24.9	157	10.9	70	24.9	157

Table 3.31. **Hydrologically connected road segments on haul routes.**

SWS	**Number of hydrologically connected haul road segments below proposed units**			
	Alt. 2	**Alt. 3**	**Alt. 4**	**Alt. 5**
Abbot Creek	23	10	0	10
Cache Creek	0	0	0	0
Candle Creek	12	10	0	10
Canyon Creek	33	27	14	27
First Creek	5	5	0	5
Headwaters Metolius River	0	0	0	0
Jack Creek	9	9	6	9
Lower Lake Creek	6	5	0	5
Upper Lake Creek	0	0	0	0
TOTAL	88	66	20	66

Table 3.32. Haul road miles by alternative with proposed miles of drainage improvements. D-I = drainage improvement

SWS	Alt. 2		Alt. 3		Alt. 4		Alt. 5	
	Haul miles	D-I miles	Haul miles	D-I miles	Haul miles	D-I miles	Haul miles	D-I miles
Abbot Creek	35.2	25.8	20.4	16.6	1.5	12.3	20.4	16.6
Cache Creek	0	0	0	0	0	0	0	0
Candle Creek	5.0	4.6	4.2	3.4	0	3.4	4.2	3.4
Canyon Creek	29.9	16.7	26.9	12.3	22.4	7.5	26.9	12.3
First Creek	15.7	14.1	15.2	12.0	7.1	2.9	15.2	12.0
Headwaters Metolius River	3.2	2.5	0	0	0	0	0	0
Jack Creek	29.6	16.3	29.1	14.9	21.8	11.8	29.1	14.9
Lower Lake Creek	25.5	12.6	24.2	12.1	1.6	0	24.2	12.1
Upper Lake Creek	1.5	0	1.5	0	0	0	1.5	0
TOTAL	145.7	92.6	121.5	71.3	54.4	37.9	121.5	71.3

All action alternatives would decommission and inactivate a subset of roads (between 70 and 77 miles) in the project area after all harvest and revegetation activities (see Ch. 2 for road numbers)(see Table 3.33). All the roads proposed for decommissioning and closure would help reduce open road densities, which was addressed as a primary aquatic concern in the Metolius Watershed Analysis (USDA 2004c). After roads are decommissioned or closed and begin to revegetate, the erosive effects of overland flow would be reduced. In addition, subsoiling the roads would reduce the amount of overland flow generated from storms or snowmelt.

Table 3.33. Affects to subwatershed road density after proposed road decommissioning.

Subwatersheds	Existing Road Density (mi/mi^2)	Alt. 2, 3 & 4 Road Density (mi/mi^2)	Alt. 5 Road Density (mi/mi^2)
Abbot Creek	**6.20**	**5.56**	**5.49**
Cache Creek	**10.71**	**10.71**	**10.71**
Candle Creek	**5.55**	**4.87**	**4.87**
Canyon Creek	**4.83**	**3.68**	**3.57**
First Creek	**5.91**	**4.81**	**4.80**
Headwaters Metolius River	**7.56**	**6.91**	**6.85**
Jack Creek	**5.58**	**5.14**	**5.14**
Lower Lake Creek	**7.54**	**7.11**	**7.00**
Upper Lake Creek	**5.72**	**5.08**	**5.07**
TOTAL	**5.89**	**5.12**	**5.05**

Also, decommissioning and inactivation over 70 miles of road would improve over 30% of the road-stream crossings in the B&B analysis area by either removing the crossing or hydrologically stabilizing the roadbed by adding drainage and excluding traffic (**Table 3.34**). Approximately 27 miles of the roads proposed for decommissioning and 10 miles of the roads proposed for closure are currently at risk of negatively affecting water quality by reducing infiltration in the PSCA or by directly transporting sediment to streams (**Table 3.35**). Of these, approximately 16 miles are in Riparian Reserves, which supports the Metolius Watershed Analysis Update recommendation to decommission and/or inactivate roads in Riparian Reserves.

Roads proposed for decommissioning that are subsoiled or disconnected from streams by removing culverts would cause some short-term sedimentation effects; however, restoring infiltration by subsoiling, and reducing erosion and future risk of erosion by removing culverts would have long-term beneficial effects. In addition, all the haul roads proposed for decommissioning or closure would meet the soil and water project design elements before hauling.

Table 3.34. Stream crossings beneficially affected by proposed road decommissioning and closure.

SWS	Existing stream crossings	Alt. 2, 3, & 4 stream crossings		Alt. 5 stream crossings	
		Proposed decom	Proposed closed	Proposed decom	Proposed closed
Abbot Creek	70	14	13	14	13
Cache Creek	0	0	0	0	0
Candle Creek	20	3	4	3	4
Canyon Creek	114	35	15	35	15
First Creek	44	5	2	5	2
Headwaters Metolius River	13	1	1	2	1
Jack Creek	62	6	7	6	7
Lower Lake Creek	29	3	1	5	1
Upper Lake Creek	17	4		4	
TOTAL	369	**71**	**43**	**74**	**43**

Table 3.35. Roads proposed for decommissioning or inactivation associated with water quality concerns (all alternatives).

Subwatersheds	Decommissioning	Inactivation	Total
Abbot Creek	3.4	0.8	4.2
Cache Creek	0	0	0
Candle Creek	1.1	0.1	1.2
Canyon Creek	10.3	2.6	12.9
First Creek	6.0	1.6	7.6
Headwaters Metolius River	0.5	0.8	1.3
Jack Creek	1.3	3.5	4.8
Lower Lake Creek	2.5	0.6	3.1
Upper Lake Creek	2.1	0.2	2.3
TOTAL	27.2	10.2	37.4

Fuels created by harvest (activity fuels) would be left on trails or piled by machine piling on the trails, whole-tree yarding to the landing and then piling, or whip felling and hand piling. All activity fuels would then be burned after the harvest by burning the piles or jackpot burning (see Fuels Report). In addition, all non-activity fuel (sub-merchantable) in excess of soil and water needs in salvage unit acres and in the Round Lake Danger Tree and Defensible Space treatments would be piled and burned. Only hand felling and piling of both activity and non-activity fuels would be allowed in RRs.

Mechanical equipment would be used in some ground-based units to pile fuels, and Project Design Element measures such as using existing skid trails would be applied to limit soil impacts. In salvage units, equipment used for fuels reduction may occasionally veer off the existing skid trails and could cause effects similar to skid trails. It could increase compaction in ground-based units by 1% (refer to Soils Report); however, as mentioned earlier, units exceeding 20% detrimental soil**Error! Bookmark not defined.** conditions would be subsoiled to lower the detrimental soil condition to the standard.

Fuel burning would not significantly increase erosion because the ground impacted by the burning would already be void of vegetation from the salvage operations and most of the skid trails and landings on which piles would be burned, would be subsoiled. Although upland timber harvest and fuels treatments would reduce future wildfire severity and suppression difficultly in some stands, it would not likely reduce sedimentation effects from a future catastrophic wildfire because treatments are not at a magnitude or in a location that would considerably reduce sedimentation risk.

All units salvaged (which consist of stand replacement and mixed mortality sites) would be replanted to expedite vegetation recovery. As a result this may expedite the return of organic material (i.e. needle fall, branches) that would help stabilize soils. In all action alternatives, an area of 2¼ square feet around each seedling would be scraped free of vegetation (scalped). As with any ground disturbing activity, scalping would increase the potential for soil erosion and sedimentation. In all but the most extreme events, soil detached from the scalp zone would likely deposit in the adjacent untreated area surrounding each seedling. Off-site movement of soil would not be expected, and erosion would decrease to its current level after about 3 years. In addition, ground cover next to streams would be maintained and it would provide an additional opportunity to trap any mobilized soil before it reaches the stream network.

Alternative 1

Short-term sedimentation caused by activities proposed in the action alternatives would not occur, and the long-term reduction in sedimentation from the proposed road improvement work would not occur. In ddition, the effects of the B&B Fire itself would continue to have the greatest influence on sedimentation within the analysis area. Under the No Action Alternative, soil erosion and water yield may slightly increase due to a reduction in vegetation from the fire, especially within the areas that burned at high intensities (Beschta, 1995). The Metolius Watershed Analysis Update identified all subwatersheds in the B&B analysis area as having a high risk of increased sedimentation from fires and past activities, except Cache Creek and Jack Creek subwatersheds (Aq. Table 23 in USDA Forest Service 2004a). Studies of other large fires have shown a significant increase in erosion and sedimentation in the first five years following the fires (USDA Forest Service 2004a; Beaty 1994; Ewing 1996; Helvey 1980; Minshall et. al 1997). Although sedimentation from the fires does not appear to have significantly increased in the 14 months following the fire (personal communication, Sussmann 2004), the risk of increases in sedimentation and streamflow will continue until vegetation reestablishes.

Under the “No Action” Alternative, no land-use activities are proposed; therefore, soil compaction would maintain the status quo. Residual effects of past harvest activities would gradually decrease; however, areas where soil has been lost or compacted may not achieve noticeable improvements within many years or decades. Roads in Riparian Reserves, identified in the Metolius Watershed Analysis Update as a major source of sedimentation, would not be reduced (USDA Forest Service 2004a). Approximately 37 miles of roads have a high or moderate risk of contributing sediment to streams in the B&B project boundary. In addition, over 88 segments of road in the B&B project area are hydrologically connected to the streams by ditches, relief structures, or road surfaces that feed directly into streams. The effects of roads and the interaction of fire effects and road effects would continue under Alternative 1.

Although there are no salvage-related plans or funding to replant burned acres, recovery of soil stability would occur at the same rate as the Action Alternatives because shrubs, grasses, and down wood, capable of trapping sediment, would help stabilize soils regardless of planting. In addition, any re-growth or needle-fall that has occurred would not be mechanically disturbed. In the short-term the return of fine woody material may be slightly slower than within treatment areas because harvest activity would break branches of the dead trees. The erosive effects of an increase in high flows would continue longer in Alternative 1 than in Action Alternatives because recovery of tree stands and associated evapotranspiration and precipitation interception would occur at natural rates, which are estimated to be slower than acres replanted with conifers in action alternatives.

Down wood, as a result of falling dead trees, will rapidly increase over the next 10 years and would exceed Forest Plan standards (refer to Fuels Report). Down wood would provide surface roughness and help trap and store sediment. In addition, down wood adjacent to streams would contribute to in-stream large woody debris recruitment and help store in-stream sediment. However, the increase in surface fuels could increase the risk of a future high severity fire, reduce effectiveness of future fire suppression efforts, and increase associated soil erosion in some stands.

Alternative 2

Upland erosion caused by activities in Alternative 2 would have only a negligible effect on sedimentation because only minimal activity would occur in the areas most likely to deliver sediment to the streams and stringent project design elements based on soil and water concerns would be implemented. Alternative 2 proposes to salvage harvest (6802 ac) and reduce small diameter fuels (3249 ac within salvage units) on the most acreage, which results in activity on 7% of the burned area**Error! Reference source not found.**. Small diameter fuels (< 16” dbh) within some of these units (3249 acres) and within the Round Lake Christian Camp (20 ac) would be machine piled and burned, as well as all activity fuels in excess of soil and water requirements. The subwatershed with the most area proposed for salvage in this alternative is Abbot Creek subwatershed (32%), which is currently at elevated risk of sedimentation from past activities and fire (USDA Forest Service 2004a). However, only 26 acres proposed for salvage are in the potential sediment contribution area (PSCA). The most salvage acres in the PSCA occur in First Creek subwatershed, which is also at elevated risk of sedimentation from past activities and fire; however, only 70 acres are proposed for treatment and these have special design criteria to help protect water quality. Salvage acres in the PSCA are mainly located in units 6, 26, 34, 44, 45, 46 and 47 and total 168 acres in ground-based units. In addition, approximately 6 miles of danger tree removal would occur in the PSCA, with three of those miles occurring in the Riparian Reserve. Only minimal low impact harvest activities would occur within Riparian Reserves.

Although ground disturbance and compaction would occur in the PSCA where ground-based salvage, danger tree removal, and associated fuels treatments are located, these activities would only result in increased detrimental soil**Error! Bookmark not defined.** condition on 33 acres (Table 3. 28). Project design elements for protecting soil and water resources would reduce the effects from these acres; therefore, sedimentation expected from salvage and danger tree activities would be minimal. These conclusions are supported by a study conducted by Chou and others in the central Sierra Nevada Mountains (cited in McIver and Starr 2000). This extensive study, which included replicates and a control, found no detectable difference in sediment output between logged and unlogged units after the Stanislaus fires.

In Alternative 2, 146 miles of road would be used for log haul, 29 miles of which are in the PSCA and 88 segments of which are potentially hydrologically connected to streams (Table 3.30**Error! Reference source not found.**). In addition, 5.1 miles of temporary roads would be used in this alternative. To help offset the sedimentation effects of haul, 63% of the haul roads would receive drainage improvements. In addition, project design elements specific for haul roads that help protect water resources would reduce the sedimentation effects from haul roads. Effects from temporary roads would also be minimal because there are only 0.4 miles of temporary roads in Riparian Reserves and all temporary roads would be subsoiled.

Other activities in Alternative 2 that could affect sedimentation are reforestation on 6802 acres and decommissioning and inactivation of 70 miles of road. Both these activities would have a long-term beneficial effect. Alternative 2 would revegetate the most acres and may provide the fastest recovery of conifer cover and organic material (i.e. needles and branches). Road decommissioning and inactivation, especially of the 37 miles of road most associated with water quality, would help restore infiltration and reduce overland flow and sedimentation to the same degree as the other action alternatives. In addition, Alternative 2 would have the most long-term beneficial effects from road drainage improvements associated with haul roads because the most road miles would receive treatments (93 miles).

Alternative 3

Effects of activities in Alternative 3 on sedimentation would be negligible and would have the least risk of increasing sedimentation in the long-term and the second least risk in the short-term due to a minimal amount of harvest (only danger tree removal) in the potential sediment contribution area and a substantial amount of long-term road improvements. Alternative 3 proposes to salvage a total of 3762 acres (4% of the burned area), which is about half of what is proposed in Alternative 2 and all of which is ground-based. In this alternative 1524 acres less than Alternative 2 of small diameter fuels (< 16" dbh) would be reduced as a result of less treatment units. In Alternative 3, the subwatershed with the largest percentage of salvage treatments would be Jack Creek subwatershed. This subwatershed is currently at a low risk of increases in sedimentation from past activities and fire (USDA Forest Service 2004a) and would receive approximately the same magnitude of treatment in all action alternatives. No salvage activities would occur within the PSCA in this alternative. Danger trees along 5 miles of haul road within the PSCA would be removed with special design restrictions. Three of these miles are within Riparian Reserves and would be removed using low impact logging methods.

In Alternative 3 there would be no increase in detrimental soil**Error! Bookmark not defined.** acres in the PSCA from salvage and only minimal potential detrimental soil acres from danger tree removal along 2 miles of haul road. In addition, project design elements would be implemented to help protect hydrologically connected road segments and reduce sedimentation effects from the danger tree removal in the PSCA. Almost the same amount of haul roads would occur in the PSCA as in Alternative 2; however, approximately 20 less segments of haul road would be hydrologically connected (Table 3.30). In addition, 1.2 miles less of temporary road would be need in this alternative as compared to Alternative 2 but the temporary road miles and effects in Riparian Reserves would be similar. Like Alternative 2, drainage improvements prior to haul and special design elements for haul would be implemented to help offset sedimentation effects from haul. In Alternative 3, 59% of haul roads would receive drainage improvements, which is similar to the percent of haul roads treated in Alternatives 2 and 5.

Beneficial activities in Alternative 3 that could affect sedimentation are reforestation on 3762 acres, decommissioning and inactivation of 70 miles of road, improving drainage on 71 miles of road, and replacing 30 undersized culverts. Although reforestation would occur on approximately 3000 acres less than Alternative 2, effects to sedimentation would be similar because there would be less ground disturbance of existing vegetation and organics. The beneficial effects of road decommissioning and inactivation in terms of sedimentation would be the same in all action alternatives and were discussed in Alternative 2. Drainage improvements in Alternative 3 would occur on 22 road miles less than Alternative 2; however, 30 culverts with erosion at the outlets would be replaced with appropriately sized culverts and armoured to help reduce sedimentation.

Alternative 4

Alternative 4 has the least impact on sedimentation and effects of the activities on sedimentation risk are negligible; however, reduction of sedimentation in the long-term would be less than the other alternatives because there would be less road improvement work. Alternative 4 proposes to salvage harvest a total of 1725 acres (2% of the burned area), which is 25% less than the acres proposed in Alternative 2 and all of it is ground-based. In addition, only 269 of these acres would receive small diameter fuels reduction. Like Alternative 3, the subwatershed with the largest percentage of salvage treatments would be Jack Creek subwatershed and the magnitude of treatment would be similar; however, 9 acres in Alternative 4 would be in the potential sediment contribution area in the Jack Creek subwatershed. Overall, activities in the PSCA in Alternative 4 are very low, 27 acres, and would only potentially cause detrimental soil**Error! Bookmark not defined.** conditions in the PSCA on 5 acres (Table 3. 28). Likewise, design elements would be implemented to help reduce sedimentation from these acres. Danger trees along 3 miles of haul road within the PSCA would be removed with special design restrictions and the 1 mile that is in Riparian Reserves would be removed with low impact logging methods.

Alternative 4 would require the least amount of haul roads and temporary roads, and only 11 miles would be in the PSCA (Table 3.30). Likewise, only about 20 segments of haul would be hydrologically connected to streams. Like other action alternatives, drainage improvements prior to haul and special design elements for haul would be implemented to help offset sedimentation effects from haul. In Alternative 4, 70% of haul roads would receive drainage improvements, which is a higher percentage than other alternatives.

Beneficial activities in Alternative 4 that could affect sedimentation are reforestation on 1725 acres, decommissioning and inactivation of 70 miles of road, improving drainage on 40 miles of road. Although reforestation would occur on approximately 5000 acres less than Alternative 2, effects to sedimentation would be similar because there would be less ground disturbance of existing vegetation and organics. The beneficial effects of road decommissioning and inactivation in terms of sedimentation would be the same in all action alternatives and were discussed in Alternative 2. Drainage improvements than can provide long-term reductions in sedimentation would occur on substantially less road miles in the analysis area in Alternative 3 (38 miles) verses other action alternatives. In addition, 30 culverts associated with erosion would not be replaced and improved in this alternative. Therefore, long-term reductions in sedimentation from beneficial activities would be the lowest in Alternative 4.

Alternative 5

Overall, effects of activities in Alternative 5 on sedimentation would be negligible and would be very comparable to Alternative 3 except that the reduction in sedimentation over the long-term would be slightly less because culvert improvements would not occur.

Alternative 5 proposes to ground-base salvage a total of 4633 acres (5% of the burned area), which is the alternative with the second highest potential sedimentation impacts. Small diameter fuels treatments would be machine piled and burned on approximately 2013 acres within units and 20 acres around Round Lake, similar to Alternative 3. In Alternative 5, Abbot Creek subwatershed would have the largest percent of subwatershed area affected by salvage and Jack Creek would be just slightly less. However, unlike Alternative 3, 63 of the salvage acres would be in the PSCA, but no more than 24 acres would be in any one subwatershed. Danger trees removal in the PSCA and RRs would be the same as Alternative 3 and the same logging methods and design elements would apply.

In Alternative 5 there would be a 12 acre increase in detrimental soil**Error! Bookmark not defined.** acres in the PSCA from salvage and the same amount of disturbance from danger tree removal in the PSCA and RRs as Alternative 3 (Table 3. 28). In addition, project design elements would be implemented to help protect hydrologically connected road segments and reduce sedimentation effects from the danger tree removal in the PSCA. Alternative 5 would have the same number of haul roads in the PSCA and hydrologically connected haul road segments as Alternative 3, and approximately the same number of temporary road miles (Table 3.30) Drainage improvements prior to haul and special design elements for haul would be the same as Alternative 3 and implemented to help offset sedimentation effects from haul.

Beneficial activities in Alternative 3 that could affect sedimentation are reforestation on 4633 acres, decommissioning and inactivation of 77 miles of road, and improving drainage on 71 miles of road. Effects to sedimentation from reforestation would be similar to other alternatives because reforestation would only occur in salvage units; therefore, any reduction in reforested acres would be off-set by a reduction in ground-disturbance from salvage activities. Although Alternative 5 would decommission and inactive 7 miles of road more than other action alternative, the beneficial effects in terms of sedimentation would be the same because the additional 7 miles of road are uplands roads and not associated with aquatic concerns. Beneficial effects to sedimentation from drainage improvements on haul roads in Alternative 5 would be less than Alternative 2 because less haul miles would be treated. Also, beneficial effects would be less than Alternative 3 because the 30 culverts with erosion at the outlets would be not be replaced (**Table 3. 25**).

Cumulative Effects

The cumulative sedimentation effect as a result of the added effect of the B&B Fire Recovery Project would be negligible; therefore, any increases in sedimentation above natural conditions would be attributed to fires or past, future, or other present management activities. Salvage acres proposed in all alternatives of the B&B Fire Recovery Project would be less than 2% of the Upper and Lower Metolius 5th field watersheds. Although up to 31 percent of any one subwatershed (which occurs in Abbot Creek SWS in Alt. 2) could be affected by salvage activities in the most impactive alternative, only 26 of these acres are in the potential sediment contribution area. In addition, no salvage activities are proposed within Riparian Reserves or within a half mile of the mainstem Metolius River. Any sediment input to the Metolius River resulting from disturbance activities associated with the B&B project would be delivered via flow from the tributaries.

Although 6802 acres would be salvaged under the most impactive alternative in the B&B Project, only 168 ground-based salvage acres, 7 mi of danger tree removal, and 29 miles of haul road are within the PSCA of 6 subwatersheds draining into the Metolius River. In addition, long-term sedimentation from roads would be reduced from the B&B Project because 37 miles of road potentially negatively affecting water quality would be decommissioned or inactivated and drainage improvements would be made on 38 to 92 miles of haul road, depending on the alternative chosen.

Some future down wood in upland areas, which would help trap sediment created from salvage activities, would be removed. Likewise, salvage activities would reduce newly established ground vegetation and increase compaction on approximately 821 acres before subsoiling, 33 acres of which are in the PSCA in the most impactive alternative (Table 3. 28). However, down wood and instream wood in areas not salvaged (over 90% of the burn area) is predicted to increase over the next 10 years as standing dead trees fall and will help trap sediment. In addition, activity slash and design elements would help reduce sedimentation effects in salvage units. Although a negligible amount of logging-related sediment may be delivered to the mainstem Metolius River in the short-term (3 to 4 years), the additional sediment input volume from harvest activities would not be enough to alter the long-term sediment input regime at either the subwatershed or watershed scale. No harvest activities are proposed within the instream wood recruitment area (i.e. 100 ft from the channel); therefore, instream wood, which helps trap sediment and create new pools, would not be altered by the action alternatives.

The sedimentation existing condition of the subwatersheds in the B&B Fire Recovery analysis area were analyzed in the existing condition section of this report and in the Metolius Watershed Analysis Update (USDA Forest Service 2004a). The past activities or events with the greatest risk of increasing sedimentation in any one subwatershed are the recent fires. Approximately, 64 percent of the B&B analysis area was burned and over 50% in most subwatersheds (
Table 3.19). Although all subwatersheds in the B&B analysis area, except Cache Creek and Jack Creek subwatersheds, have elevated streamflow and sedimentation risks from past activities and fires, the additional impact of the B&B Fire recovery project would be negligible at the subwatershed scale (6th field) (see Sedimentation Effects discussion). Salvage effects are spread out over nine subwatersheds and activities in the PSCA are less than 70 acres in any one subwatershed. In addition, various restoration activities such as road decommissioning/inactivation, road drainage improvements, and revegetation would occur.

The existing condition as it relates to sedimentation of the Metolius watersheds (5th field scale) was evaluated in the Metolius Watershed Analysis Update and reflects the effects of past activities and fires (USDA Forest Service 2004a). Further analysis of detrimental soil**Error! Bookmark not defined.** condition from past activities in the Metolius watershed indicates that the percent of the Metolius 5th field watersheds that could be in detrimental soil condition is potentially 10%. Only approximately 1% of those detrimental soil condition acres are a result of harvest activities in the last 10 years. In addition, there are 140 miles of system roads in Riparian Reserves within the Metolius watersheds that could affect sedimentation. Regardless of the activities in the watershed, sedimentation in the Metolius River still appears to be remarkably low, according to a study of sediments accumulated in the Metolius Arm of Lake Billy Chinook reservoir from 1964 to 1998 (pre-fire) (O'Connor et al. 2003) . This is especially notable because the 34-year period includes the two largest flow events in the last 140 years. Therefore, sedimentation from past management is assumed to be within the historic range for both the Metolius River and Lake Billy Chinook Reservoir.

At the watershed scale the past activities or events with the greatest potential risk of increasing sedimentation are the B&B Fire Complex (2003), Link Fire(2003), Cache Mountain Fire (2002), and Eyerly Fire(2002) (**Map 3.1**). Approximately 35% of the larger Metolius 5th field watersheds was burned by these fires, of that, 14% was by a stand replacing fire (
Table 3.19). Studies of fire effects on sedimentation have shown large increases (200 to 1000%) in sedimentation after fires (Hauer and Spenser 1998; Helvey 1980), which are generally a result of intense rainfalls occurring within the short-term period before the re-establishment of effective ground cover. Although one rainstorm greater than a 2-year event occurred in the B&B project area in the first year following the fire, no significant overland flow or erosion was observed. In addition, the risk of sedimentation continues to decrease as vegetation reestablishes. Likewise, preliminary monitoring of silt fences in steep high burn severity slopes in the Eyerly Fire area show that erosion in the burn area has been minimal. Less than 0.1 ton per acre of sediment was eroded from these areas during the first year following the Eyerly Fire.

Although the B&B Fire Recovery Project would increase detrimental soil condition by up to 711 acres after mitigation, this would be spread out over 6 subwatersheds and less than 35 acres would be in the area mostly likely to contribute to streams, the PSCA. Therefore, harvest activities proposed in the B&B project would not even increase potential detrimental soil conditions in the 5th field watersheds by 1 percent. In addition, road decommissioning and inactivation would help reduce system road miles in Riparian Reserves and potential sedimentation.

At the subwatershed scale (6th field) future foreseeable activities in the B&B analysis area that could increase sedimentation are the McCache Vegetation Management Project and the Metolius Basin Vegetation Management Project (Table **3.4**). The subwatersheds in which the B&B Fire Recovery Project and these activities primarily overlap are: First Creek, Jack Creek and Lower Lake Creek (Table 3.5). Although up to 32% of a subwatershed may be affected by these activities, very little disturbance would occur in Riparian Reserves. Therefore, the cumulative future effects would be negligible at the subwatershed scale. Both Metolius Basin and McCache Vegetation Management Projects are primarily commercial thinning projects of live stands (< than 16" dbh in Met. Basin and < 21" dbh in McCache) with various pre-commercial harvest prescriptions and fuels treatments. Treatments in riparian reserves would be minimal and at least 100 feet away from the stream. In addition, all trees harvest from the Riparian Reserve would be hand-felled and winched or left on site. Future foreseeable projects in the B&B analysis area that would help reduce sedimentation are the Brush Creek Side Channel Restoration Project – Phase II, and decommissioning or closing 62 miles of road as part of the Metolius Basin and Bull Trout Streamside Protection projects.

The cumulative effects of the B&B Fire Recovery Project and future foreseeable projects mentioned above at the watershed scale (5th field) and other future foreseeable projects outside the analysis area but within the Upper or Lower Metolius 5th field watersheds would also be negligible. The only additional project at this scale would be the Eyerly Fire Recovery project (4877 acres) and no harvest activities are proposed within Riparian Reserves. Also, this project proposes 4 miles of roads for decommissioning, which would beneficially affect sedimentation. The B&B Fire Recovery Project would only affect 2% of the Metolius 5th field watersheds and the combined affect of all these projects, including the B&B project, would affect less than 10% of the watersheds and very little of that would occur in areas likely to contribute sediment to the streams.

Stream Temperature
Measure: Trees harvested within one potential tree height from perennial streams

Alternative 1

The No Action Alternative would have a negligible effect on stream temperature because no shade reducing activities would occur; however, long-term potential increases in shade producing vegetation from road decommissioning and closure would not occur. The B&B Fire would continue to have the greatest influence on stream shade within the analysis area. Most of the streams in stand replacing burn mortality are intermittent and are usually dry during summer low flows when shade is most important. However, water temperature in perennial reaches in Abbot Creek, Brush Creek, Cabot Creek, and Candle Creek increased after the fire. Currently, Brush Creek, Lake Creek and Link Creek have exceeded the 2003 water temperature standard. Regardless, the No Action Alternative would not affect the up-coming 2004 303(d) listing of any streams because no activities would occur that would affect stream shade. Stream temperature may increase in streams not monitored after the fire that were burned by a stand replacing fire, such as Bear Valley (≈2 mi) and First Creek (≈5 mi). Shade will increase as vegetation becomes reestablished and as standing dead trees fall into the channel.

Grasses and shrubs have benefited from the fire and have already shown rapid re-growth in the 1.5 years since the fire. No actions will take place that improve or degrade water quality. Proposed road decommissioning and closure of 26% of the roads within 100 feet of perennial stream channels would not occur, as a result, the potential long-term increase in shade producing vegetation from these activities would not occur.

Alternatives 2, 3, 4, and 5

Salvage harvest would not indirectly affect water temperature by removing the shade component along stream channels because harvest is not planned within the Riparian Reserves along stream channels under any action alternative. Although some select danger trees in Riparian Reserves within the defensible space strategy would be removed, all these would be at least 100 feet from stream channels and would not provide shade. Therefore, the B&B Fire Recovery Project would not affect 303(d) listing status of streams for water temperature exceedances above the State standard. Under all action alternatives, 26% of road miles within 100 feet of perennial steam channels would be decommissioned or inactivated. This would allow vegetation that could help stream shade reestablish. Therefore, ***effects of the proposed harvest activities on stream temperature would be negligible and effects of some proposed road decommissionings and closures could provide a long-term beneficial effect.***

Cumulative Effects

The B&B Fire Recovery Project would not increase water temperatures; therefore, ***there is no cumulative water temperature effect as a result of the combined effects of the B&B Fire Recovery Project and other past, present or foreseeable projects.*** The B&B Fire Recovery would not affect stream temperatures because no activities would occur within 100 feet of perennial streams.The single most important event affecting water temperature within the analysis area would continue to be the B&B Fire. Grass and shrubs have re-sprouted, but hardwood and conifer regeneration has been slow to occur.

Nutrients/Retardant

Measure: Acres of soil detrimentally affected within the PSCA within the first 5 years after the fire.

All Alternatives and Cumulative Effects

Most nutrients and retardant from fire suppression activities have already been transported to the streams and flushed out and/or taken up by plants. Studies have shown that nutrient spikes in streams can occur after fires but usually only last 1 to 5 years (Spencer and Hauer 1991; Debano et al. 1998; Gresswell 1999). There has been significant revegetation of shrubs and grasses and no proposed activities that would effect soil erosion and potential nutrient transport in at least the first 2 years after the fire. In addition, the increase in detrimental soil**Error! Bookmark not defined.** condition acres in the PSCA from the action alternatives would be less than 35 acres in the most impactive alternative. ***There would be no direct, indirect or cumulative nutrient or retardant effects in the B&B analysis area or the Metolius 5th field watersheds from the alternatives.*** Although an increase in nutrients in Lake Billy Chinook (LBC) reservoir could affect the 303(d) listings of pH and chlorophyll *a*, indirect and cumulative effects to these parameters would be negligible because of the reasons mentioned above and the fact that the action alternatives only affect 4% of the area draining into LBC reservoir.

Streamflow

Measure: Percent live tree canopy harvested, acres compacted in the PSCA, miles of decommissioning/inactivation of roads affecting aquatic resources

Alternative 1

Effects of the No Action Alternative on streamflow would be negligible because no trees would be harvested and no additional compaction would occur in areas likely to deliver overland flow to steams. However, decommissioning and closure of 37 miles of roads that potentially affect streamflow would not occur; therefore, overland flow generated from these roads would continue to occur. Under the "No Action" Alternative no additional soil compaction would occur because no land-use activities are proposed.

The effects of the B&B Fire itself would continue to have the greatest influence on hydrology and streamflows within the B&B analysis area. Although infiltration is naturally high in the project area and overland flow occurs infrequently, the significant decrease in evapotranspiration due to the fires could affect streamflow. As discussed in the existing conditions streamflow section and in the Metolius Watershed Analysis Update, the CET model was used to model evapotranspiration changes in the subwatersheds most affected by the B&B fire. Percent CET was predicted to decrease between 1 and 22 units for the subwatersheds in the B&B analysis area (USDA Forest Service 2004a). In addition, other subwatershed variables were analyzed to determine the risk of increased streamflows. As a result, Candle Creek, Canyon Creek, First Creek, and Headwaters of the Metolius River subwatersheds were at highest risk of increased streamflows from the B&B fire. Under Alternative 1, there is no direct funding or plans to replant burned acres. Recovery of evapotranspiration processes and precipitation interception in the long-term would be more rapid under the Action Alternatives because planting would restore conifer cover more quickly than "No Action" under Alternative 1. Accordingly, streamflows would take longer to return to pre-fire levels in Alternative 1.

Alternatives 2, 3, 4 and 5

Effects of the proposed harvest activities on streamflow would be negligible and effects of proposed road decommissionins and closures would provide long-term beneficial streamflow effects. The action alternatives would have a negligible effect on streamflow because no live trees would be removed and soil compaction would be minimal and mitigation would be applied. In addition, infiltration is naturally high in the project area and overland flow occurs infrequently. Although some precipitation adheres to dead trees and returns to the atmosphere, harvest would not measurably reduce interception or evaporation. Under the action alternatives, units that were harvested would be replanted with conifers. Recovery of evapotranspiration processes and precipitation interception in the long-term would be more rapid under action alternatives than under "No Action" because planting 2 year old trees would restore conifer cover more quickly. Likewise, recovery of infiltration, which would reduce overland flow, would be more rapid under Action Alternatives because 37 miles of road that potentially affect streamflow would be decommissioned or closed.

Any increase in overland flow from proposed activities is most likely to occur on compacted surfaces (i.e. skid trails, roads, landings). Soil compaction from proposed activities can increase streamflow if overland flow is routed to the streams. Salvage activities would disturb newly established ground vegetation and could increase compaction on approximately 821 acres before subsoiling in the most impactive alternative, a portion of which is hydrologically connected to streams. The area mostly likely to contribute overland flow is the PSCA. In both action alternatives detrimental soil**Error! Bookmark not defined.** condition (which includes compaction) would increase, but by less than 35 acres in the potential sediment contribution area (Table 3. 28). In addition, no compaction would occur within Riparian Reserves. Areas compacted in the PSCA would be given priority for subsoiling and would not exceed Forest Plan guidelines of less than or equal to 20% detrimental soil condition. In addition, soil and water design elements would be applied to help reduce the effects.

The amount of logs proposed for removal would have a negligible effect on runoff and streamflow. Fuel loading outside of units, as a result of falling dead trees, will rapidly increase over the next 10 to 15 years and is predicted to exceed Forest Plan standards (refer to Fuels Report). The amount of dead wood available for slowing overland flow would rapidly increase beyond pre-fire conditions. More than 90% of the post-fire downed wood would be unaffected in all alternatives and a specified amount of downed wood and snags would also be left within units. In addition, no wood would be removed within 100 feet of stream channels and within salvage units activity slash, herbaceous vegetation off skid-trails, and design elements would help slow overland flow. Instream wood, which helps dissipate flow energy, would not be altered by the action alternatives because no harvest activities are proposed within the instream wood recruitment area (i.e. 100 ft from the channel).

Some future down wood in upland areas, which would help slow overland flow off skid trails, would be removed. Likewise, salvage activities would reduce newly established ground vegetation and increase compaction in the PSCA on approximately 34 acres before subsoiling in the most impactive alternative (Table 3. 28). However, down wood and instream wood in areas not salvaged (over 90% of the burn area) is predicted to increase over the next 10 years as standing dead trees fall and will help trap reduce overland flows. In addition, activity slash and design elements would help reduce effects to overland flow in salvage units. No harvest activities are proposed within the instream wood recruitment area (i.e. 100 ft from the channel); therefore, instream wood, which helps dissipate flow energy, would not be altered by the action alternatives.

Cumulative Effects

The cumulative streamflow effect as a result of the added effect of the B&B Fire Recovery Project would be negligible; therefore, any increases in streamflow above natural conditions would be attributed to fires or past, future, or other present management activities. The action alternatives would have a negligible effect on streamflow because no live trees would be removed. In addition, soil compaction, as some portion of detrimental soil**Error! Bookmark not defined.** condition, would increase on less than 35 acres within the PSCA of 6 subwatersheds (Table 3. 28). Long-term overland flow from roads would be reduced from the B&B Project because 37 miles of road potentially negatively affecting streamflow would be decommissioned or inactivated and drainage improvements would be made on 38 to 92 miles of haul road, depending on the alternative chosen.

Because salvage of dead trees and associated activities have a negligible effect on streamflow in the subwatersheds, it has an even less effect on the free-flowing reaches of the Metolius River. Salvage acres proposed in all alternatives of the B&B Fire Recovery Project would be less than 4 % of the area that drains into the free-flowing reaches of the Metolius River and no more than 32 percent in any one subwatershed. In addition, no salvage activities are proposed within Riparian Reserves or within a half mile of the mainstem Metolius River. Any flow input to the Metolius River resulting from compaction associated with the B&B project would be delivered via flow from the tributaries.

The recent past, present and future foreseeable activities in the B&B project area, B&B analysis area, or the Metolius 5th field watersheds with the greatest streamflow effects are the recent fires (refer to Summary of Cumulative Effects section and **Map 3.1**; Table **3.4**). Various vegetation management projects have occurred in the Metolius watersheds; however, recent fires have had the largest predicted evapotranspiration effect. Approximately 64 % of the B&B analysis area was burned by either the B&B or Link Fires, all of which occurred in the last 2.5 years. Approximately, 41% of the watershed area that drains into the free-flowing reaches of the Metolius River was burned by these fires plus the Eyerly and

Cache Mountain Fires (2002), and of that, 11 percent was by a stand replacing fire. Studies have shown increases in water yield following fires ranging from 7 % (Farnes 2000) to 52 % (Helvey 1980), more variability in the amount of increase in water yield or peak flow is reported for created openings (Scherer 2000, Stednick 1995, Fowler et al. 1987, Troendle and King 1985). Although one rainstorm greater than a 2-year event occurred in the B&B project area in the first year following the fire, no significant overland flow was observed.

Various streamflow factors were evaluated at the subwatershed scale (6th field) to determine the effects of past management and recent fires (refer to Existing Condition section). Although the Metolius Watershed Analysis Update identified Candle Creek, Canyon Creek, First Creek, and Headwaters of the Metolius River subwatersheds as have high streamflow risk factors from past activities and fires, the additional impact of the B&B Fire recovery project would be negligible at the subwatershed scale (6th field). Salvage effects are spread out over nine subwatersheds and activities that could cause compaction in the PSCA of these subwatersheds would occur on less than 70 acres in any one subwatershed. In addition, various restoration activities such as road decommissioning/inactivation, road drainage improvements, and revegetation would occur that would help reduce the risk of overland flow.

The Metolius River streamflow data show no trend due to management or fires in the 5th field watersheds; however, detecting a trend would be difficult due to the porous geology. Therefore, the change in the evapotranspiration index (% CET), due to the loss or removal of vegetation from recent fires, fire suppression, past timber management, and roads was used to estimate existing streamflow conditions in the Metolius Watershed (combined Upper and Lower Metolius 5th field watersheds) (refer to Existing Condition/Streamflow section). The existing percent CET for the area draining into the Metolius River is 27 (USDA Forest Service 2004a). This is less than the historic mean of 36 % but within the historic range of variability (7 to 61%). Recent fires have reduced % CET in the watersheds from 34% to 27%. Although CET does not directly translate into streamflow due to watershed characteristics such as infiltration and precipitation, overall streamflow is predicted to increase but be within the range of historic water yields and peaks.

The B&B Fire Recovery Project would only affect 4% of the area draining into the free-flowing reaches of the Metolius River (5th field scale) and it would not have a detectable effect on % CET because no live trees would be harvested. However, the B&B project could increase soil compaction on 711 acres, but less than 35 acres would be in the area mostly likely to contribute to streams. Therefore, harvest activities proposed in the B&B project would not increase potential soil compaction in the 5th field watersheds by even 1 percent. In addition, road decommissioning and inactivation would help reduce system road miles in Riparian Reserves and potential overland flow.

Future foreseeable activities in the B&B analysis area that could affect streamflow at the subwatershed (6th field) and watershed (5th field) scale are the same as those discussed in the Sedimentation Cumulative Effects section of this report. Proposed harvest treatments in Riparian Reserves would be minimal or none in all future foreseeable projects and would occur at least 100 feet away from streams. No compaction would occur within the Riparian Reserves of these projects because equipment would be limited to existing roads. Some live trees will be harvested in the McCache and Metolius Basin Vegetation Management Projects, but a reduction in evapotranspiration is likely to be minimal because these are primarily thinning projects. The Eyerly Salvage (5th field scale) would have only a negligible streamflow effect because no live trees would be harvested and soil compaction would not be at a magnitude to negatively affect streamflow. Future foreseeable projects in the B&B analysis area that would help reduce overland flow and associated peakflows is road decommissioning or closure associated with various projects (refer to Cumulative Effects for Sedimentation). Although up to 32% of a subwatershed in the B&B analysis area may be affected by these activities, very little disturbance would occur in Riparian Reserves. In addition, the combined affect of all these projects, including the B&B project, would affect less than 10% of the watersheds and very little of that would occur in areas likely to contribute overland flow to the streams.

Channel Condition
Measure: Alteration of stream bank and bed stability measured by changes in streamflow, sedimentation, riparian vegetation, and large woody debris recruitment. Specific measures include: percent live tree canopy harvested, of soil detrimentally impacted in the PSCA, miles of decommissioning/inactivation of roads affecting aquatic resources, haul road miles within the PSCA, haul road drainage improvement miles, acres harvested in Riparian Reserves, acres harvested within one potential tree height from streams

Alternative 1

The No Action Alternative would have a negligible effect on channel condition because no activities would occur that would effect stream bank and bed stability. The B&B Fire itself would continue to have the greatest influence on channel condition within the analysis area. Conditions and hydrologic function as described in the Existing Condition section would continue as they are. The Metolius Watershed Analysis Update predicted a risk of morphological change in the type B and C intermediate reaches in Canyon Creek, the type B intermediate reach and type E lower reach of Brush Creek, and the type C reaches in Candle Creek and First Creek. Changes to channel morphology could include increased bank erosion, increased width-to-depth ratio, changing the location of pools (filling in some and creating others), and increasing sedimentation. All these effects depend on the timing and magnitude of peak flows and the abundance of in-stream wood.

Between 0 and 54 % of RRs within the subwatersheds in the B&B analysis area were mostly denuded (stand replacing fire) and are more susceptible to erosion. Instream wood prior to the fire was generally abundant in the B&B analysis area and is predicted to significantly increase as standing dead trees in riparian areas fall. Instream wood will help mitigate the predicted increase in sedimentation by trapping sediment and creating new pools.

In Alternative 1, there are no project-related plans or funding to replant burned acres; therefore, vegetation recovery from the B&B Fire and past harvest activities would continue to occur at natural rates. Under the “No Action” Alternative, no land-use activities are proposed; therefore, soil compaction would maintain the status quo. In addition, soil effects from past activities would remain unchanged. Long-term channel effects from roads would continue because road decommissioning, closure, and drainage improvements proposed in the Action Alternatives would not occur as a result of the B&B Fire Recovery R.O.D.

Alternatives 2, 3, 4, and 5

The action alternatives would have a negligible effect on channel condition because the effect on stream bank and bed stability would be negligible. Changes in streamflow, sedimentation, riparian vegetation, and LWD recruitment can affect stream bank and bed stability. The action alternatives would only have a minimal effect on streamflow because evapotranspiration would not be altered on site and the increase in compaction from ground-based activities in the PSCA would not be at a magnitude that would significantly increase streamflow. By not increasing streamflows, especially the more erosive high flows, the action alternatives would not increase the risk of stream channel erosion. Under all action alternatives, upland units that were harvested would be replanted with conifers. Recovery of conifers, which would increase evapotranspiration, and likely reduce overland flow and associated risk of channel erosion would be more rapid under the Action Alternatives than under the “No Action” Alternative.

Proposed activities would have only a negligible effect on sediment deposition and associated channel erosion because large riparian buffers and sufficient levels of down wood would intercept most of the upland erosion caused by activities and prevent it from being transported to the streams. The risk of channel effects from debris slides would not increase because no harvest activities would occur on high risk debris slide areas that could reach a stream (refer to Soils Report, Helicopter Units/Direct Effects) and project design elements such as the use of streamside buffers (described below) and special treatments in the PSCA would be implemented. Removing dead trees would not compromise slope stability because tree roots would not be altered. In addition, approximately 37 miles of road, directly affecting aquatic resources, would be decommissioned or closed after all proposed activities are completed. If any sediment is transported to the streams it would most likely be stored behind obstructions or deposited in slow velocities areas in the intermediate reaches of the drainage and even less of that sediment would reach the Metolius River.

In the Action Alternatives, no machine travel would occur within 320 feet of fish-bearing streams or within 160 feet of perennial non-fish bearing streams or intermittent streams; therefore, existing and newly established riparian vegetation, which provides channel stability, would not be disturbed by timber harvesting or associated salvage activities. Instream wood in the fire area is predicted to increase over the next 10 years as standing dead trees in RRs fall into the channel, and the B&B Fire Recovery Project would not affect this because no trees would be removed within one potential tree height from the streams and no harvest would occur on slopes with high debris slide risk of reaching a stream. Pools, which help dissipate stream energy and maintain stream bed and bank stability, would not have a detectable effect from the project because there would be only a negligible effect on streamflow, sedimentation, and in-channel LWD.

Cumulative Effects

The cumulative channel condition effect as a result of the added effect of the B&B Fire Recovery Project would be negligible; therefore, any degradation to channel condition would most likely be attributed to fires or past, future, or other present management activities. Salvage activities would have a negligible effect on channel condition in the tributaries to the Metolius River because salvage effects on streamflow, sedimentation, riparian vegetation, and wood recruitment, all of which affect channel bank and bed stability, would be negligible. Salvage acres proposed in all alternatives of the B&B Fire Recovery Project would be less than 4% of the area that drains into the free-flowing reaches of the Metolius River. Although up to 32 percent of a subwatershed could be affected, less than 70 acres of ground-based harvest would occur in the PSCA and even less of that would be detrimentally**Error! Bookmark not defined.** impacted (Table 3. 28). In addition, only limited removal of danger trees would occur in the Riparian Reserves and none would be harvested within the instream wood recruitment area (i.e. 100 ft from the channel); therefore, instream wood, which helps trap sediment and create new pools, would not be altered by the action alternatives.

The channel condition existing condition of the subwatersheds (6^{th} fields) in the B&B Fire Recovery analysis area were analyzed in the existing condition section of this report and in the Metolius Watershed Analysis Update (USDA Forest Service 2004a). The past activities or events with the greatest risk of negatively affecting channel condition in any one subwatershed are the recent fires. Approximately, 64 percent of the B&B analysis area was burned and over 50% in most subwatersheds (Table 3.19). Although stream reaches in Candle Creek, Canyon Creek, and First Creek subwatersheds have elevated risk of channel morphological change from past activities and fires, the additional impact of the B&B Fire recovery project would be negligible at the subwatershed scale (6^{th} field) (see Channel Condition Effects discussion).

Salvage activities would have a negligible effect on channel condition in the tributaries to the Metolius River because salvage effects on streamflow, sedimentation, riparian vegetation, and wood recruitment, all of which affect channel bank and bed stability, would be negligible. Cumulative effects on streamflow and sedimentation are negligible because no live trees would be harvested, there would be limited (< 70 ac) and regulated activity in the PSCA, and only a minimal increase in compaction (Refer to Cumulative Effect section for Streamflow and Sedimentation). In addition, various restoration activities such as road decommissioning/inactivation, road drainage improvements, and revegetation would occur. Cumulative effects to riparian vegetation would be negligible because no compaction would occur within Riparian Reserves and some compaction may be reduced because approximately 15 miles of road decommissioning would occur in RRs which may include subsoiling. Cumulative effects to instream woody debris and future wood debris would be negligible because no harvest of trees within the wood recruitment area (1 potential tree height from stream and debris slide areas that could reach streams) would occur.

The existing condition as it relates to channel condition of the Metolius River (5th field scale) was evaluated in the Metolius Watershed Analysis Update and reflects the effects of past activities and fires (USDA Forest Service 2004a). Predicted cumulative effects to the channel condition of the Metolius River from the B&B Fire Recovery Project and other past, present, and future foreseeable projects or events are evaluated based on effects to streamflow, sedimentation, riparian vegetation, and wood recruitment because all these components affect channel bank and bed stability. The streamflow and sedimentation existing condition of the Metolius River were already discussed in detail in other sections and flow was determined to be stable and sedimentation was thought to be relatively low.

Riparian vegetation along the Metolius River is generally healthy and well established, especially in the Upper Metolius where Riparian Reserves are by medium and large trees (USDA Forest Service 2004a). In addition, the percent unstable banks along the Metolius River is only about 1%, primarily due to it's stable, spring-fed flow. Instream large wood debris, which helps dissipate stream energy, is thought to be below historic wood densities (Houslet 2004; USDA Forest Service 2004a). Average instream wood density for the Metolius River is approximately 50 logs/mi, and 85% of the wood has been actively added to the channel. Large wood densities are probably below historic frequencies due to active wood removal in the Metolius River between 1930 and 1950; however, part of the low frequency of wood in some reaches of the Metolius is due to drier vegetation types, which have a lower rate of natural recruitment. Pools, which also help dissipate stream energy, are limited in the Metolius River and pool frequency is only about 4 pools/mi. Some reasons for the low pool frequency are the geology (some bedrock constraints), the channel type, and a lack of large wood. Although pool frequency is low, the pools that exist are large and deep (USDA Forest Service 2003; USDA Forest Service 1999).

At the watershed scale the past activities or events with the greatest potential risk of increasing morphological change in the Metolius River are the recent fires (**Map 3.1**). Approximately, 41% of the watershed area that drains into the Metolius River (verses Lake Billy Chinook reservoir) was burned by these fires, and of that, 11 percent was by a stand replacing fire. Although only 2 miles of the Metolius River was burned by a low intensity fire, the Metolius River may see increases in stream flow, sediment, and LWD from the tributaries. However, the risk of morphological change in the Metolius River still remains low due to its well vegetated stream banks and connection to the floodplain. In addition, the risk of morphological change decreases as vegetation reestablishes in the tributaries.

The effect of salvaging dead trees and the associated activities on channel condition of the Metolius River (5th field scale) would be negligible because it was negligible at the subwatershed scale. Salvage acres proposed in all alternatives of the B&B Fire Recovery Project would be less than 4 % of the area that drains into the Metolius River. Predicted effects to the channel condition of the Metolius River from the B&B Fire Recovery Project were evaluated based on effects to streamflow, sedimentation, riparian vegetation, and wood recruitment. Any flow or sediment input to the Metolius River resulting from compaction associated with the B&B project would be delivered via flow from the tributaries. These cumulative streamflow and sedimentation effects were already discussed in detail in other sections and are predicted to be negligible. No salvage activities are proposed within Riparian Reserves or within a half mile of the mainstem Metolius River. In addition, LWD recruitment would be unaffected by the project because no trees would be removed within natural wood recruitment areas for either the tributaries or the Metolius River.

At the subwatershed (6th field) and watershed (5th field) scale future foreseeable activities in the B&B analysis area that could affect channel condition are the same as those discussed in the Sedimentation Cumulative Effects section of this report. Cumulative effects to channel condition from the added effect of the B&B project would be negligible because streamflow and sedimentation risks would be negligible (see Cumulative Effects of Streamflow and Sedimentation sections), activities in Riparian Reserves would be limited, and no harvest activities would occur within 100 feet of stream channels. In addition, the combined affect of all these projects, including the B&B project, would affect less than 10% of the watersheds and very little of that would occur in areas likely to contribute overland flow and sediment to the streams and none would occur within half a mile of the Metolius River.

3.6 Forest Vegetation

Introduction

This section describes the Existing Condition of forest vegetation within the B&B Fire Recovery Project Area and the anticipated effects of the considered alternatives (including no action) to forest vegetation from salvage, fuels treatment, and reforestation activities.

Existing Condition

Effects from the B&B Complex Fire

The B&B Fire burned approximately 90,696 acres. Of that total, approximately 85,685 acres were on Forest Service Lands, 3,803 acres were on the Warm Springs Indian Reservation and 1178 acres were on private lands. Of the Forest Service acres affected by the fire, 19,568 acres were on the Willamette National Forest, McKenzie and Detroit Ranger Districts and 66,147 acres were on the Sisters Ranger District.

Forest Types Affected by the Fire

The B&B Fire affected a wide range of forest types (as described by plant association groups) on the Sisters Ranger District[35] (see Table 3.36 and Map 3.5). The fire occurred within the Metolius Basin (2,700 ft in elevation) all the way up to the crest of the Cascades (6,500 ft in elevation). As a result, the affected area encompassed the lower elevation dryer ponderosa pine forests (PP; generally found below 3,500 ft.), mid-elevation dry mixed conifer forests (PPD; found between 3,000 and 5,000 ft. elevation), wet mixed conifer forest (MCW; generally found between 3000 and 5000 ft. elevation) and high elevation lodgepole pine (LPP), sub-alpine fir and mountain hemlock forests (MH) (found above 4,000 ft. elevation). A variety of riparian vegetation was also affected in all the forest types as well as some of the non-forest area.

The lower elevation ponderosa pine forests are found on the eastern edge of the B&B fire and the project area. In these forests, the fire regime here was historically of the frequent low severity type – the fires occurred between 1 to 35 years, averaging 7-15 years. This fire regime (Fire Regime I[36] led to a high percentage of large open park-like structure at the turn of the century (USDA Forest Service, 1996). Today, this area is primarily composed of smaller diameter second growth trees because a significant portion of the original mature ponderosa pine overstory had been removed by past harvest. This structure is relatively unchanged by the fire (see next section).

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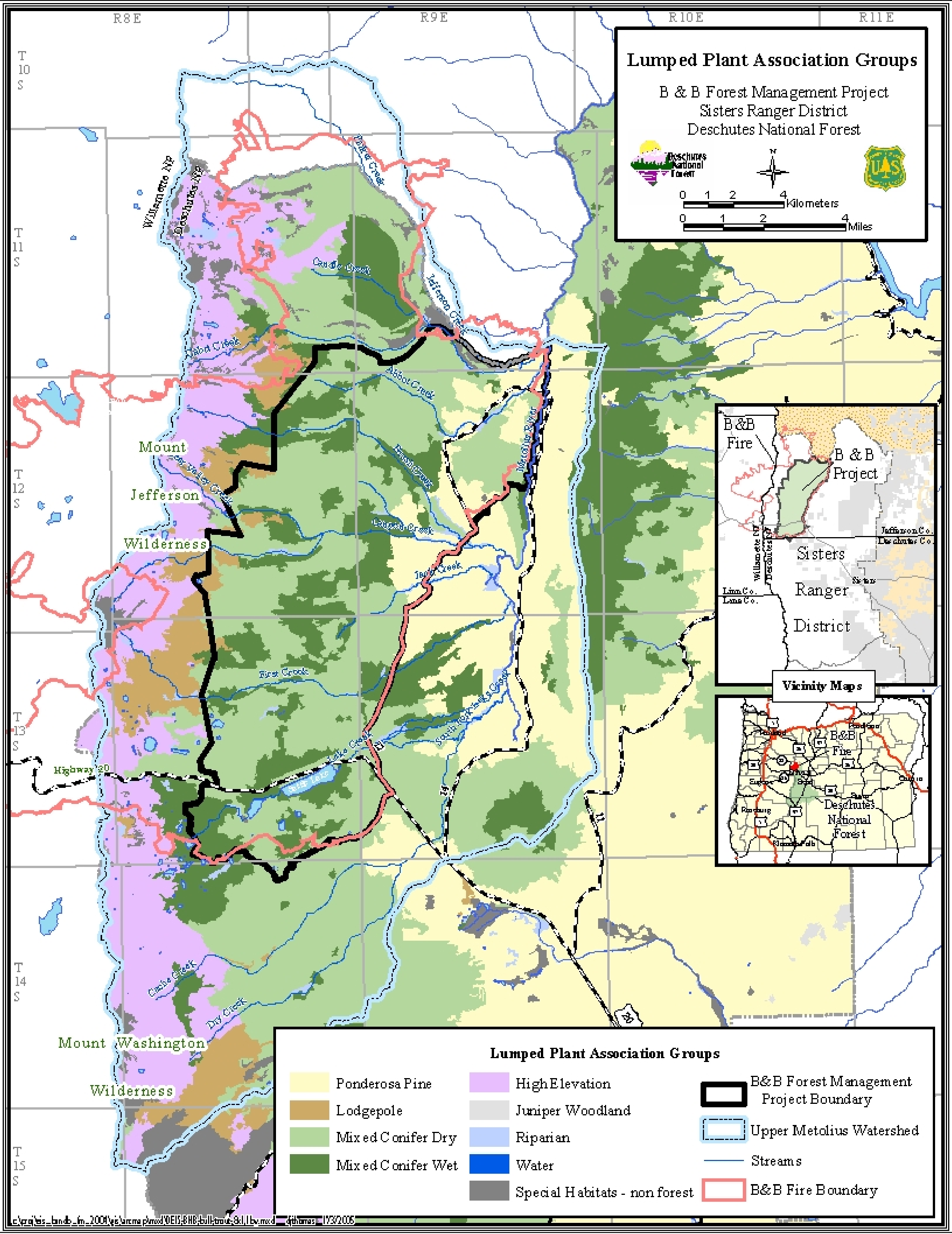
[35] Potential natural vegetation on the Sisters Ranger District has been mapped to the plant association level. The basic document used for typing the plant associations was the Plant Associations of the Central Oregon Pumice Zone (Volland, 1976, Volland, 1985). Plant associations were further combined into plant association groups (PAG) based on similarities in climax species and site productivity, and then PAGS were further grouped into lumped plant association groups (LPAG) for analysis purposes. PAGs and LPAGs within the B&B Fire Area and the B&B Fire Recovery Project Area are displayed in Table 3.36 and Map 3.5.

[36] Natural or historic fire regimes as discussed within this report are based on the definitions in the Pacific Northwest Fire Regime Variant developed by Evers (2002). The Pacific Northwest Fire Regime Variant is based on the five natural (historical) fire regime classes from Hardy et al. (2001) as interpreted by Hann and Bunnell (2001). This natural/historic fire regime concept is a general classification of the role fire would have played in the absence of human fire suppression by mechanical methods but also includes the influence of aboriginal burning.

Table 3.36 - Plant Association Groups (PAGs) for the B&B Fire Area and the B&B Fire Recovery Project Area.

							Percent Area
Mixed Conifer Dry	MCD	Mixed Conifer Dry	MCD	30,924	47%	24,531	60%
Ponderosa Pine Dry Ponderosa Pine Wet	PPD PPW	Ponderosa Pine	PP	3,657	6%	3,856	9%
Mixed Conifer Wet	MCW	Mixed Conifer Wet	MCW	14,415	22%	10,675	26%
Mountain Hemlock Dry White Bark Pine Dry	MHD WBPD	High Elevation	HE	9,084	14%	13	0%
Lodgepole Pine Dry Lodgepole Pine Wet	LPD LPW	Lodgepole Pine	LPP	5,245	8%	724	2%
Cinder Lava Rock Alpine Meadow Meadow Xeric Shrub	CINDER LAVA ROCK AMDW MDW XSHB	Special Habitats	SH	1,140	2%	182	0%
Mesic Shrub Riparian Hardwood	MSHB RIP HWD	Riparian	RIP	805	1%	585	1%
Water	WATER	Aquatic	AQU	504	1%	369	1%
GRAND TOTALS				65,773	100%	40,935	100%

Map 3.5. Lumped Plant Association Groups



Prior to the B&B, the mid-elevation mixed conifer forests in the project area consisted of large remnant early seral species (ponderosa pine, Douglas fir and western larch) and a dense true fir dominated understory. Ponderosa pine was the major component of the remnant overstory; Douglas-fir and western larch were minor components. The fir understory is composed of mainly white fir with some Douglas-fir and incense-cedar and minor amounts of ponderosa pine.

This dense forest structure and fir dominated species composition is highly susceptible to severe insects, disease outbreaks and severe wildfires. From 1985 to 1992 a western spruce budworm outbreak occurred throughout the mixed conifer forest in the project area. This outbreak, in combination with widespread root disease and density induced bark beetle attacks in the ponderosa pine, affected approximately 115,000 acres and killed many trees. Based on mortality in a comparable mixed conifer LSR on the Sister RD, it was estimated that 72% of the acres suitable for northern spotted owl nesting, roosting and foraging habitat was lost as a result of this western spruce budworm outbreak (USDA Forest Service, 2001).

The primary historical fire regimes for the mixed conifer forests are highly variable and depend on a combination of stochastic factors including: weather at the time the fire occurs and pre-fire forest fuel structure. In other words, potential forest structure and landscape patterns are much more variable and the end result is thought to be much less consistent than they are in the ponderosa pine. Thus, we are referencing “historic” as simply what occurred at the turn of the century rather than claiming a predictable repeatable pattern of disturbance. Prior to the turn of the century, it appears that fire returned at less than 50 year intervals (Fire Regime IIIA) in the drier mixed conifer (MCD) portion of the B&B. This created, predominantly open park-like stands dominated by ponderosa pine, Douglas fir and an abundance of the large ponderosa pine, Douglas-fir and larch (USDA Forest Service, 1996).

Upper elevations and areas with moist wizard soils are the most productive areas of the mixed conifer forest (MCW). This increased productivity resulted in a somewhat different structure, density and species composition and fire periodicity than in the MCD. Because of the better growing conditions, moister fuels, and longer return interval it leads to denser more multi-storied stands. This leads to higher severity fire when a fire does occur. This, in turn leads to more areas of stand replacement when a fire occurs (Fire Regime IIIB).

The higher elevation plant associations, mountain hemlock, white-bark pine, subalpine fir and lodgepole pine, are primarily found above 4,000’ in designated wilderness or in the Santiam Pass area. These forest types are dominated by trees smaller than 21” DBH with some patches dominated by trees over 21” DBH. The predominance of smaller trees is a result of a wildfire that occurred in 1871 and encompassed approximately 10,000 acres (Simon, 1991).

The dominant fire regime here was probably a stand replacing fire regime with a 35 to 100+, fire return interval (Fire Regime IV). These high elevation forest types also probably contained some Fire Regime V, a stand replacing fire regime with a fire return interval greater than 200 years. In the high elevation forest types, Fire regime V is most likely in areas in which fire return is greater than 200 years due to topographical position such as areas close to the tree line or on north slopes.

Along with these basic forest types, diverse plant habitat is also provided by the courses of intermittent and permanent streams (riparian zones), seeps and springs, seasonally moist and dry meadows, forest fringes, scablands and large rock outcrops.

Vegetation Mortality

The stands within the B&B fire and the B&B project area burned at varying intensities based on the current condition of the vegetation (species composition, structure and density), dead fuel loading (both vertical and horizontal), topography and weather conditions at the time of the fire.

The effects of the fire have been classified into 3 categories based on the effect to the forested canopy as follows: low mortality, moderate mortality and high mortality. The acres burned in each category are displayed in Table 3.37 and the categories are described below.

Table 3.37. Mortality to vegetation for the B&B Fire and the B&B Fire Recovery Project within the Upper Metolius 5th Field Watershed.

Vegetation Mortality	Metolius 5th Field Watershed		B&B Fire Area on Sisters RD		B&B Project Area on Sisters RD	
	Acres	% of Watershed	Acres	% of B&B Fire	Acres	% of B&B Project
Low	27,011	22%	21,952	33%	15,457	38%
Moderate	14,526	12%	12,794	19%	7,529	18%
High	34,073	28%	30,462	46%	17,494	43%
Outside of Fire	47,843	39%	565	1%	455	1%
Total	123,502	100%	65,773	100%	40,935	100%

Low Mortality: These areas generally received a low to severe underburn that resulted in low mortality in the overstory trees (generally less than 25%), 10% to 90% mortality and perhaps consumption of the ground vegetation, and 25% to 75% consumption of the existing down woody debris.

Many of these acres appeared to have experienced a “nice underburn”. In some cases this is true, however, in other cases, the underburn was very severe and is likely to result in the loss of most of the white fir and other non-fire resistant components (e.g., lodgepole pine, western white pine, incense cedar, western red cedar and other true firs) as well as younger ponderosa pine and Douglas-Fir, if present. In the areas of severe underburning, it appears that most of the older, larger ponderosa pine and Douglas-fir will be able to survive this intense underburn, however, due to the intense heat of the fire at the base of the non-fire resistant components, primarily white fir, it can be expected that even the older, larger white fir and other similar components will continue to be lost over the next 3 to 5 years, or longer, due to the effects of the fire. It is expected that the white fir trees that were not killed outright by the fire but are under stress will continue to die from a variety of factors (fire effects, or insects, or diseases) over the course of the next 5 or more years.

Some areas within this category may actually be unburned, but in general these are isolated areas and are the exception rather than the rule.

Moderate Mortality: These areas experienced mixed mortality burning where the over-story tree mortality ranges from 25% to 75%. Many areas tend toward the high end of the mortality range with some scattered small patches of 100% mortality. The primary tree species to make it through the fire in these areas were the large overstory ponderosa pine and Douglas-fir. These areas also received a very severe underburn resulting in 90% to 100% mortality and consumption of the ground vegetation and 50% to 80% consumption of the existing down woody debris. A percentage of these acres will need reforestation.

High Mortality: These areas received very high intensity fire that resulted in, for all practical purposes, a stand replacement event. In most areas, the over-story tree mortality is 100% but can be as low as 75%, especially on the edges of these areas. These acres will require reforestation.

Vegetation Mortality by Lumped Plant Association Group

Vegetation mortality by lumped plant association group is displayed in tables 3.38 and 3.39. Map 3.6 shows the distribution of vegetation mortality classes over the fire landscape on the Sisters Ranger District. Figures 3.1 and 3.2 provide a representation of the acres and percentages of the vegetation mortality classes by lumped plant association groups (LPAG). Across the B&B Fire on the Sisters

Ranger District, stand replacement fire occurred on approximately 42% to 53% of all plant associations except the lodgepole pine plant association which experienced approximately 69% stand replacement mortality, and the ponderosa pine plant association which experienced just under 20% stand replacement mortality.

Table 3.38. Vegetation mortality by Lumped Plant Association Group for the B&B Fire on the Sisters Ranger District.

LPAG	Total Acres	Vegetation Mortality				Total
		Low	Moderate	High	Moderate + High	
Aquatic	504	n/a	n/a	n/a	n/a	100%
High Elevation	9,084	33%	26%	42%	67%	100%
Lodgepole Pine	5,245	18%	13%	69%	82%	100%
Mixed Conifer Dry	30,924	31%	22%	47%	69%	100%
Mixed Conifer Wet	14,415	32%	16%	51%	68%	100%
Ponderosa Pine	3,657	68%	13%	19%	32%	100%
Riparian	805	39%	7%	54%	61%	100%
Special Habitats	1,140	93%	2%	4%	7%	100%
Total	65,773	34%	19%	46%	66%	100%

Table 3.39. Vegetation mortality by Lumped Plant Association Group for the B&B Fire Recovery Project.

LPAG	Total Acres	Vegetation Mortality				Total
		Low	Moderate	High	Moderate + High	
Aquatic	396	n/a	n/a	n/a	n/a	100%
High Elevation	13	0%	0%	100%	100%	100%
Lodgepole Pine	724	39%	21%	40%	61%	100%
Mixed Conifer Dry	25,380	32%	20%	48%	68%	100%
Mixed Conifer Wet	10,877	40%	18%	42%	60%	100%
Ponderosa Pine	3,937	70%	12%	18%	30%	100%
Riparian	626	42%	7%	51%	58%	100%
Special Habitats	190	98%	0%	2%	2%	100%
Total	42,143	38%	18%	43%	61%	100%

Map 3.6. B&B Fire Vegetation Mortality

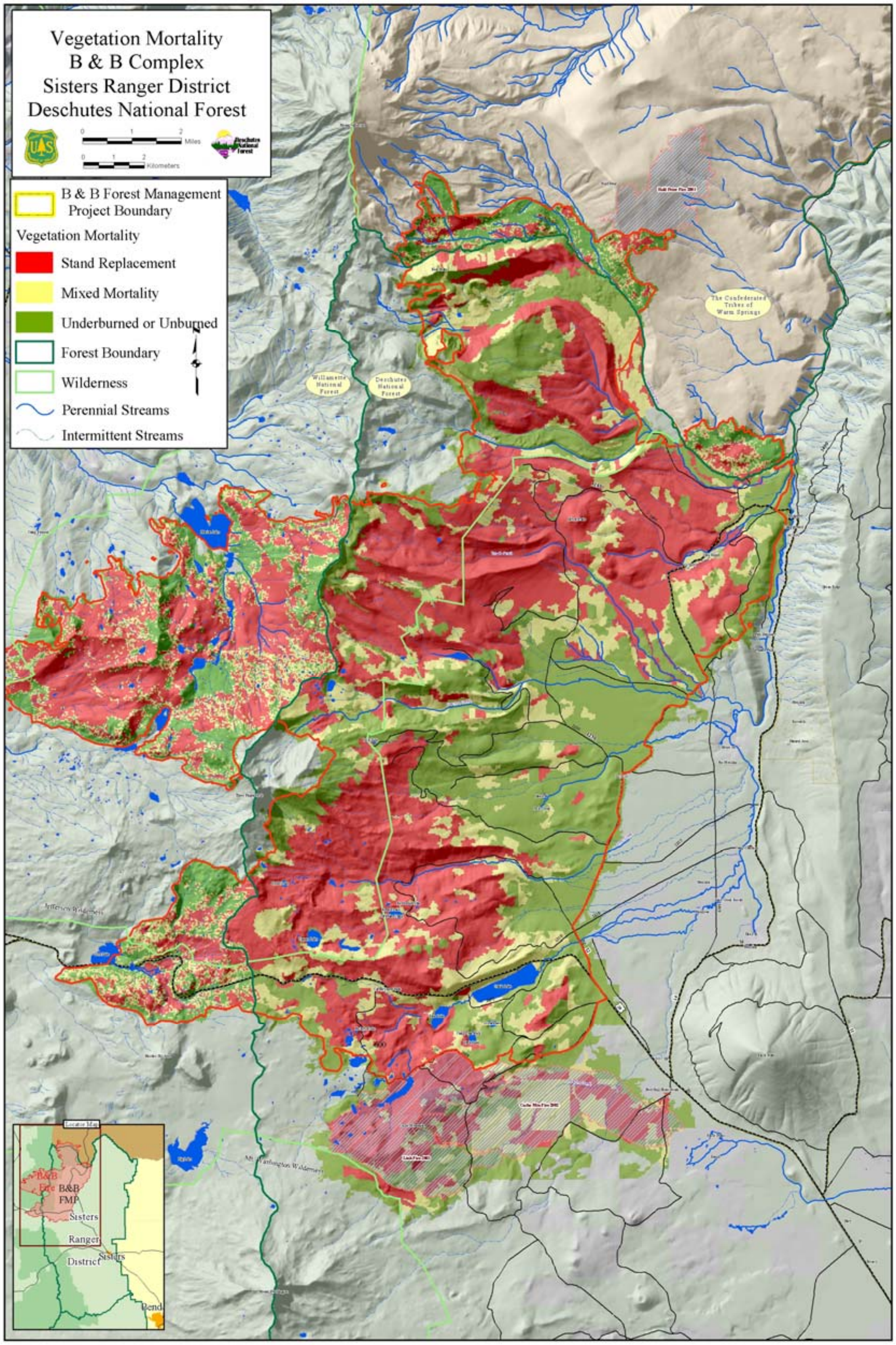


Figure 3.1. Vegetation mortality by Lumped Plant Association Group for the B&B Fire Area.

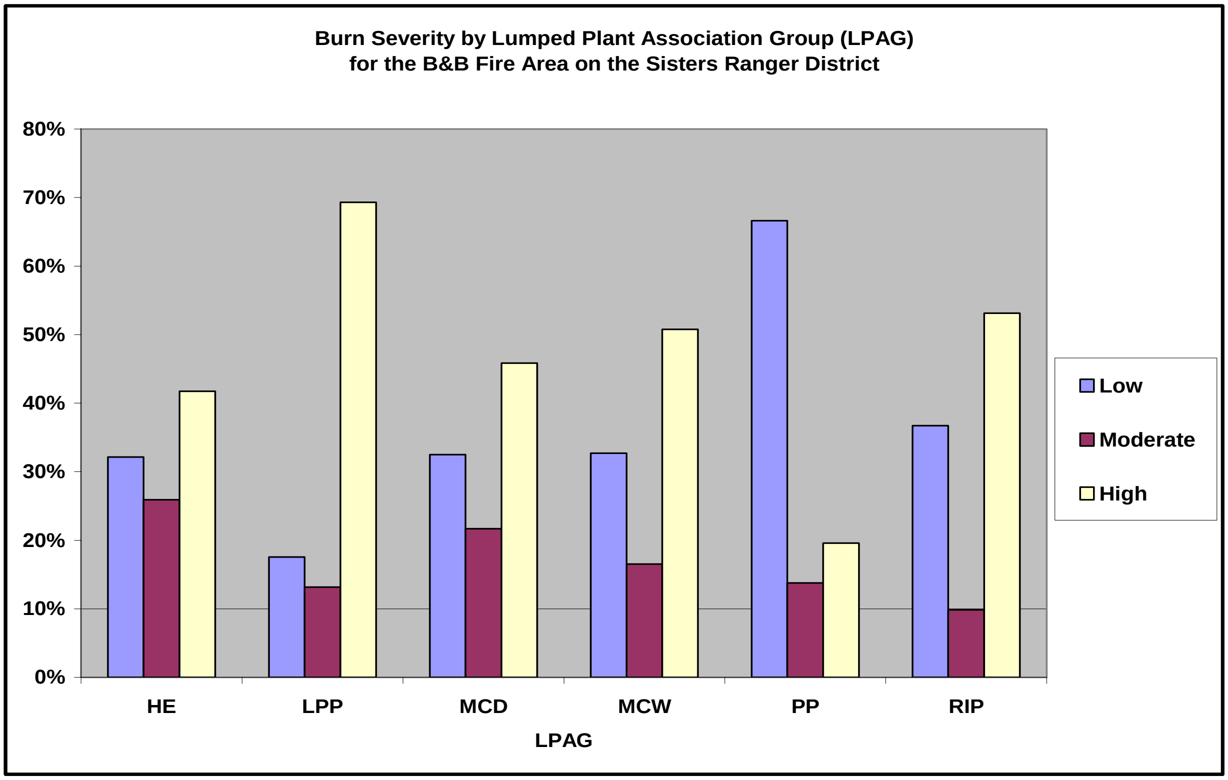
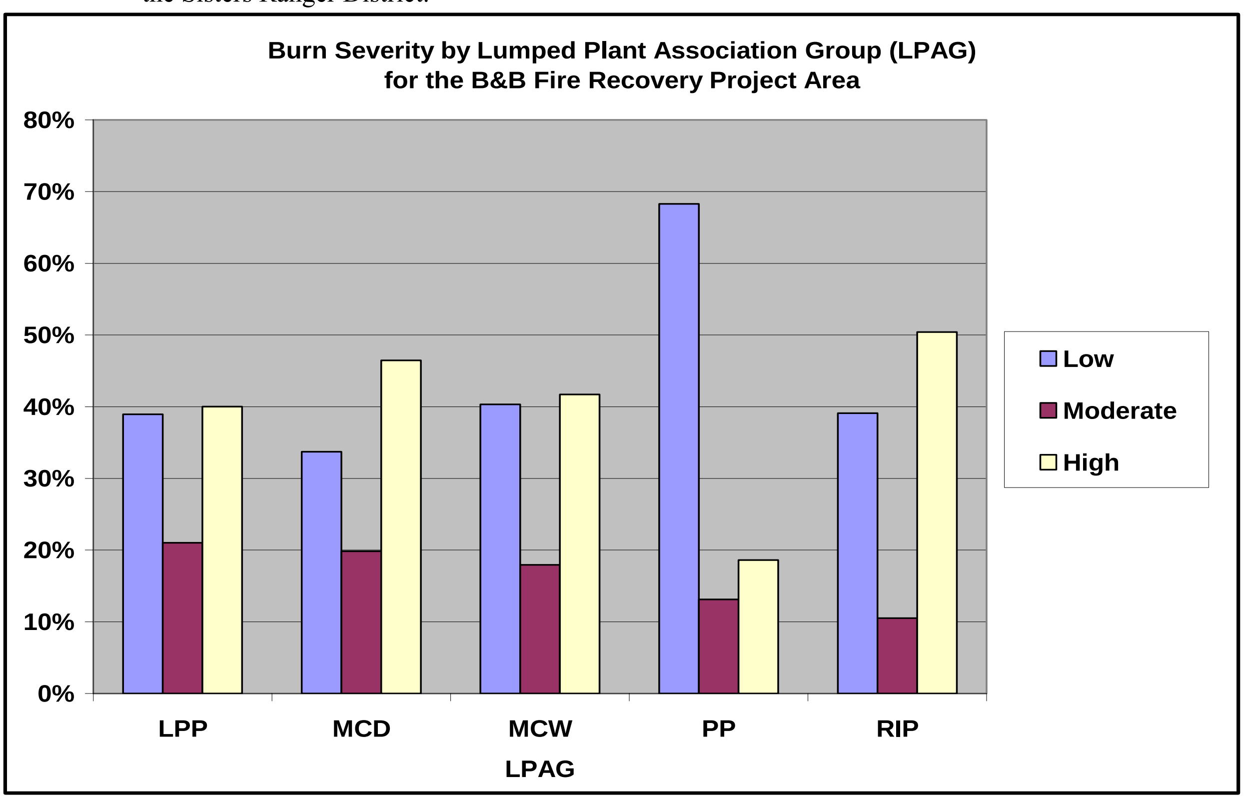


Figure 3.2. Vegetation mortality by Lumped Plant Association Group for the B&B Fire Recovery Project Area on the Sisters Ranger District.



Stand replacement fire patches on the Sisters Ranger District occurred as basically 2 large patches, one centered around Round Lake from the crest of the Cascades east to the private land in T13S, R8E, S13 and north/south from Jack Lake to Cache Mt., and the other stand replacement patch centered around Abbot Butte from the crest of the Cascades east to almost the Metolius River and north/south from the Warm Springs Reservation to Canyon Creek.

The mixed mortality stands are primarily located along the edges of the stand replacement patches, within night burning strips between daytime stand replacement runs and within the larger areas of underburning where the fire made intense runs.

Vegetation mortality by Northwest Forest Plan (NWFP) Allocation

Vegetation mortality by NWFP allocation is displayed in Tables 3.40 and 3.41. Figures 3.3 and 3.4 provide a visual representation of the acres and percentages of the vegetation mortality classes by NWFP Allocation. High mortality, stand replacement fire was highest in the congressionally withdrawn and late-successional reserve allocations at 53% and 51% of these allocations, respectively.

Table 3.40. Vegetation mortality by Northwest Forest Plan (NWFP) Allocation for the B&B Fire on the Sisters Ranger District.

NWFP Allocation	Total Acres	Vegetation Mortality					Total
		Non - Forest	Low	Moderate	High	Moderate + High	
Administratively Withdrawn	1,131	26%	41%	24%	9%	33%	100%
Congressionally Withdrawn	23,506	1%	27%	20%	53%	73%	100%
Late-Successional Reserve	25,231	0%	30%	19%	51%	70%	100%
Matrix	15,904	0%	49%	19%	32%	51%	100%
Private	1,178	2%	69%	15%	14%	29%	100%
Total	66,951	1%	34%	19%	46%	65%	100%

Table 3.41. Vegetation mortality by Northwest Forest Plan (NWFP) Allocation for the B&B Fire Recovery Project.

NWFP Allocation	Total Acres	Vegetation Mortality					Total
		Non - Forest	Low	Moderate	High	Moderate + High	
Administratively Withdrawn	1,032	29%	35%	26%	10%	36%	100%
Congressionally Withdrawn	0	n/a	n/a	n/a	n/a	n/a	n/a
Late-Successional Reserve	23,599	0%	31%	18%	51%	69%	100%
Matrix	16,304	0%	48%	19%	33%	52%	100%
Private	1,208	2%	70%	14%	13%	28%	100%
Total	42,143	1%	39%	18%	42%	60%	100%

Figure 3.3. Vegetation mortality by Northwest Forest Plan (NWFP) Allocation for the B&B Fire Area.

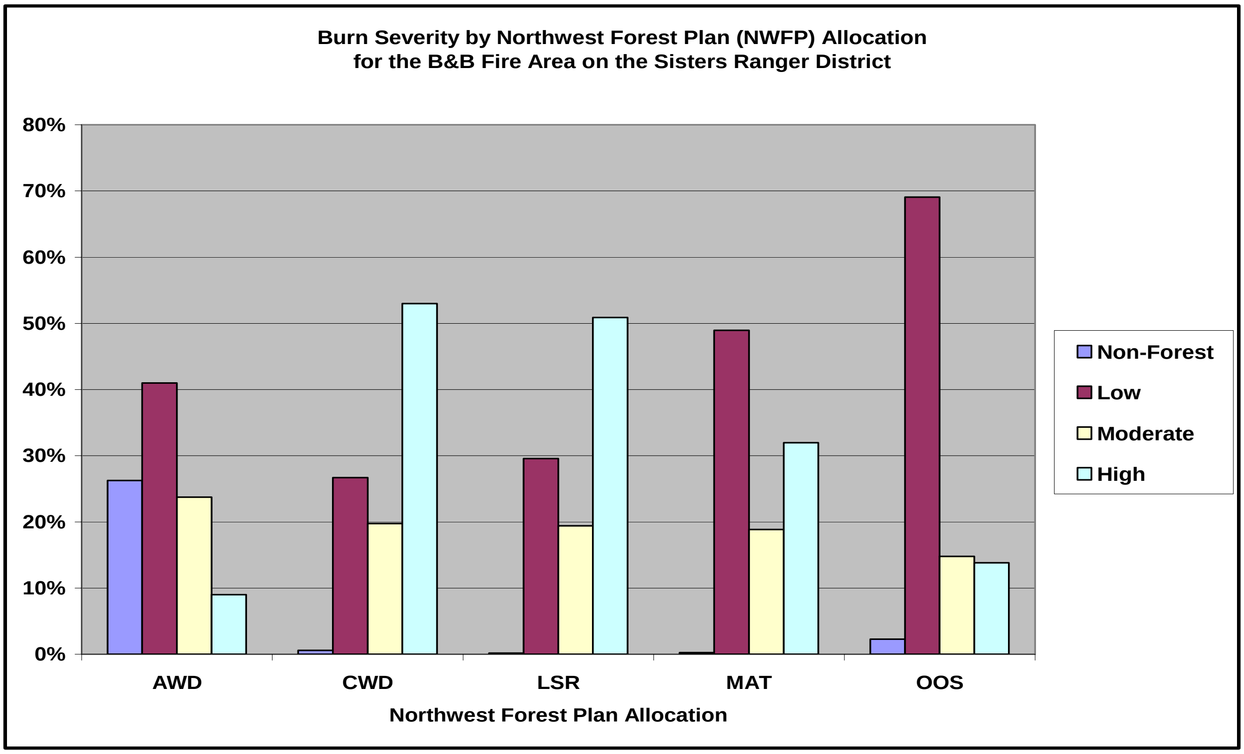
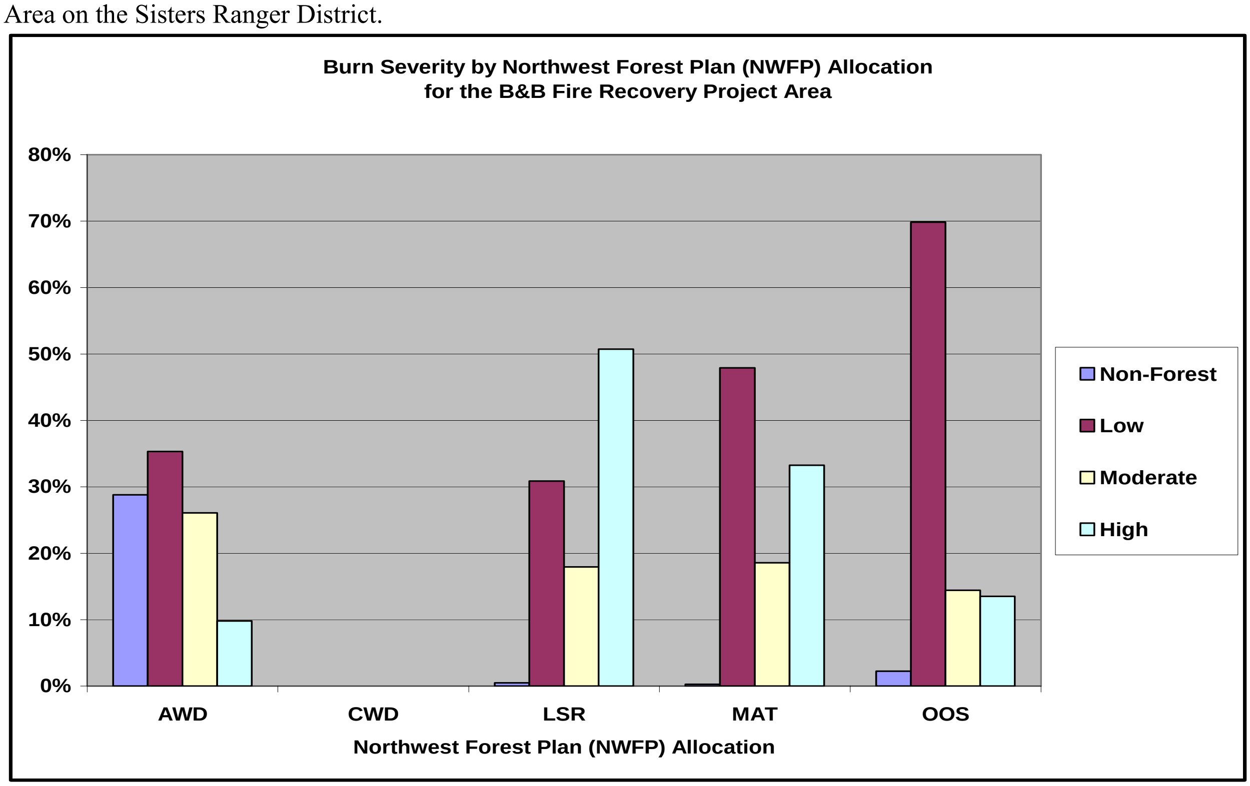


Figure 3.4. Vegetation mortality by Northwest Forest Plan (NWFP) Allocation for the B&B Fire Recovery Project Area on the Sisters Ranger District.



Stand Mortality and Timber Resources Affected by Fire

The estimated timber resource killed of trees 12" DBH or larger within the B&B Fire Recovery Project area and within all fires within the Metolius 5th field watershed was approximately 130 and 180 million board feet, respectively.

Post-Fire Stand Structure and Seral Stages by Lumped Plant Association Groups

Lumped Plant Association Groups: Within the area burned by the B&B fire, approximately 69 percent lies within mixed conifer plant associations, 22 percent within high elevation mountain hemlock and lodgepole pine plant associations, 6% in ponderosa pine plant associations and 4 percent within other, miscellaneous plant associations. Within the B&B Fire Recovery Project area, approximately 86 percent lies within mixed conifer plant associations, 9% in ponderosa pine plant associations and 5 percent within miscellaneous plant associations. Table 1 displays the breakdown of plant association groups (PAG) and lumped plant association groups (LPAGS) within the National Forest boundary of lands affected by the B&B fire and within the B&B Fire Recovery Project Area.

Post-Fire Seral-Structural Stages by Lumped Plant Association Group: Post-fire seral-structural stages for the main LPAGs within the B&B Fire Recovery project area (mixed conifer dry, mixed conifer wet, ponderosa pine, lodgepole pine and riparian) are displayed in Tables 3.42, 3.43, 3.44 & 3.45. A measure of the fire's effects on stand structure can be found in the percentages of grass/forb/shrub size class. The mixed conifer dry and wet LPAGs are now 48% and 42% grass/forb/shrub, the riparian LPAG is 51% percent grass/forb/shrub and the ponderosa pine LPAG is 18% grass/forb/shrub. Also, within the mixed conifer and riparian plant associations, much of the remaining stands are dominated by late seral species (i.e., late and mid seral stages), primarily white fir. The amount of stand initiation (i.e., grass/forb/shrub size class) created by the B&B fire and the percentage of the stands remaining after the fire that are dominated by late seral species underscores the importance of the remaining larger/older early seral stand types and species such as ponderosa pine, Douglas-fir and western larch in terms of wildlife habitat, shade, seed source, etc. It will be important to protect these components from potential future stand replacing disturbances and it will also be important to accelerate the development of future early seral species and stand types by first making sure they are established and then accelerating their growth through proper density management.

Table 3.42. Post-Fire Seral-Structural Stages in Mixed Conifer Dry PAG

Size Class (DBH)	Seral Stage				
	No Data*	Early	Mid	Late	Total
No Data	0%	0%	0%	0%	0%
Grass/Forb/Shrub	0%	48%	0%	0%	48%
<5"	0%	6%	0%	2%	9%
5" to 8.9"	0%	2%	0%	2%	5%
9" to 20.9"	0%	7%	11%	17%	36%
21"+	0%	1%	1%	1%	3%
Total	0%	64%	12%	23%	100%
* Non-Forest or No Data					

Table 3.43. Post-Fire Seral-Structural Stages in Mixed Conifer Wet PAG

Size Class (DBH)	Seral Stage				
	No Data*	Early	Mid	Late	Total
No Data	0%	0%	0%	0%	0%
Grass/Forb/Shrub	0%	42%	0%	0%	42%
<5"	0%	10%	0%	4%	14%
5" to 8.9"	0%	2%	1%	2%	5%
9" to 20.9"	0%	4%	18%	12%	34%
21"+	0%	0%	2%	3%	5%
Total	0%	58%	22%	21%	100%
* Non-Forest or No Data					

Table 3.44. Post-Fire Structural Stages in Ponderosa Pine PAG

Size Class (DBH)	Structural Stage Total
No Data	0%
Grass/Forb/Shrub	18%
<5"	3%
5" to 8.9"	29%
9" to 20.9"	49%
21"+	1%
Total	100%
* Non-Forest or No Data	

Table 3.45. Post-Fire Seral-Structural Stages in Riparian PAG

Size Class (DBH)	Seral Stage				
	No Data*	Early	Mid	Late	Total
No Data	2%	0%	0%	0%	2%
Grass/Forb/Shrub	0%	51%	0%	0%	51%
<5"	0%	2%	1%	0%	4%
5" to 8.9"	0%	3%	11%	0%	14%
9" to 20.9"	0%	5%	12%	13%	30%
21"+	0%	0%	0%	0%	0%
Total	2%	61%	25%	13%	100%
* Non-Forest or No Data					

Natural Regeneration

It is expected that there will be good natural regeneration in the areas of moderate and low mortality fire and poor to nonexistent natural regeneration in the areas of high mortality, stand replacement fire. Overall, the B&B fire occurred at one of the best times of the year for the possibility of good natural regeneration for three reasons. First, it was a good cone year. Second the seeds had matured. Third the seeds had not dispersed and therefore were not consumed by the fire. The fire started on Aug. 19, 2003 and made its last big run more than two weeks later on Sept. 6, 2003. Casual observation of cone crops for 2003 indicated that cone production was fairly good on almost all species within the B&B fire area. In general, cone and seed maturity usually occurs between Aug.15 and Sept. 15 and seed dispersal usually occurs between Sept. 1 and Sept. 30. Consequently, the seeds were mature but had not been dispersed from the cones by the time the fire occurred in most areas. As a result, conifer seeds were protected from consumption by the fire. Then, shortly after the fire, seed dispersal was observed over a large portion of the fire area.

The abundance of seed did not translate into good regeneration in the severely burned areas however. During the field season following the fire (2004) good seed germination was observed in underburned and mixed mortality areas but not in stand replacement areas. Seed germination was poor to non-existent with only occasional areas of good seed germination. Although a good cone crop was observed across the B&B fire area prior to the fire and good seed dispersal was also observed across the B&B fire area after the fire, good germination of seedlings was only consistently noted in the moderate and low mortality fire areas the spring/summer after the fire. The reason that seed germination in areas of high fire mortality (i.e., stand replacement areas) was non-existent to poor is not certain but they were probably heat killed. In areas of high mortality, the primary fire behavior was a crown fire. Although cones were not consumed in these crown fires and the seeds were able to disperse normally, they had already been killed by the baking heat of the fire.

Environmental Consequences

Data and Analysis of Stand Treatments

Vegetative analysis and estimates of stand conditions prior to and following the fire were conducted using stand exam data, photo interpretation, satellite imagery and the Most-Similar-Neighbor (MSN) Imputation Program (Crookston, et. al., 2002) from within the INFORMS (Integrated Forest Resource Management System) Program (USDA Forest Service, 2004). MSN is a method for utilizing existing data to fill in missing data on similar stands (i.e., most similar neighbor) across an analysis area (e.g., project area, landscape, etc.). To conduct MSN, there must be some information available for all stands, such as aerial photo interpretation or landsat satellite data and more detailed or desired information, such as field-sampled stand exam data, available for some stands. The data available for all stands is then used by the MSN program to identify which of the stands without detailed, field-sampled data is most similar to the stands with detailed, field-sampled data. The stand with detailed, field-sampled data that is most similar to stands without detailed, field-sampled data then supplies or imputes the data for the stands without detailed, field-sampled data. Consequently, one ends up with a landscape or project area in which all stands have detailed field-sampled data.

For the B&B project, analysis was conducted at two different scales, the 5th field watershed (Upper Metolius Watershed) and the project area which is a subset of the watershed. The District has stand exam data on only 34% of the project area. In order to conduct analysis between alternatives for the B&B project it was desirable to have detailed stand exam data across the project area and the Metolius 5th field watershed. To accomplish this, the District employed the MSN Program for imputing data across the watershed. MSN was conducted across the entire Sisters Ranger District using photo delineated stands/polygons as the base vegetation layer. Landsat satellite data was used as the universal data available for every stand and for determining stand similarity for detailed data imputation. Stand exam data (from 1995, 1996, 1997, 1998, 2000 and 2002) was the detailed data used for imputing data into stands without field-sampled stand exam data.

The imputed data set for the entire 5th field watershed was then entered into the Forest Vegetation Simulator (FVS) (Dixon, 2002) model developed by the Forest Service. The Forest Vegetation Simulator (FVS), at its most basic level is a family of forest growth simulation models. Since its initial development in 1973, it has become a system of tightly linked analytical tools. These tools are based upon a growing body of scientific knowledge gleaned from decades of natural resources research and are based on the framework of the original Prognosis growth and yield model (Stage, 1973). The Fire and Fuels Extension (FFE) to FVS simulates fuel dynamics and potential fire behavior over time and can be used to simulate and predict snag fall down rates, fuel loadings, and parameters affecting fire behavior and fuels accumulation and decay.

The FVS model was used to compare alternative actions for the B&B Fire Recovery Project area including salvaging timber, treating fuels, reforestation by planting and natural regeneration, and stand and wildlife habitat development over time. The FVS model has a variant that is calibrated to South Central Oregon and Northeast California (SORNEC Variant) (Dixon, 1992) based on studies measuring stand characteristics throughout that landscape.

The FVS program models growth and stand characteristics such as canopy cover, average diameter and trees per acre by size class and species composition. This assists comparing alternatives and their effects in future stand development. Using the model, levels of stocking, habitat conditions, and different management scenarios are developed. The FVS model uses stand density index (SDI) to estimate mortality rates in stands. The growth model in FVS depends on plant associations to project growth and stocking limitations and has the ability to increase or decrease stand growth if growth data are included. Growth projections within FVS are made from average plant association productivity.

The FVS model also has specific information on local snag fall down rates and decomposition in orer to model snag and down-wood dynamics. The decay and fall down rates of snags and fuels within the model vary depending on species, size class and the current condition of snags and logs. The simulated breaking and falling snags are added to the surface fuels where further decay modeling occurs. The fall down rates and subsequent fuel loadings are important to model to compare effects of removing fuels and not removing fuels in future stand management. Estimates of snag levels post-fire were based on average conditions found in stands across the project area based on stand exams conducted during the summer of 2004. The subsequent snag condition and longevity was modeled into the future using the FVS model.

Effects Common to All Alternatives

Dead Trees and Live Trees

For the purposes of this project, trees will be identified as dead or alive depending on whether the tree has any green needles. Trees without any green needles will be considered dead. Trees with any green needles will be considered alive. For all practical purposes, all trees within the boundary of the B&B fire were affected by the fire to some degree. Consequently, for this project, live trees will be evaluated to determine the likelihood of surviving the effects of the fire based primarily on guidelines developed by Scott, et al. (2002). Trees rated moderate and high likelihood of surviving the effects of the fire will be retained under all alternatives. Trees rated low probability of survival will be variably retained depending on the Northwest Forest Plan management allocation (late-successional reserve versus matrix). Low probability of survival trees that are retained will serve as "green tree replacements" for existing snags once those snags fall over. This retention is in addition to the stands that will have no removal of low probability of survival trees.

All trees rated as moderate to high probability of survival will be left within harvest units. Trees with low-moderate crown and bole scorch, trees with healthy live crowns at least 20 percent of the total height of the tree, and trees with little or no evidence of bark beetles, are the types of trees that are considered to be likely to survive the effects of the fire and that are expected to survive for an extended period. These trees will provide genetic diversity, through their seed, to the regenerating stands. Some incidental cutting of trees that are rated as moderate to high probability of surviving the effects of the fire may occur in order to facilitate placement of skid trails and landings, however, attempts will be made to minimize the removal of these types of trees.

Effects of Alternative 1 - No Action

Under Alternative 1, no active management would occur under this project.

Timber harvest, fuels reduction and reforestation would not occur if Alternative 1 is implemented. Under Alternative 1, the forested portion of the analysis area would remain as described under the *Forest*

Vegetation Existing Condition section above. Most areas would carry an unusual amount of fuel loadings into the next several decades, unless or until a reburn occurs in areas with high fuel loadings.

Insect Infestation
Within untreated moderate and low intensity burn areas, trees that were damaged (but not killed) by the fire would provide brood habitat for bark beetles and wood boring insects. These insects, in turn would serve as the vectors for the introduction of various fungi into the wood that they infest. The density of dead and damaged trees that would be left under Alternative 1 would result in the decay of wood and provide a food source for future insect infestation. Please see the *Insect and Disease* section, *3.11* for additional information.

Restoring Forest Cover
Restoration of forest cover under this alternative would rely entirely on natural regeneration. As described under the existing condition, natural regeneration within B&B Fire area and the B&B project area is expected to be fairly good in the low and moderate mortality areas and poor to non-existent in the high mortality stand replacement areas. Based on limited data collected on first year conifer germinates within the B&B fire area during the summer of 2004, natural regeneration is likely to be highly variable regarding stocking densities and be composed of primarily white fir. In low and moderate fire mortality areas, natural regeneration can be expected to vary from hundreds to thousands of trees/acre and be composed of primarily (80% to 90%) white fir with minor components of Douglas-fir, ponderosa pine and other minor species. In the high mortality, stand replacement areas, natural regeneration can be expected to be very low in most areas with stocking varying from no trees to up to 50-100 trees per acre with the average trees/acre in the 10-20 range with exceptions that might run as high as several hundred trees per acre. Species composition in the high mortality, stand replacement areas will also be dominated by white fir with minor amounts of Douglas-fir, ponderosa pine and other minor species.

The most critical factor in the establishment of new forested stands through natural regeneration in high mortality stand-replacement areas will be the available future seed source. In these areas, where regeneration was not established immediately after the fire, future natural regeneration could occur from seed from adjacent stands, seed from the surviving large trees, and/or dissemination by other means such as wind. Ponderosa pine seed is not easily disseminated over a large area due to its large size and heavy weight. Douglas-fir seed is lighter and disperses better from adjacent stands. In general, in the high mortality, stand replacement burn areas, without an available seed source within 600 feet, or without planting, stand establishment and growth to a stand containing 5” to 9” DBH trees is expected to take 75-150 years or longer. With planting, this would generally occur in 20 – 40 years.

The development of dispersal habitat under this alternative would be similar to the action alternatives given the potential for natural regeneration across the project area. However, wherever dispersal habitat develops under a passive management scenario (i.e., Alternative 1) it would be composed primarily of white fir at high densities and this stand composition and structure would be highly unstable and susceptible to stand replacing disturbances such as wildfire and insects and diseases.

The development of early seral (ponderosa pine, Douglas-fir, western larch), medium/large (21”+dbh) habitat would be unlikely under this alternative where stands are dominated by white fir at high densities. Consequently, forest stands that regenerate as described under the no action alternative are not likely to meet long term management objectives.

No tree planting would be done under Alternative 1. Without future stand replacing disturbances in a passive management scenario, it could take 50-100 years or longer for a conifer stand to become established in high mortality, stand replacement areas. This is due to poor natural regeneration immediately after the fire and the lack of future seed sources. Without tree planting there are likely to be large areas with few to no trees that are dominated by shrubs.

Effects on Funding: Funding for planting and associated activities comes from two sources: appropriations from Congress and KV collections from timber sale receipts. In recent years, one budget item has been used to fund thinning of small trees and reforestation outside of timber sales. Consequently, there is essentially a direct trade-off between thinning and planting, i.e. if more planting is funded with this budget item, then less thinning will be funded. Given the large fire seasons of 2002/2003 (B&B Fire, Cache Mt. Fire, Link Fire, B and B Complex, Biscuit Fire, etc.), using only appropriated funds for reforestation could lead to a substantial reduction in funds available for small tree thinning. KV funds collected from salvage sale receipts (following the implementation of any of the action alternatives) would provide an additional source of needed funds for planting and reforestation activities.

Effects Common to All Action Alternatives (2, 3, 4 and 5)

Untreated Areas within Action Alternatives

No active management would occur on a majority of the acres under the action alternatives under this project. See Table 3.46 for the number of acres that will be treated and not treated under each alternative. No active management would occur on 83% of the project acres under Alternative 2, 91% of the acres under Alternative 3, 96% of the acres under Alternative 4 and 89% of the acres under Alternative 5.

Table 3.46. Acres treated and not treated by alternative and fire mortality.

Alternative	Vegetation Mortality							
	Low		Moderate		High		Total	
	Treated	Not Treated	Treated	Not Treated	Treated	Not Treated	Treated	Not Treated
	Acres							
1 (No Action)	0	15,457	0	7,529	0	17,494	0	40,935
2	1,260	14,197	1,297	6,232	4,246	13,248	6,802	34,133
3	895	14,562	863	6,666	2005	15,489	3,762	37,173
4	746	14,711	529	7,000	450	17,044	1,725	39,210
5	1,207	14,250	1,007	6,522	2,418	15,076	4,632	36,303
Alternative	Percent of the Project Area							
1 (No Action)	0%	38%	0%	18%	0%	43%	0%	100%
2	3%	35%	3%	15%	10%	32%	17%	83%
3	2%	36%	2%	16%	5%	38%	9%	91%
4	2%	36%	1%	17%	1%	42%	4%	96%
5	3%	35%	2%	16%	6%	37%	11%	89%
Alternative	Percent of the Vegetation Mortality Class							
1 (No Action)	0%	100%	0%	100%	0%	100%	0%	100%
2	8%	92%	17%	83%	24%	76%	17%	83%
3	6%	94%	11%	89%	11%	89%	9%	91%
4	5%	95%	7%	93%	3%	97%	4%	96%
5	8%	92%	13%	87%	14%	86%	11%	89%

Under the action alternatives a majority of the acres will remain untreated. No timber harvest, fuels reduction or reforestation would occur on these acres and most of these acres will carry an unusually large amount of fuel loadings into the next several decades unless they reburn. In the untreated areas of the action alternatives the effects to forest vegetation would be similar to those described under the effects of Alternative 1, No Action.

Recovery of Economic Value

Units proposed for salvage harvest under all action alternatives have measurable economic recovery. The action alternatives also provide for the recovery of economic value in the harvesting of Special Forest Products (e.g. posts, poles, biomass, firewood, and house logs) but on a limited scale as compared to the volume of salvage harvest units.

A detailed discussion of the impacts related to recovery of economic value is contained in *section 3.9 Economic and Social Analysis Environmental Consequences*.

Reforestation

Reforestation of the ponderosa pine and mixed conifer plant associations is required to achieve the management goals of the Deschutes Forest Plan and to follow National Forest Management Act and Regional office direction (Goodman 2002). Minimum stocking levels for ponderosa pine sites are directed to be 125 trees per acre of free to grow seedlings (USDA Forest Service, 1994). The deforestation caused by the fire is outside the historical range of variability in that historically there were not very large stand replacement fires in the ponderosa pine plant associations or mixed conifer dry sites, and the stand replacement fires which did occur left some residual large early seral trees within the stands to disseminate seed. The fires which went through the project area in 2003 removed tree canopies and left no seed trees over large areas.

Ponderosa pine seed is transitory and does not remain viable long after its initial year unless frozen and stored in controlled conditions. Transient seed is typically found on the surface of the duff and was thus consumed when the duff was volatized. Transient seed left on the site will be low. This seed includes many of the annual grasses and forbs as well as the coniferous trees. Persistent seed on these sites is expected to be mostly brush species, i.e., ceanothus, chinquapin, bitterbrush and manzanita (Volland 1985). Revegetation is also expected from plants which have reproductive tissue in the soil which includes perennial forbs, sedges and some grasses such as fescue. Ceanothus and chinquapin also tend to sprout from surviving root crowns. The revegetation of these species will reduce the ability of ponderosa pine to reforest the site (Volland 1985). Grass and brush can be expected to dominate the site for more than four or five decades without artificial regeneration of ponderosa pine, Douglas-fir, western larch and western white pine from locally adapted seed.

Locally adapted seed is used for all species in reforestation following guidelines for seed transfer rules within seed zones. Most seed will be collected within the Sisters Ranger District although some may come from adjacent area within the breeding zone. Western white pine seedlings will be from trees which were progeny of trees selected for blister rust resistance.

Modeling of stand characteristics of stands that experienced stand replacement wildfire using FVS has shown that after planting 175 seedlings per acre of (ponderosa pine (40%), Douglas-fir (40%), western larch (15%) and western white pine (5%)) with 70% survival after the third year, the stands in 2040, will have average diameters of 10” DBH, average canopy cover of 40%. With thinning to 60 trees/acre in 2040, the average diameter in 2050 becomes 14” DBH and the average canopy cover becomes 27%. By the end of the modeling period in the year 2100, the average diameter of the stands is 21” DBH with a canopy cover of 32%.

To be effective, reforestation in ponderosa pine and mixed conifer plant associations, trees typically may need protection from a variety of elements including, competing vegetation and large (e.g., deer and elk) and small (e.g., gophers) animals. The more damage a seedling experiences, the less chance it has of survival. Seedlings growing slowly due to competition from brush and grass take longer to grow large enough to no longer be vulnerable to damage by animals. Reducing the impact of competing vegetation is critical in the first few years of seedling establishment and can be reduced by planting healthy seedlings and establishing trees immediately following disturbance. Damage or mortality from animals may occur soon after planting and up to a decade following establishment, depending on animal population and movement dynamics, and the ability of seedlings to grow out of a small vulnerable stage. Protection from these animals can be compounded by slow growth due to competing vegetation. Protection from large herbivorous animals will include repellents applied as needed until the majority of the trees have grown above browse height. Protection from gophers will be accomplished with traps or poisoned oats. Planting on open ground in Central Oregon allows trees to be exposed to high surface temperatures around the root/stem interface. This phenomenon can decrease survival and growth of planted seedlings. High soil temperatures impacting seedlings can be reduced through micro site planting of seedlings in the shade of remaining logs, stumps or other objects. All of these treatments can be used in combination with each other to quickly establish a stand of fire adapted conifers on dry sites where otherwise a stocked stand will not be established for a very long time. Animal damage control treatment acres include all acres of salvage for each alternative. Potential treatments on all salvage acres include repellents for big game and trapping or baiting with strychnine treated oats for gopher control. Big game repellents include but are not limited to BGR (big game repellent) or Tree Guard. Animal damage control will be considered only when it appears that stocking will drop below 50 trees per acre on acres designated as late-successional reserve under the Northwest Forest Plan and below 100 trees per acre on acres designated as matrix under the Northwest Forest Plan.

Reforestation within the B&B Fire area is planned to meet the needs of wildlife and the ecosystem as well as NFMA requirements. Within ponderosa pine plant associations, reforestation will be through planting strictly ponderosa pine at a level that will produce 100 – 150 trees per acre free to grow after 5 years. Mixed conifer sites will receive varying amounts of species diversity depending on actual plant association and aspect. The drier plant associations and aspects will be planted to produce 100 – 150 trees per acre of 60% to 80% ponderosa pine and 20% to 30% Douglas-fir and 5% to 10% western larch and western white pine. For the wetter, more productive plant associations and aspects, the species mix will include less ponderosa pine (as low as 40%) and more Douglas-fir (as high as 40%), western larch (up to 15%) and western white pine (up to 5%). This variation will emulate the historical condition. It is expected that with exclusion of fire, additional natural regeneration of white fir and lodgepole pine and other minor species will become established in the next century and contribute to species diversity. Where prescribed fire is carried out, the stands will retain the species planted with variable levels of mortality.

A desired stocking level of 100-150 trees per acre at age 5 was selected for much of the area to meet a wide range of resource objectives including, large game cover and travel corridors, spotted owl dispersal habitat, timber values within Matrix lands, and large diameter tree and snag potential. The level of stocking was chosen with the expectation of some loss of trees due to initial seedling mortality, mortality due to animal damage, and subsequent prescribed fire. Following initial prescribed fire application, survival of the stands can be evaluated and desired stands or tree characteristics can be selected. This should occur in the third or fourth decade following establishment. At that time areas or stands which will be best placed for dispersal habitat can be left at denser stocking. Stands can be thinned to levels which will develop the large tree architecture typical of more open-grown trees where it is desired.

Jerry Franklin, in his comments on the Biscuit Fire Recovery EIS, mentioned that “establishment of dense, uniform stands is completely inappropriate in the LSRs and on any PAG identified as fire regime types I and II” (Franklin 2004). Franklin proposes variability in planting; however, establishing a stand is more difficult than modifying the density of an established stand. Consequently, the plan for this project is to get stands established at a relatively low density (100-150 trees/acre) compared to historical plantation densities (400-600 trees/acre) and then introduce variability in the survival of established trees through limited animal damage control, prescribed burning and/or future thinning entries. It is also expected that future natural regeneration will contribute to stand diversity in species composition and tree density.

Restoring Forest Cover

Restoration of forest cover under the action alternatives would rely on both natural regeneration and artificial regeneration (i.e., planting). Natural regeneration would be relied upon in some areas not treated under this project. The consequences of natural regeneration are discussed under Alternative 1, the no action alternative. Natural regeneration may occur on 83% of the project acres under Alternative 2, 91% of the project acres under Alternative 3, 96% of the project acres under Alternative 4 and 89% of the project acres under Alternative 5. Artificial regeneration (i.e., planting) would be implemented on all acres that are salvaged under each action alternative. Planting would occur on up to 17% of the project acres under Alternative 2, 9% of the acres under Alternative 3, 4% of the acres under Alternative 4 and 11% of the acres under Alternative 5.

All areas salvaged within the project area would be reforested by planting using a combination of appropriated funds and KV collections from salvage sale receipts. Section 3.9 on economics discusses the costs of reforestation under the different alternatives. Table 3.47 displays the acres of reforestation by alternative by vegetation mortality class.

Table 3.47. Reforestation by alternative and vegetation mortality class.

Alternative	Acres of Reforestation by Vegetation Mortality			
	Low	Moderate	High	Total
1	0	0	0	0
2	1,260	1,297	4,246	6,803
3	895	863	2,005	3,762
4	746	529	450	1,725
5	1,207	1,007	2,418	4,632

Alternatives 2, 3, 4 and 5 of this project would initiate reforestation on up to 4,246 acres, 2,005 acres, 450 acres and 2418 acres, respectively, of salvage in stand replacement conditions. The remaining stand replacement acres under each alternative, 13,248 acres, 15,489 acres, 17,044 acres and 15,076 acres, respectively, would be left to regenerate naturally and would proceed through a longer period as grass/forb/shrub and eventually seedlings/saplings.

While fire is unquestionably a natural process in the forests within the B&B Project, the type of stand replacement fire that much of this area experienced was outside of the historic range of variability, and a seed source for natural regeneration is lacking in many areas. Because of this lack of seed source, and because of competition from the shrub communities found in this area, natural regeneration of forest cover would be a slow process (perhaps 75-150 years or more) over much of the area.

The objectives of conifer planting are to, 1) more quickly establish tree cover for species needing it, (e.g., goshawks, spotted owls, and deer and elk), 2) establish desirable early seral (i.e., ponderosa pine, western larch and Douglas fir) species composition and 3) establish trees at a density that allows for flexibility in meeting present and potential future management objectives. This would involve planting at a wide spacing (minimum spacing would be 15 by 15 feet, or about 194 trees per acre) and using animal damage control (repellants for big game and trapping or poison oats for gophers) as necessary. These sites are estimated to be about 90 percent plantable, so the actual number of trees planted would be about 175 trees/acre. Survival at the end of the fifth year after planting is expected to be approximately 70%, consequently stocking at the end of the fifth year is expected to average 100-150 trees/acres. It is expected that planting at this density with 70% survival would eliminate the need for precommercial thinning. It is, however, anticipated that at least one commercial thin will be needed in 30 to 40 years to keep the stands healthy and growing well to meet the management goal of growing large trees for forest and wildlife habitat. With one commercial thin from below to 60 trees/acre, modeled in 2040, at the end of the projection period in 2100, the trees will average approximately 21” DBH and be composed primarily of ponderosa pine, Douglas-fir with minor amounts of western larch and western white pine.

The goal of reforestation treatments within LSRs is to hasten restoration of late-successional forest habitat. A goal that is integrated with reforestation strategies is restoration of low and mixed severity fire regimes. Restoration of low intensity fire regimes would help protect existing late successional forest habitat from high intensity stand replacement fires. Reforestation should not impede restoration of low intensity fire regimes, because protection of existing late-successional forest habitat is more important than the restoration of late-successional forest habitat.

Balancing these two restoration goals, restoration of late successional forest and restoration of low intensity fires, could be accomplished through integration of both goals into treatment prescriptions and the appropriate timing of both reforestation and future prescribed burning activities. Plantations may be protected from or included in prescribed burning areas, dependant upon burning conditions and stand conditions.

Traditional reforestation practices, utilizing "tight" tree spacing and "weeding of non-crop trees," which are typical timber management objectives, are not appropriate for LSRs within the recovery area. The goal of traditional reforestation practices is to optimize conifer site-dominance and growth, while the goal of reforestation in the LSRs is "beneficial to the creation of late-successional forest conditions." Traditional reforestation and other timber management practices are based on the assumption that fire exclusion would be successful, and after the B&B Fire, it is clear that fire exclusion was not successful and will not be successful through time, especially in this large, and summer-dry area. Reforestation practices in LSR should minimize potential conflicts with natural fire processes and only help facilitate the establishment, survival, and growth of approximately 20-40 large (> 21" DBH) over-story conifer trees per acre.

For a conifer seedling to become a late-successional-sized tree (>21" DBH), the seedling would first have to become established, then grow and survive both extended competition and periodic wildland fires until it is large enough to have some physiological resistance to fire, such as thick bark. A commonly used model (Forest Vegetation Simulator) predicts adequate physiological resistance for fifty percent of Douglas-firs to survive low intensity fires when 6" DBH (8" DBH for ponderosa pine). Local experience would support what the models predict in regenerated stands.

The pattern of the burn area in the B&B Fire has resulted in few or no conifer seed sources available over large areas, especially in severely burned, stand replacement areas. Given this scenario, it is difficult to predict the amount of time that would pass before late successional or old growth forest habitat could develop with a passive management approach. One thing that is certain: if conifers are not present, either from natural seeding or planting, late successional or old growth forest habitat would be delayed for at least 100 years, or longer. Factors such as global climate change, and local cycles in wet and dry periods also weigh in as a consideration for establishment of a new forest.

The restoration rate of late successional forest habitat can be increased with planting and competition reduction and animal damage control treatments. Without disturbances in a passive management scenario, it could take eighty (80) years for a conifer to grow to 10" DBH. However, lack of a seed source in severely burned, stand replacement areas is a major concern for the B&B Fire area and there would likely be large areas with no trees without tree planting. With reforestation and active management such as low intensity prescribed fire, tree sizes are estimated to range up to 16" DBH in the same timeframe, and the primary species composition would be ponderosa pine and Douglas-fir. It is estimated that a 21" tree would be available for wildlife habitat in 80 - 120 years with planting and intermediate treatments such as thinning and prescribed burning.

Planting would restore or increase certain species to areas where they were extirpated or their abundance severely reduced by exotic pathogens or the result of fire exclusion. Disease resistant western white pine is proposed where they historically occurred, as well as ponderosa pine, Douglas-fir and western larch. Other species such as white/grand fir and incense cedar that were historically present in less abundance due to periodic low intensity fires would naturally regenerate over time and increase the species diversity.

Reforestation activities would benefit the creation of late-successional forest conditions because they will facilitate the establishment of desired, long-lived, early seral tree species and will hasten restoration of the appropriate amount of large trees important for long term management objectives while recognizing low intensity fire is integral to the healthy functioning of late successional forest habitat in the area. Reforestation would occur where natural regeneration could take decades to establish young conifers, which would then compete with other established vegetation and take a long time to grow into large trees.

Changes in Dead Tree Numbers

The effects of dead trees per acre (snag numbers) on wildlife species depend on the species under consideration and its requirements, and the ability of species to exploit this transient habitat type. The B&B Wildlife Report contains detailed discussions of these effects.

Cumulative Effects

Silviculture and Timber Management History

Most of the roaded area within the fire perimeter had been under timber management before the fire. Partial cutting of the overstory trees on flatter terrain began shortly after World War II (circa 1946) using crawler tractors. Regeneration cutting began in the 1980's, with staggered-setting patch clearcuts and shelterwoods ranging from 10 to 40 acres being the norm. Approximately 9,200 acres were converted to plantations by this method. Cable logging systems were introduced with the advent of regeneration harvest cutting. On the flatter terrain, sanitation/salvage and overstory removal cuts were continued in the areas between the regeneration units.

The current high-density road system in the areas previously managed for timber reflect a density that was based on the use of short-span high lead systems (e.g. jammer systems with a 600 ft. reach) and skidding with crawler tractors (primarily downhill). Road spacing for these systems was based on a maximum external yarding distance (EYD) of approximately 600 ft. (measured as slope distance).

Another factor in the development of this high-density road system was the use of crawler tractors on slopes up to 40 percent. To facilitate downhill skidding, roads were often located in the bottoms, close to intermittent streams and draws. Many of these steeper areas would now be logged using cable systems, because of the concerns for soil disturbance, displacement, and compaction, and the bottom roads are no longer needed. In general, road access to the tops of future cable logging settings is available with the use of short temporary spur roads out to landing locations.

Potential for Post-Fire Mortality from Insects

The effects of wildfire typically result in a large increase in the populations of certain forest insects. Recently dead wood is colonized by a wide variety of wood boring insects and bark beetles. These insects introduce various fungi into the wood that they infest and the fungi begin the decay process that eventually leads to the recycling of the dead material and the release of nutrients back into the system. The section, *3.17 , Insects and Disease*, provides a detailed discussion resulting from the analysis of insects and their effects on dead and damaged trees.

3.7 Fire and Fuels

Affected Environment

Ecological Role of Fire as a Disturbance Process

In April 2002, a national course-scale assessment was completed that quantifies land condition in the coterminous United States. The analysis describes the degree of fire regime departure from historic fire cycles due to fire exclusion and other influences (Schmidt et al 2002).

This course scale analysis identifies changes to key ecosystem components such as species composition, structural stage, tree or shrub stand age, and canopy closure. It characterizes the landscape by five "Fire Regime Groups" and three "Fire Condition Classes" (USDA/USDI 2002).

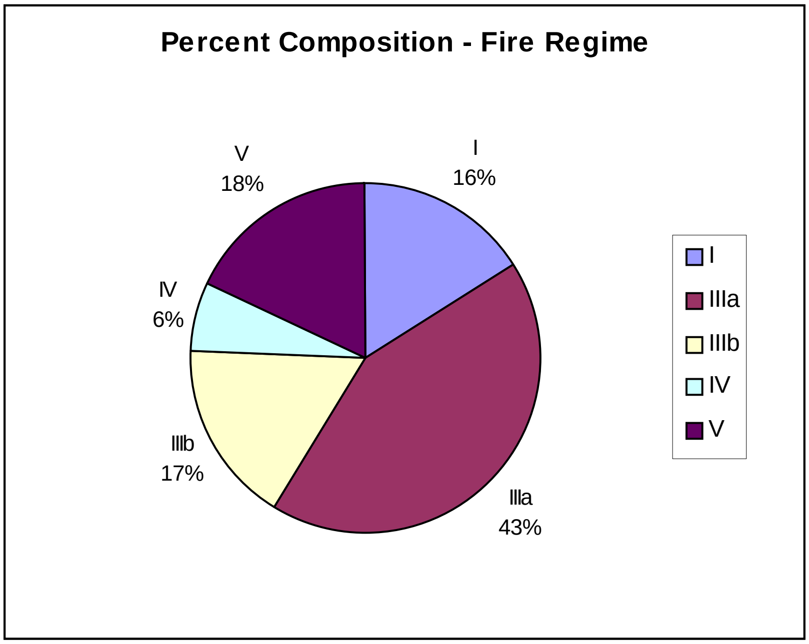
A fire regime is a generalized description of fire's role within an ecosystem – characterized by fire frequency, predictability, seasonality, intensity, duration and scale (USDA/USDI 2002). Fire condition class is a landscape-level attribute which characterizes the degree of departure from historic reference conditions of vegetation composition and structure, and fire frequency and severity that currently exist inside the fire regime.

The national fire regime scheme has been modified for use within the Central Oregon Area (Central Oregon Fire Management Plan, USFS 2003e). For B&B Fire Area, fire regimes are identified by plant association group (PAG), as shown in the Table 3.48. Fire regime composition for the Metolius Watershed is displayed in the Figure 3.5.

Table. 3.48 Fire Regimes

Fire Regime Group	Fire Frequency	Fire Severity	Plant Association Group
I	0 – 35 years	Low	Ponderosa Pine
II	0 – 35 years	Stand Replacement	Non-forest grass
IIIa	< 50 years	Low/Mixed	Mixed Conifer Dry
IIIb	50 – 100 years	Mixed	Mixed Conifer Wet
IV	35 – 100 years	Stand Replacement	Lodgepole Dry
V	> 200 years	Stand Replacement	Mountain Hemlock and Whitebark Pine

Figure 3.5 – Percent Composition of Fire Regime for the Metolius Watershed



There are three Fire Condition Classes that categorizes and describe vegetation composition and structure condition that currently exist inside the Fire Regime Groups.

Condition Class Descriptions
Condition classes are a function of the degree of departure from historic fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire exclusion, timber harvesting, grazing, introduction and establishment of exotic plant species, insects or disease (introduced or native), or other past management activities (see Table 3.49).

Table. 3.49 Condition Classes within the B&B Fire Recovery Project Area

Condition Class	Attributes	Example Management Options
Condition Class 1	▪ Fire regimes are within or near an historical range. ▪ The risk of losing key ecosystem components is low. ▪ Fire frequencies have departed from historical frequencies (either increased or decreased) by no more than one return interval. ▪ Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
Condition Class 2	▪ Fire regimes have been moderately altered from their historical range. ▪ The risk of losing key ecosystem components has increased to moderate. ▪ Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This change results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. ▪ Vegetation attributes have been moderately altered from their historical ranges.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
Condition Class 3	▪ Fire regimes have been significantly altered from their historical range. ▪ The risk of losing key ecosystem components is high. ▪ Fire frequencies have departed (either increased or decreased) by multiple return intervals. This change results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. ▪ Vegetation attributes have been significantly altered from their historical ranges.	Where appropriate, these areas need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.

Vegetation Condition

Pre-Fire Condition

Fire Regime I: Fire Regime I consists of the dry and wet ponderosa pine PAG's and makes up about 16% of the B&B Area. Historical ranges of variability (HRV) have been developed for the various seral/structural stages. The pre-fire conditions were characterized by a deficiency of area dominated by large –size ponderosa pine. The HRV for this structural stage is 30 – 70%, the pre-fire condition was 15%. The majority (80%) of the Fire Regime I area was dominated by pole (5 – 9" dbh) and small (9 – 20" dbh) sized stands of ponderosa pine. Departure from historical reference conditions is estimated to be about 65%.

Fire Regime IIIa: Fire Regime IIIa consists of the dry mixed conifer PAG and makes up about 43% of the B&B Area. Because the fire frequency was relatively short for this regime historical ranges for seral/structural stages are skewed toward the occurrence early seral species, such as ponderosa pine. The pre-fire condition for this regime shows a marked effect of fire exclusion with a general deficiency of area dominated by early seral species compared to historical ranges. Historically, the expected area dominated by early seral species would be from 35 – 79%. Pre-fire composition for early seral conditions was 23%. Departure from historic reference conditions is estimated to be between 33 and 67%.

Fire Regime IIIb: Fire Regime IIIb consists of the wet mixed conifer PAG and makes up about 17% of the B&B Area. Pre-fire conditions for Fire Regime IIIb were close to the HRV's for most seral/structural stages, deficiencies were apparent in areas dominated by large size trees (>20" dbh) for all seral stages. Departure from historical reference conditions is estimated to be less than 33%.

Fire Regime IV: Fire Regime IV consists of the lodgepole pine PAG and makes up about 6% of the B&B Area. Pre-fire conditions for Fire Regime IV were within the HRV's for seral/structural stages. Departure from historical reference conditions is estimated to be less than 33%.

Fire Regime V: Fire Regime V consists of the mountain hemlock PAG and makes up about 18% of the B&B Area. Pre-fire conditions for Fire Regime V were close to the HRV's for most seral/structural stages, deficiencies were apparent in areas dominated by large size trees (>20" dbh) for all seral stages. Departure from historical reference conditions is estimated to be less than 33%.

Post-Fire Conditions

In this section severity is being described in terms of tree mortality.

Fire Regime I: Effects of the B&B Fire did not substantially change the pre-fire vegetation conditions within this fire regime since most of the area burned at low intensity. The fire resulted in an increase of area dominated by early successional grass, forbs, shrub stage of about 5%. Departure from reference conditions is estimated to be about of 63%.

Fire Regime IIIa: Currently about 32% of the area within this fire regime is dominated by the grass, forbs, shrub stage, the HRV for this stage is 2 – 15%. Some of the area which was dominated by late successional stages was lost in the fire, a loss of approximately 21%. Departure from historic reference conditions is estimated to be in excess of 67%.

Fire Regime IIIb: Effects of the B&B Fire resulted in loss of much of the tree dominated area. Currently approximately 41% of area within this fire regime is dominated by early successional grass, forbs, shrub stage, the HRV for this stage is 3 – 20%. Departure from historic reference conditions is estimated to be between 33 and 67%.

Fire Regime IV: Effects of the B&B Fire resulted in loss of some of the tree dominated area. Currently approximately 46% of area within this fire regime is dominated by early successional grass, forbs, shrub stage, the HRV for this stage is 10 – 35%. Conditions within this fire regime are likely within the range expected since the fire regime is one of long-interval stand replacement fires. Departure from historic reference conditions is estimated to be less than 33%.

Fire Regime V: Effects of the B&B Fire are variable within this fire regime. Currently approximately 18% of area within this fire regime is dominated by early successional grass, forbs, shrub stage, the HRV for this stage is 3 – 20%. Departure from historic reference conditions is estimated to be less than 33%. Except for a deficiency of large tree dominated areas the area within this fire regime supports vegetation conditions similar to that expected naturally.

Fire Frequency and Severity

To better understand the pre and post fire condition below, also frequently used terms that relate to fire and the effects of fire on natural ecosystems, relevant terms are define below:
(1) *Fire Frequency* refers to the number of fires in a specified time an area.
(2) *Fire Severity* refers to the degree to which a site has been altered or the successional process disrupted by fire. Fire severity, loosely, is a product of fire intensity and residence time (DeBano et al 1998, p.11).

Historic fire occurrence and severity is discussed in the Metolius Watershed Analysis Update (USDA Forest Service, August 2004).

Pre-Fire Condition

Fire Regime I: The Deschutes National Forest maintains a historical large fire record dating back to about 1905. An analysis of this record indicates that up to the occurrence of the B&B Fire a few acres had burned within the area. The historical reference fire frequency ranges from about 5 to 35 years. This short-interval fire cycle would indicate that most of the Fire Regime I area would have experienced 3 or more fire events during the last 100 years. Prior to the B&B Fire frequency of fire disturbance had departed substantially from reference conditions.

Fire Regimes IIIa and IIIb: The historical reference fire frequency ranges from 35 to 100 years. It is likely that within the B&B Fire area most of the area in these Fire Regimes had missed 1 fire cycle.

Fire Regimes IV and V: The historical reference fire frequency ranges from 100 to 200+ years. It is likely that within the B&B Fire area most of the area in these Fire Regimes had not missed a fire cycle.

The historical record contains little data on the severity of past large fires. Historically fires occurring with Fire Regime I were low intensity and had little effect on the dominant vegetation layer. Large-stand replacing fire could occur within Fire Regime I under extreme weather conditions, but were very rare events associated with exceptional droughts.
Within Fire Regimes IIIa and IIIb historically were of mixed intensity and had variable effects to the dominant vegetation. Large, stand replacing fire could occur but were usually rare. Fire disturbance resulted in a mix of stand ages and size classes. Historical fire severity within Fire Regime IIIa would tend to low intensity supporting and maintaining a higher percentage of early seral ponderosa pine.

Post-Fire Condition
In this section severity is being described in terms of tree mortality.

The scale, intensity and severity of the B&B Fire was characteristic compared to reference conditions within Fire Regime I. Burn severity for the B&B Fire within Fire Regime I was characteristic with about 5% of the area affected as stand replacement. The fire severity expected within Fire Regime I under historical conditions would be low severity.

Burn severity for Fire Regime IIIa was likely outside the historical range of variability, with 38% of the area affected as stand replacement. Burn severity for Fire Regime IIIb was likely within the historical range of variability, with 18% of the area affected as stand replacement.

Table 3.50 summarizes the elements of vegetation condition, fire frequency and severity in the determination of condition class for the B&B Fire Area.

Table. 3.50 B&B Pre- and Post-Fire Fire Regime Elements

Fire Regime	Vegetation Condition*	Fire Frequency	Fire Severity	Condition Class
I				
Pre-Fire	65%	70%	80%	3
Post-Fire	65%	60%	60%	2
IIIa				
Pre-Fire	40%	50%	50%	2
Post-Fire	70%	40%	60%	3
IIIb				
Pre-Fire	25%	40%	25%	1
Post-Fire	40%	25%	35%	2
IV				
Pre-Fire	20%	20%	20%	1
Post-Fire	20%	10%	10%	1
V				
Pre-Fire	15%	20%	10%	1
Post-Fire	20%	10%	10%	1
Note: * Departure from Reference Conditions				

Fire Regime IIIa which makes up the majority of the B&B Fire area is characterized as Condition Class 2, because of moderate departure from reference conditions for vegetation, fire frequency and intensity. Fire Regime I is characterized as being in Condition Class 3 because of a substantial amount of departure from reference conditions. Fire Regimes IV and V are shown as Condition Class 1 and essentially functioning with the ranges of historical reference conditions.

Fuel Loading and Arrangement

Fuel levels and risk of damage from wildfires is a component of the purpose and need for the B&B Fire Recovery Project. Components are described below.

- Bringing fuel load levels and fuel arrangement to conditions that reduce the likelihood of stand-replacement fire in regenerated stands, particularly during the early stages of stand development, will promote the long-term survival and growth of new conifers.

  Fuel load and arrangement will be described for the B&B Fire Area. Fuel conditions resulting from the alternatives will have associated effects on fire behavior including potential fire intensity. The effect a fire may have on resources depends on fire intensity and the conditions of the environment, including vegetation, in which it burns.
- Adjusting the fuel conditions within ponderosa pine stands, particularly within the urban interface boundary to levels supporting the future use of prescribed fire. Salvage and fuel treatment in these stands would result in fuel characteristics reflective of Condition Class 1, where prescribed fire could be used for maintenance and the likelihood of damage to large ponderosa pine from wildland fire would be reduced.

  Estimates of fire behavior under prescribed fire conditions are described. Low intensity prescribed fire applied within ponderosa pine stands would maintain stand density, species composition and structure to meet habitat requirements and reflect the historical fire disturbance regime.
- Fuel loading within the Metolius Late Successional Reserve (LSR) is likely to reach levels that would potentially damage soil productivity, residual live trees and snags in the event of a reburn.

The Northwest Forest Plan provides direction to enhance and protect late and old structure within Late Successional Reserves. Over time the existing dead trees will fall and become down wood accumulating as surface fuels with the potential to increase fire intensity. It is recognized that down wood is an essential component of ecosystems within the B&B Fire area, particularly within LSR, providing wildlife habitat, soil protection and other important functions. Alternative down wood levels that provide essential function and levels which represent a potential for adverse impacts to soil productivity and other ecosystem components is analyzed.

- Fire risk is elevated in areas of human development and along major roads. There is a need to protect the surrounding forest from risk of fire spreading from the developed campgrounds (i.e., Round Lake), Suttle Lake Recreation Area, Highway 20 and urban areas (i.e., Camp Sherman, Black Butte Ranch; etc.)

  Concentrations of human activity have increased the probability, of fires along roads, urban areas and campgrounds within and adjacent to the B&B Fire area, in recent years more people are recreating, as well as, constructing new homes adjacent to national forest lands. To address these and other concerns a Community Wildfire Protection Plan (CWPP) is being developed for the greater Sister area using a collaborative approach which involves federal, state, and private entities with a anticipated signing date of April 1, 2005. Fuels treatment is proposed to reduce fuel loading and remove ladder fuels within these areas (refer to fuels treatment map). Fire behavior potential is described for the alternatives.

Existing Conditions
Fuel Loading
One objective in burned areas is to reduce fuels so that they more closely approximate historical dead and down woody fuel loads. At lower and middle elevations, this is an important ecological concept because fuel loads can significantly contribute to the effects of a fire disturbance but often exist in levels above pre-European settlement (Brown 2000 p. 14; Everett et al 2000 p. 220). It is generally accepted that fire suppression and past large-tree harvesting operations have contributed to excess tree densities and fuel loads in ecosystems that developed with relatively short fire intervals (Brown 2000 p. 7).

In many places in the western United States, organic matter is produced at a higher rate than it can be cycled by decay. The accumulation of this woody material may increase the likelihood of large stand replacing wildland fire (DeBano et al 1998, p. 140). "Fuel buildups continue and become more continuous in distribution. As a consequence, subsequent occurrence of high-severity fire results in generally greater changes in plant compositions and structure than would occur if the communities had been subjected to more frequent low-intensity fires" (DeBano et al 1998, p. 201). Uncharacteristically high fuel levels create the potential for fires that are uncharacteristically intense (Franklin and Agee 2003). If lower and mid-elevation ecosystems are to experience a disturbance regime similar to that which they are adapted, the fuels must first be reduced to keep fire effects within an historical range. One goal of this project is to manage future fuel loads and fuel arrangement to be within a manageable range for both fire control and ecosystem processes.

The post-fire conditions and consumption of large wood found at the B&B Fire (as well as other recent fires on the Deschutes National Forest) has shown that large fuels greater than 12 inches are indeed flammable and dry out during the fire season. Large fuels were completely consumed over extensive areas of the fire, contributing to tree mortality and in some instances, severe soil heating.

A down woody fuels inventory was completed in portions of the B and B Fire area in 2003. Existing down wood, or surface fuels are variable depending on the fuels and vegetation conditions, and fire behavior which existed when the fire burned. The variability of existing fuels is illustrated below. The examples shown below display the variability in arrangement, size class distribution and loading of fuels.

Figure 3.6 illustrates a relatively low amount of surface fuels (quantified in Table 3.51). Total surface fuel loading is 6.88 tons per acre, all less than 9 inches in diameter material. Loading by size class is shown below. Current fire hazard is low since fuels are light and discontinuous. Surface fuel loading will increase as standing dead trees fall.

Figure 3.6 – Existing Fuel Loading

Table 3.51 Surface Fuel Loadings Associated with Figure 3.6

Surface Fuel Loading – Size Class (Tons per Acre)					
0-3”	3-6”	6-9”	9-20”	20+”	Total
1.31	2.05	3.51	0	0	6.88

In Figure 3.7 a moderate level of existing surface fuels is shown (quantified in Table 3.52). Total surface fuel loading is 33.12 tons per acre, with most fuels in the less than 9” diameter class.

Figure 3.7 – Existing Fuel Loading at Moderate Level

Table 3.52 – Surface Fuel Levels Associated with Figure 3.7

Surface Fuel Loading – Size Class (Tons per Acre)					
0-3"	3-6"	6-9"	9-20"	20+"	Total
12.34	3.82	9.41	7.54	0	33.12

Figure 3.8 represents a condition where total surface fuel loading is relatively high at 92.15 tons per acre (quantified in Table 3.53). The loading is concentrated in a few large pieces of down material. In this case, there is very little loading less than 9" diameter.

Figure 3.8 – Heavy Fuel Loading, concentrated in few large pieces

Table 3.53 – Surface Fuel Loadings Associated with Figure 3.8

Surface Fuel Loading – Size Class (Tons per Acre)					
0-3"	3-6"	6-9"	9-20"	20+"	Total
0.04	0	0	35.03	57.09	92.15

Estimates of surface fuels were made by unit and alternatives using FVS-FFE, *Forest Vegetation Simulation with Fire and Fuels Extension* (USDA FS 2004). Modeling predicted fuels loads post harvest over time within the B&B fire perimeter following the B&B Fire of 2003. Modeling was done in the Mixed Conifer Dry, Mixed Conifer Wet, Ponderosa Pine Dry, Ponderosa Wet and Lodgepole Pine Dry plant association groups that burned with high, moderate, or mixed intensities. *Standing dead or aerial fuels are not included in this summary.*

Fire History Analysis and Recent Large Fires

Fire history studies provide strong evidence that fire of the past occurred quite frequently, many times within the life span of the dominant tree species (Skinner, and Chang 1996). Unlike today, fire of the past did not occur as isolated events. Instead, they occurred regularly and greatly influenced the development of forest habitats (Agee 1993, Chang 1996, Skinner & Chang 1996, Mohr and others 2000).

Based on historic records the Metolius Watershed Analysis area has recorded 32 large fires during the period from 1900 through 2003 which have burned 106,566 acres, 72% of the watershed during the last century. This pattern will likely remain constant into the future (USFS 1995).

Between 1995 and 2003 eight large fires burned in the Metolius Watershed (WS) consuming 82,944 acres (Table 3.54). Large fires are defined as over 100 acres.

Table 3.54 Recent Large Fires Within the Metolius Basin

Year	Fire	Cause	Size	Acres in Watershed
2003	Bear and Booth	Lightning	91,902	67,251
2003	Link	Human Caused	3,590	3,590
2002	RNA	Rx Burn	167	167
2002	Cache Mtn.	Lightning	3,859	3,809
2002	Eyerly	Lightning	23,099	5,652
1999	Cache Creek	Lightning	382	382
1998	Square	Lightning	113	113
1996	Jefferson	Human Caused	3,689	1,989
Totals			126,801	

A closer look at the fire history above reveals that of the total acres burned in the Metolius watershed since 1900, 78% have burned in just the past 8 years. Over the past 104 years, the average acres burned by large fires in this watershed have been 3,330 acres per fire. In the past 8 years, average acres burned by large fires have been 10,368 acres per fire. In the previous 96 years it was 984 acres per fire. The majority of the large fires in the Metolius Basin has been lightning caused with two human caused.

Discussion of Factors Used to Describe Effects of the Alternatives

Fire Behavior

Fire Behavior is the manner in which fire reacts to topography, weather, and fuels (DeBano et al 1998 p. 11; NWCG,1998 p. G-7). These three elements comprise the fire environment, the surrounding conditions, influences, and modifying forces that determine fire behavior (NWCG, 1994 p. 8). Modifying any one of these elements has a direct result on fire behavior, which is basically described by flame length and rate of spread. Favorable conditions for crown fires include heavy accumulations of dead and downed litter, conifer reproduction and other ladder fuels, and continuous conifer tree forest (Rothermel 1991 p.2).

The greater the fuel loading, the more intensely a fire is likely to burn (DeBano et al 1998 p.57) Conversely, a reduction in fuel loading can limit the fires intensity. Fuel characteristics affecting fire behavior are vegetative density, species composition, amount of surface fuel, arrangement of fuels and moisture content (Rothermel 1983 p.9). Fuels contribute to the rate of spread of a fire, the intensity/flame length of the fire, how long a fire is held over in an area, and the size of the burned area (Rothermel 1983 p.59).

Treatments that reduce surface fuel loads have been shown to decrease fire behavior and severity (Graham et al 1999 p.18, 20) (Pollet and Omi, 1999, p. 3). Van Wagtendonk (1996) found in fire simulations that a reduction in fuel loads decreased subsequent fire behavior, increased fire line control possibilities and decreased fire suppression costs. Fire line construction rates increase with decreased fuel loads, decreased fuel loads means a lower resistance to control.

Intensive forest management that involves the creation of activity fuels (slash) can indeed increase fire behavior parameters such as rate of spread and flame length. However, treatment of slash (e.g. burning, chipping, removal, isolation) will reduce fire behavior and fire intensity (Omi and Martinson, 2002). Graham et al (1999 p.22) reports that thinning from below and intermediate tree harvest can effectively alter fire behavior by reducing crown bulk density and ladder fuels, but will not reduce crown fire potential unless tree densities are substantially reduced. Graham et al (1999 p.20) also states that all intermediate treatments should be accompanied by surface fuel modification, and the most success is achieved when using prescribed fire for such treatments.

There are three types of fuels that affect fire behavior; fine fuels such as grass or forbs, small woody fuels less than three inches in diameter and large woody fuels greater than three inches in diameter Fine fuels are the major contributors to fire spread, carrying the ignition and flaming front of a fire (Rothermel 1983 p.1). Without these fine fuels, many fires will not get large, although there are exceptions. However, eliminating fine fuels (litter, duff, grasses) is neither possible nor desirable. Small woody fuels influence a fire's rate of spread and fire intensity, and small woody fuels lose their moisture faster, start easier and burn more readily (Agee 1993).
Under a frequent fire regime it will be possible to maintain fine fuels at lower levels and various patch sizes than under a less frequent fire regime, but fine fuels will always exist. Aside from eliminating the fine fuels that contribute to fire spread, only the total amount and arrangement can be modified to benefit fire control efforts. From a firefighter's perspective, it is better to construct fire line through 2" of this small material to reach mineral soil (therefore stopping fire spread) than to dig through 10" of fine fuels because the fire line construction will progress faster and the fire could potentially be contained at a smaller size.

Large fuels (greater than 3" diameter) do not contribute greatly to fire spread, and are not considered in the BEHAVE fire spread prediction model, though they do remain burning after the fire front has passed (Andrews 1986 p.9) and contribute to fire severity. Due to large dead and down woody fuel contributions to fire behavior and control, reducing the amount of large, dead and down woody debris will increase the potential for using prescribed fire, in turn; help keep the fine fuel load at a relatively low level.

There are several expressions of fire intensity. Radiant intensity is the rate of thermal radiation emission. Convective intensity is that part of the total heat output from a fire that lifts gases and entrains air above the flame zone. Total fire intensity, the rate of heat output of the fire as a whole, is the function of the rate of area burned, fuel loading, and estimated heat yield. Reaction intensity, the total heat release per unit area of fuel bed divided by the burning time, is the time-averaged rate of heat release of the active fire front. Fireline intensity, also called Byram's intensity, is the product of the available heat of combustion per unit area of ground surface and the rate of spread of the fire. The two equations presented below are identical, DeBano et al. 1998 is in metric units and Rothermel's is in English units. The equation is (from DeBano et al 1998 p. 57):

$$I = .007HWR, \text{ where}$$
$$I = \text{intensity (kW/m)}$$
$$H = \text{Heat yield (cal/g)}$$
$$W = \text{fuel loading (Mg/ha)}$$
$$R = \text{rate of spread (m/min)}$$

Fire line intensity was also described by Rothermel in 1991 as:

$$I = Rwh, \text{ where}$$
$$I = \text{intensity (Btu/ft/s)}$$
$$R = \text{rate of spread (ft/s)}$$
$$W = \text{available fuel (lb/sq ft)}$$
$$H = \text{heat of combustion (Btu/lb)}$$

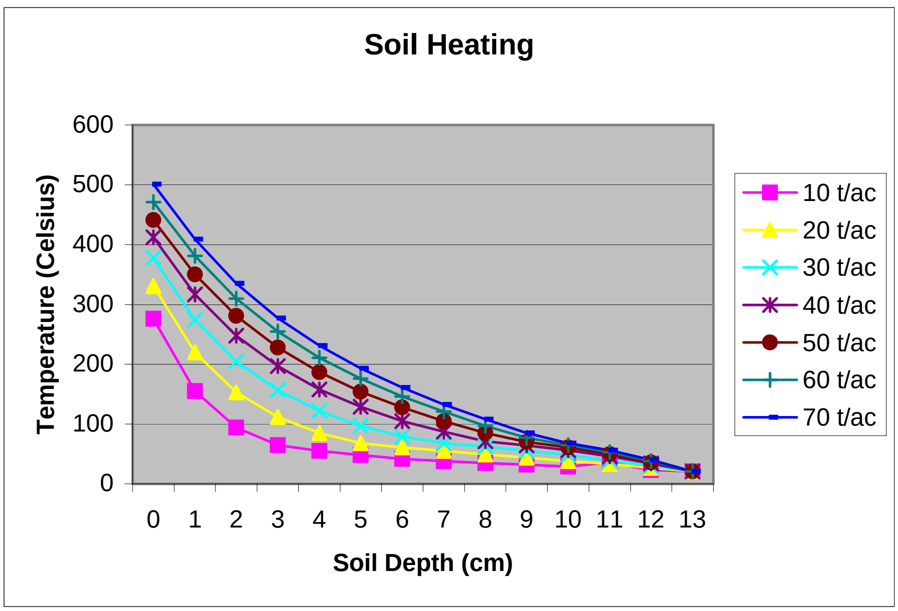
Based on these established relationships it follows that if available fuel is reduced, there is a reduction in fire line intensity. Fireline intensity has been related empirically to flame length, which is easily measured in the field (DeBano et al 1998 pp. 56 – 57).

Fire Hazard
Fire hazard generally refers to the difficulty of controlling potential wildfire. It is commonly determined by fire behavior characteristics such as rate of spread, intensity, torching, crowning, spotting, and fire persistence and by resistance to control. Fire severity, referring to the effects of fire on the ecosystem, may also be considered to be an element of fire hazard (Brown et al, 2003, p. 4).

Downward heat transfer into the soil is an important determinant of fire severity (Ryan and Noste 1985). Fire intensity, largely a measure of upward heat transfer, is not a reliable indicator of fire severity because it correlates poorly with downward heat transfer (Brown et al, 2003).

The potential for soil heating and associated damage to soils is largely influenced by the amount of surface fuels and size and arrangement of such fuels. Soil heating directly kills soil microorganisms or alters the reproductive capacity of some species (DeBano 1991). The effects are short-term when soil heating is low and does not penetrate beyond the uppermost soil layer, such as typically occurs in low severity fires (Harvey et al. 1994). The effects from high severity fires last longer and reach deeper into the soil. Figure 3.9 below displays maximum temperature and depth of soil heating based on surface fuel loading.

Figure 3.9 Potential for Soil heating by Fuel Loading (tons per acre)



A temperature of 60 degrees (Celsius) or more are lethal for soil organisms (Debano, 1998). Heating between 220 and 460 degrees (Celsius) combusts soil organic matter and, in doing so, affects soil properties dependent on organic matter. The destruction of organic matter can be beneficial, because it provides large amounts of readily available plant nutrients. However, it has the disadvantage of destroying soil structure, with the extent of damage depending largely on the rate at which organic matter replenishment occurs following fire. It could cause long-term damage in arid environments where organic matter is replenished slowly (Debano, 1998), such as is the case for Fire Regime I, and to a degree Fire Regime IIIa, areas within the Eyerly Fire area.

Soil heating is a complicated process that depends on the burnout time of duff and woody material, removal of the insulating duff layer, and soil properties (Brown et al, 2003). Excessive soil heating is concentrated beneath large woody fuel pieces particularly in the vicinity of piece intersections.

Resistance to Control

Resistance to control is generally viewed as an estimate of the suppression force required for controlling a unit of fire perimeter. The USDA Forest Service Pacific Southwest Region (1976) developed a resistance to control rating scheme based on difficulty of handline construction and an inventory of downed woody fuel loadings by size classes. High and extreme resistance to control ratings were reached for the following loadings in tons per acre – Table 3.55:

Table. 3.55 High and Extreme Resistance to Control Ratings Based on Loadings in Tons per Acre

0 – 3 inch diameter	3 – 10 inch diameter	
	High	Extreme
5	25	40
10	15	25
15	5	15

The above ratings were based on the assumption that few downed pieces greater than 10-inch diameter were present. In computing the ratings, the number of large pieces (greater than 10 inches) by length class is more important than their loading in determining resistance to control. If the number of pieces greater than a 10-inch diameter exceeded 10 to 20 per acre, depending on length, less 3 – 10 inch diameter material would be required to reach the high and extreme resistance to control ratings (Brown et al, 2003).

Restoring Fire as a Disturbance Process

One objective in burned areas is to reduce fuels so that they more closely approximate historic dead and down woody fuel loads. At lower and middle elevations, this is an important ecological concept because fuel loads can significantly contribute to the effects of a fire disturbance but often exist in levels above pre-European settlement (Brown, R. 2000 p.14; Everett, et al 2000 p. 220). It is generally accepted that fire suppression and past large-tree harvesting operations have contributed to excess tree densities and fuel loads in ecosystems that developed with relatively short fire intervals (Brown, R. 2000 p.7).

In many places in the western United States organic matter is produced at a higher rate than it can be cycled by decay. The accumulation of this woody material may increase the likelihood of severe stand replacing wildfires (DeBano et al. 1998 p. 140). "Fuel buildups continue and become more continuous in distribution. As a consequence, subsequent occurrence of high-severity fire results in generally greater changes in plant compositions and structure than would occur if the communities had been subjected to more frequent low-intensity fires"(DeBano et al. 1998 p. 201). If lower and mid-elevation ecosystems are to experience a disturbance regime similar to that which they are adapted, the fuels must first be reduced to keep fire effects within an historic range.

One goal of this project is to manage future fuel loads and fuel continuity to within a manageable range for both fire control and ecosystem processes. Treatments which reduce surface fuels, increase canopy base height, decrease crown density, and increase the proportion of fire-resistant trees (example ponderosa pine) contribute to the fire-resiliency of forest stands (Graham et al, 2004).

Within the B&B Fire area Fire Regimes I and IIIa,b would be areas on which to focus for restoring fire's role as a disturbance process. The occurrence of the B&B Fire presents an opportunity to examine the affected area and identify areas and treatments that would help create conditions favorable for the re-introduction of fire, primarily prescribed fire, as a disturbance process into the area in the future.

Fire Regime I: Fire regime I includes Wet and Dry Ponderosa Pine plant association groups (PAGs). In ponderosa pine forests, it has taken several decades of fire suppression to create the conditions existing which existed prior to the B&B Fire, and one treatment is not going to immediately return this forest to a condition to which it would function under the historical low-severity fire regime (Brown, R. 2000 p.13). The goal, then, is not to completely return these forests to a historic fuel load with one treatment, but to prescribe treatments that would start to move them toward a historic level, which would allow a more natural fire regime to function.

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

To move forests towards a more natural fuel condition, fire will be managed, through the use of prescribed fires. Actions proposed in the alternatives are aimed at reducing fuel loading now so that as conifer stands develop the option of using prescribed fire will be available to either maintain or enhance desired conditions. A reduced fuel load would increase the variance of weather and fuel conditions under which prescribed fire could be applied.
Hall (2003) suggests that the historical condition contained very little woody fuel averaging about 3 to 6 tons/acre. The optimum range of Coarse Woody Debris (CWD) for warm dry forest types is described as 5 to 20 tons per acre (Brown, 2003). After the B&B Fire, projected fuel loads show the surface fuel loads on most PP sites exceeding 40 tons/acre, after 25 years, estimations and models predict that fuel loads could exceed 100 tons/acre on some sites.

Fire Regime III: Fire Regime III includes the mixed conifer wet and mixed conifer dry PAGs. Agee (1992) believes that historically the mixed conifer forests show the most frequent fire activity of all Eastside forests, although cooler, wetter sites (mixed conifer wet) would tend to have longer fire return intervals. Frequent fire intervals in drier plant associations are likely due to higher productivity, when compared to Ponderosa pine associations. After a fire, the fine dead fuels needed to carry another fire are rapidly replaced in the mixed conifer associations.

The optimum range of Coarse Woody Debris (CWD) for cooler mesic types is described as 10 to 30 tons per acre (Brown 2003). After the B&B Fire, projected fuel loads show the surface fuel loads on most mixed conifer sites exceeding 60 tons/acre. After 25 years, estimations and models predict that fuel loads could exceed 120 tons/acre on some sites.

To introduce prescribed fire as a disturbance in the B&B Fire area, it is necessary to first remove some of the fuels to allow for these fires to be safe and ecologically beneficial. From a firefighting perspective, less fuel is better, however, it is not ecologically appropriate to reduce fuel levels below that which provides for other ecosystem functions and such reductions are not proposed in this project.

Activities Proposed

Helicopter Fuel Treatments:

Salvage logging would be done with either yard with tops attached to the log or whole-tree-yard. In some units unmerchantable dead trees from 3 to12 inches dbh would be felled. Unmerchantable tree felling is proposed to hasten the fall and decay process of this material and to make available to the prescribed fire operations jackpot under-burning (JP). Unmerchantable tree felling would be done over an estimated 60 to 70% of the unit area. Some areas within units may not have an abundance of this size material, and some areas within units would be left untreated to maintain diversity of conditions.

Following salvage harvest and unmerchantable tree felling, prescribed fire is planned for units 44, 45, 47, 54 and 145 totaling 517 unit acres. Reducing fuel concentrations of dead and down material would be the focus of prescribed fire, as mentioned above. Prescribed fire would be applied to about 60 percent of each unit (Table 3.56).

Table 3.56 Unmerchantable tree felling and prescribed fire within helicopter units

Alternative	Acres
Alternative 1	0
Alternative 2	517
Alternative 3	0
Alternative 4	0
Alternative 5	0

Ground-base Fuels Treatments:

Salvage logging would be done with either yard with tops attached or whole-tree-yard. In some units unmerchantable dead trees from 3 inches to 12 inches dbh would be felled. Unmerchantable tree felling is proposed to hasten the fall and decay process of this material and to make the material available to grapple piling operations.

Unmerchantable tree felling would be done over an estimated 60 to 70% of the unit area. Some areas within units may not have an abundance of this size material and some unit areas within units would be left untreated to maintain diversity of conditions.

Grapple piling is prescribed for most ground-based harvest units. Grapple piling would be confined to existing skid trails, so that soils effects are limited to those areas already used in the salvage operations. The amount of area unreachable by grapple pile depends on the skid trails spacing but it is estimated that 30 to 40 percent of each unit would not be reachable.

Due to possible limitation of the grapple machine, units could be assessed for additional hand-piling and/or jackpot burning of fuels located between skid trails if fuel loadings were not sufficiently reduced after machine operations from existing trails (Table 3.57).

Table 3.57 Unmerchantable tree felling and grapple piling

Alternative	Acres
Alternative 1	0
Alternative 2	2,732
Alternative 3	1,725
Alternative 4	269
Alternative 5	2,013

Fuel Strategy Treatment Areas:

The B&B Fuels Strategy has identified high priority areas for hazardous fuels reduction based on recommendations outlined in the updated Metolius Watershed Analysis (2004). One goal of the strategy is to manage future fuel loads and arrangements to be within a manageable range for both fire control and ecosystem process. Through management, fuels are modified to modulate fire behavior, ameliorate fire effects, and reduce cost of fire suppression. Fuels management can include reducing the loading of available fuel, converting fuels to those with lower flammability, or isolating or breaking up large continuous bodies of fuels.

Treatments are proposed for areas identified in the fuel strategy for defensible space: (1) Wildland Urban Interface (Camp Sherman, Suttle Lake Recreation Complex and Round Lake; etc.), (2) Major roads (2 and 4 digits) and (3) Existing and Potential NRF habitat areas (See Fuels Strategy). Defensible space is being defined in the strategy as a developed and/or maintained fuel break 100-500ft wide that serves as an anchor point during fire suppression and as an escape route from wildfires for firefighters and the public. There are several important factors related to the fuels strategy and treatments proposed in salvage units. First, is fire behavior, modifying fuels to generate low intensity wildfires (flames lengths less than 4 feet) under all weather conditions. These conditions are desired in areas outlined in the Defensible space strategy.

Treatments would include felling unmerchantable dead trees from 3 to 12 inches dbh. Felled material along with existing surface fuels above unacceptable levels would then be hand piled or grapple piled and then burned.

Table 3.58 shows treatment acres by alternative for defensible space:

Table 3.58 Fuel Strategy Treatment Acres by alternative

Defensible Space	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Major Roads	2,703	1,425	692	1,886
Existing NRF	324	178	152	257
Potential Future NRF	2,376	1,410	1,086	1,644
WUI	2,720	1,149	58	1,602
Totals *	**5,394**	**1,149**	**58**	**1,602**

*Totals does not equal the sum of the parts, as areas may overlap

Environmental Consequences

General Description of Vegetative Succession and Fuels Conditions
Alternative 1 – "No Action"

Vegetative succession following forest fire including reburn depends on a number of interacting factors including fire severity, prefire vegetation, species adaptations to fire, environmental conditions and chance.
The following description of likely vegetative succession and fuels condition development over time is patterned after Brown et al, 2003, p. 9. Additional site specifics are described for the B&B Fire area based on existing literature and observation of the B&B Fire area.

0 to 10 Years After B&B Fire (2003 – 2013)
During this period small diameter standing dead trees, those less than 3 inches dbh, will fall to the ground, while larger dead trees remain. Natural conifer regeneration would be sparse if any and likely would be dominated by lodgepole pine.

Native forbs and grasses would begin to re-occupy the site. Notable among shrub species would be snowbrush (Ceanothus velutinus), which will likely become re-established quickly, resprouting from existing burned plants and from dormant heat scarified seed in the soil. Another shrub likely to be present is greenleaf manzanita (Arctostaphylos patula).

Surface fuels for most of this period would not support fire spread sufficiently to pose a threat of any damage. Depending on distribution shrubs and grasses may have become sufficiently established over patches of an acre or less to present a horizontally continuous fuel bed of fine fuels to support the spread of small fires of an acre or so in size. Potential for reburn is low during this period of time (Beschta et al, 1995).

Fuel model 2 or 5 would characterize the fuel condition. Fire intensity would be low to moderate with flame lengths of 2 – 4 feet resulting under most weather conditions. Wildfire would be a surface fire with no potential for crowning, and spotting would be minimal. Potential for suppression forces to control this type of wildfire would be high.

10 to 30 Years After B&B Fire (2013 – 2043)
Most stands will have experienced rapid increases in surface fuel loading as a high percentage of the standing dead trees fall. Surface fuels loading would increase in most stands to a total of 40 to 70 tons per acre.

Native grasses and shrubs would be well established, with shrub species dominating the understory. Shrub composition would likely be dominated by snowbrush with manzanita well represented especially on south facing slopes and areas of shallower soils (Volland 1976). Some conifer regeneration is expected to be evident during this time period. Density of conifer regeneration would be expected to be low probably less than 150 trees per acre and patchy in distribution. Early seral species lodgepole pine and ponderosa pine would be expected.

Downed CWD would exhibit some decay and support a longer burning period. A duff layer would not be well established and would be unable to contribute to soil heating (Brown et al, 2003). High severity fire could be substantial where a large proportion of the soil surface was directly overlain by large woody material (Brown et al, 2003).

Fuel model 6 (shrub) would characterize the fuel condition due to the anticipated dominance of shrubs. A portion of the area would also be characterized as fuel model 12 due to the relatively high level of larger woody fuels. Potential fire behavior increases during this period due to the increased fuel bed depth, fuel loading and arrangement. Potential flame lengths would be in excess of 10 feet under severe conditions and 4 to 6 feet under moderate conditions. Wildfires would tend to be surface fires, however potential for tree torching and crowning would be high depending on the density of continuity of naturally regenerated trees. Potential for spotting would be high due to large numbers of snags, and high potential for lofting firebrands into the air. These fuel conditions would present control problems to suppression forces responding to such a fire primarily due to high fire intensity (>4 ft flame lengths), spread rate (high in fuel model 6) and resistance to control due to high levels of down fuel.

30 to 60 Years After B&B Fire

Surface fuels during this period would be at moderate to high levels generally exceeding 40 tons per acre. Most of the reduction in the amount of CWD would be due to decay, as material less than 3 inches diameter decays relatively quickly while larger material remains.

As conifer trees develop and produce shade shrub species such as snowbrush and manzanita would begin to decrease (Volland 1976). Pre-fire data from forest inventory plots give an indication of the understory plant composition and percent cover under a well-developed forest canopy. The general trend would be toward decreased percent cover as the conifer canopy increases, shrubs would be present but not as dominant as they had been during earlier periods following the fire.

Downed CWD would exhibit considerable decay and support a longer burning period. A duff layer would be establishing to a variable extent depending on overstory conifer development. Burnout of large woody pieces and duff would be assisted by the interaction of these two components (Brown and others 1991).

Total surface fuel loading begins to decrease after 50 to 60 years, primarily due to decomposition. Smaller diameter CWD decays faster than larger pieces and make up a smaller percent of the total amount. The dynamics of movement of biomass through the system is shown below based on projections using FVS and FFE.

Fuel model 6 (shrub) would characterize the fuel condition due to the anticipated dominance of shrubs. A portion of the area would also be characterized as fuel model 12 due to the relatively high level of larger woody fuels. Potential fire behavior increases during this period due to the increased fuel bed depth, fuel loading and arrangement. Potential flame lengths would be in excess of 10 feet under severe conditions and 4 to 6 feet under moderate conditions. Wildfires would tend to be surface fires, however potential for tree torching and crowning would be high depending on the density and continuity of naturally regenerated trees. Potential for spotting would be high due to snags, and high potential for lofting firebrands into the air. These fuel conditions would present control problems to suppression forces responding to such a fire primarily due to high fire intensity (>4 ft flame lengths), spread rate (high in fuel model 6) and resistance to control due to high levels of down fuel.

Figure 3.10 displays the acres of fuels less than 3 inches diameter, at different loading ranges for the no action alternative. The amount of area with fuels less than 3 inches diameter greater than 5 tons per acre would peak about year 2010, at 39,100 acres (65% of the area). This occurs because smaller standing dead trees would fall sooner than larger trees. The scale of the analysis is the Metolius Watershed.

Figure 3.11 displays the acres of fuels greater` than 3 inches diameter, at different loading ranges for the no action alternative. The amount of area with fuels greater than 3 inches diameter, at more than 30 tons per acre would peak about year 2090. This is because the scale of the analysis is the Metolius Watershed, and all areas are represented, including non-burned, low, mixed and stand replacement mortality areas.

Within stand replacement areas, fuel loading for greater than 3 inch diameter material peaks about year 2030 – 2040.

Figure 3.10: Estimated Fuel Loading, No Action

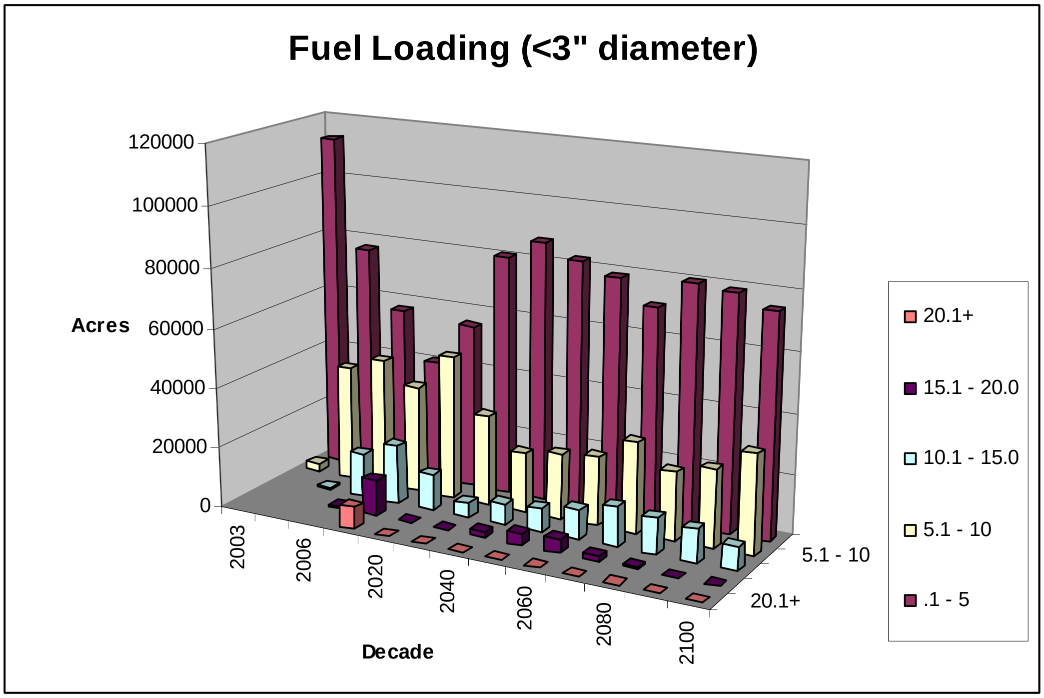
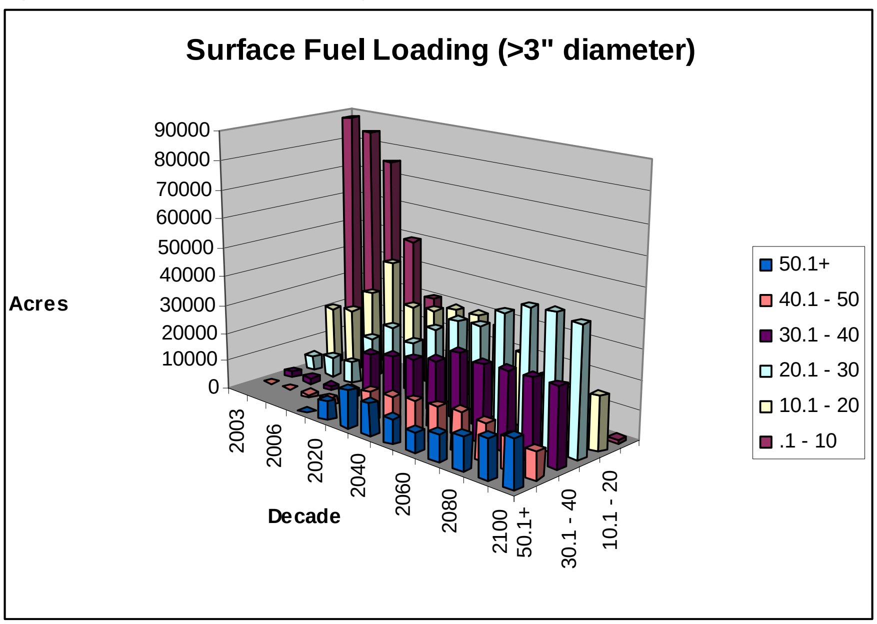


Figure 3.11: Surface Fuel Loading (>3" diameter)



Alternatives 2, 3, 4, and 5 (Areas Treated with Salvage and Fuels Reduction)

There is no universally accepted view on the potential for an area to burn again after a major fire similar to the B&B Fire. Some references cite that the occurrence of a high intensity fire does not increase the potential for a reburn (Beschta, et al 1995), while others (Brown, et al 2003) suggest that site-specific conditions may play a role for an area to burn again after a large intense fire. An assumption could be made that the probability of ignition remains unchanged in the post-fire environment; that is human activity continues as it has historically, because of the Highway 20 and recreational attractions of the area, and natural ignitions (lightning) also remain unchanged. This would result in the fire occurrence rate remaining constant and at historic levels for the future. Considering that the potential for a wildfire to ignite remains unchanged, the expected fire behavior and fire effects can be compared by alternative.

Based on the extent of proposed treatments, the alternatives will have varying effects on the fuel loading and arrangement that affect the potential spread rate, intensity, and resistance to control should a wildfire be ignited. Fast moving fires may involve more area before sufficient suppression forces are able to respond and contain the spread. Higher intensity fires and fires burning in heavy fuels may require additional resources or a different type of suppression equipment in order to contain the spread. Recent monitoring has shown a correlation between reburn and an increase in detrimental effects to soil and vegetation in portions of the 2003 Booth and Bear Fire where they reburned through the 1987 Cabot Lake and Brush Creek fires (Shank 2004). Although there were parts of the Cabot Lake and 1996 Jefferson Fire that did not reburn because of lack of ground fuels sufficient to carry the fire, Shank noted an increase in the extent of detrimentally burned soils as a result of subsequent fires in areas that had previously burned.
The trees proposed for commercial removal are not live and have no fire resistance attributes. Standing dead trees (snags) often contribute to increased fire spotting distances, which can increase fire spread and present control problems for future suppression actions.

0 – 10 Years After B&B Fire (2003-2013)
Vegetation succession and fuel development during this period would be similar for all alternatives. During this period, small diameter standing dead trees, those less than 3 inches dbh, will fall to the ground while larger dead trees remain standing. Natural conifer regeneration would be sparse if any and likely would be dominated by lodgepole pine.

Fuel model 2 or 5 would characterize the fuel condition. Fire intensity would be low to moderate with flame lengths of 2 – 4 feet resulting under most weather conditions. Wildfire would be a surface fire with no potential for crowning, and spotting would be minimal. Potential for suppression forces to control this type of wildfire would be high.

10 to 30 Years After B&B Fire (2013 – 2043)
Units treated with salvage and fuels treatment will have reduced surface fuel loading compared to untreated areas. Surface fuels loading would increase in most stands to a total of 25 to 40 tons per acre. A few stands with low number of trees per acre at the time of the B&B Fire will likely maintain at low level of surface fuels. With salvage and fuels treatment maximum surface fuel loading is reached earlier than under no treatment.
Native grasses and shrubs would be well established, with shrub species dominating the understory. Shrub composition would likely be dominated by snowbrush with manzanita well represented especially on south facing slopes and areas of shallower soils (Volland 1976).

Density of conifer planted trees would be expected to be 150 to 200 trees per acre. Early seral species dominated by ponderosa pine would be expected. The diameter and height of planted trees is expected to be greater than naturally regenerated trees because they have occupied the site for a longer period of time.

Downed CWD would exhibit some decay and support a longer burning period. A duff layer would not be well established and would be unable to contribute to soil heating (Brown et al, 2003). High severity fire could be substantial where a large proportion of the soil surface was directly overlain by large woody material (Brown et al, 2003). In areas where salvage and fuel treatments are accomplished a lower percentage of the area would be directly overlaid by large woody material.

Fuel model 6 (shrub) would characterize the fuel condition due to the anticipated dominance of shrubs. A portion of the area would also be characterized as fuel model 10 due to the relatively high level of larger woody fuels. Potential fire behavior increases during this period due to the increased fuel bed depth, fuel loading and arrangement. Potential flame lengths would be in excess of 10 feet under severe conditions and 2 - 4 feet under moderate conditions. Wildfires would tend to be surface fires, potential for tree torching and crowning would be high depending on the density and continuity of regenerated trees. Potential for spotting would be low to moderate due to reduced snag levels. Fewer control problems would be experienced by suppression forces responding to wildfires primarily due to lower potential fire intensity 4 ft flame lengths, spread rate (high in fuel model 6) and less resistance to control due to lower levels of down fuel.

Table. 3.59 shows that Alternatives 2 and 5 create conditions on more of the recovery area where the fuel loads are within the ranges recommended in the Metolius Late Successional Reserve Assessment. For ponderosa pine stands the recommended range is 10 – 15 tons per acre; for mixed conifer the range is 12 – 24 tone per acre; and for mountain hemlock the range is 23 – 35 tons per acre. Brown et al (2003) determined “optimum” levels of down coarse woody debris for soil and wildfire considerations. The optimum levels for wildlife including standing and down was 5-20 tons per acre on dry forest types and 10-30 tons per acre on other forest types. Alternatives 2 and 5 produce these conditions on more of the project area than the other alternatives and Alternative 4 would have these conditions on the least amount of the project area. Table 3.60 displays acres within the watershed where loading for fuels less than 3 inches diameter is less than 5 tons per acre by alternative.

Table. 3.59 Amount of Project Area with Fuel Loading not Exceeding 10-35 Tons Per Acre

Effects Indicator	Alt. 2	Alt. 3	Alt. 4	Alt. 5	
Acres where Fuel Loading does not exceed 10 – 35 tons per acre	3,596	2,079	1,404	2,584	
Percent of project area	9%	5%	3%	6%	

Table 3.60: Acres by Alternative with <3” fuels at less than 5 tons per acre (decades 2010, 2020, 2030)

	2010	2020	2030
Alternative 1	40793	55327	80476
Alternative 2	43096	59690	81391
Alternative 3	41996	56770	80856
Alternative 4	41860	55997	80647
Alternative 5	42550	58450	81280

Alternative 1 provides the least amount of acres with fine fuels at less than 5 tons. Higher loadings of fine fuels would tend to make future wildfires burn more intensely and have a faster spread rate. Fire intensity (flame length) would be increased and be more likely to result in vegetation mortality. The implementation of future prescribed fire would be limited because of the higher fuel loading of fine fuels.

Alternative 2 provides the most acres with fine fuels at less than 5 tons. This is due to the larger amount of acres treated under Alternative 2. Potential fire intensity would be reduced affording some protection to existing vegetation. The implementation of prescribed fire in the future would be increased over the other alternatives. Spread rates and fire intensity would be reduced in treated areas which would increase the effectiveness of suppression actions.

Alternatives 3, 4 and 5 provide amounts of fine fuels at amounts between Alternatives 1 and 2, depending on the amount of area proposed for treatment.

Table 3.61 displays acres within the watershed where loading for fuels greater than 3 inches diameter is less than 30 tons per acre by alternative.

Table 3.61 Acres by Alternative with >3" fuels at less than 30 tons per acre (decades 2030, 2040, 2050)

	2030	**2040**	**2050**
Alternative 1	73831	72971	72768
Alternative 2	77086	76696	76847
Alternative 3	75877	74085	74529
Alternative 4	74795	73546	73641
Alternative 5	76542	75493	76021

Alternative 1 provides the least amount of acres with large fuels at less than 30 tons. Higher loadings of large fuels would tend to make future wildfires with longer burn durations. The implementation of future prescribed fire would be limited because prescription conditions would be more limited. There would be potential for increased smoke production because of increased consumption. Production rates of suppression forces would likely be reduced because of the heavier material

Alternative 2 provides the most acres with large fuels at less than 30 tons. This is due to the larger amount of acres treated under Alternative 2. The implementation of prescribed fire in the future would be increased over the other alternatives. There would be lower potential on treated areas for detrimental soil heating since burn duration would be reduced.

Alternatives 3, 4 and 5 provide amounts of large fuels at amounts between Alternatives 1 and 2, depending on the amount of area proposed for treatment.

3.8 Transportation – Roads and Access

Introduction

A Forest Wide Roads Analysis was completed in 2003 (prior to the fire) that analyzed all maintenance level 3-5 roads on the Deschutes National Forest. Preliminary transportation analysis for the B&B Fire area began in the fall of 2003 (during the fire), with inventories and surveys of all existing roads within the burned areas, primarily as part of the BAER effort. Following Forest Service Transportation Policy, an ID team conducted a Roads Analysis across the fire area in the spring of 2004. The purpose of the Roads Analysis was to examine all roads within the B&B fire, adjacent Link fire (2003), and some adjacent areas to identify opportunities for future road management actions based on the benefits, problems, and risks associated with the existing road system.

Environmental Consequences

Existing Condition

Current Road System

There are approximately 388 miles of known roads within the B & B Fire Recovery Project area. This includes 257 miles of open forest system roads ranging in standard from primitive, unsurfaced wheel tracks to two lane paved roads. There are also 100 miles of closed roads, and an additional 25 miles of “other” roads which are on private lands or belong to other agencies, including 6 miles of state highway.

About 12% of the system consists of Highway Safety Act roads which are maintained at a standard that accommodates low clearance passenger vehicles. This system has historically been designed and maintained to accommodate the mix of traffic resulting from resource extraction activities (logging) and a significant amount of recreation traffic, thus there is a fairly good road system in place which can handle most existing or proposed traffic generating scenarios

Road Maintenance Practices

Approximately 12% of the road mileage in this area receives routine maintenance each year. This occurs primarily on the maintenance level 3-5 roads. These roads are maintained to Highway Safety Act standards, and are the higher level, higher use, roads which are typically paved, rocked, or have an otherwise improved surface.

The remaining 88% of the road system consists of lower standard, high clearance only or closed single lane roads, (maintenance levels 1&2). These roads receive little or no routine maintenance. They typically receive only what is necessary to correct imeadiate safety or environmental problems, or when they are being used for commercial activity. Traditionally, maintenance associated with commercial use (log haul) has been the primary means of maintaining these otherwise low use roads. The closed roads in this area are also included in this category.

Maintenance deficiencies have been identified for most roads in the fire area through annual deferred maintenance surveys, and in recent BAER and other post-fire road condition surveys. Many roads, (approximately 150 miles) were improved, and maintenance was performed, following the fires through the BAER program. This consisted cleaning ditches and culverts, adding waterbars and driveable dips, and adding or replacing culverts throughout the area. Most of the highest priority work was done, but there was not enough time or money to accomplish all work needed on all roads.

Road Drainage Conditions

Some ditches and drainage structures are hydrologically connected with streams in the area. Wet weather haul may have to be restricted and additional drainage work may need to be done on some roads in the area if they cannot be resurfaced under this project. This work would include things like the installation of additional relief culverts, additional relief waterbars, and the armoring of some existing culvert and waterbar outlets. The addition of relief culverts and waterbars is needed to eliminate the hydrologic connection with the streams. Wet weather haul restrictions and appropriate maintenance can prevent the rutting and carrying of worn surfacing and subgrade.

Deferred maintenance and post-fire surveys also identify a number of existing culverts that are undersized or otherwise do not meet current standards and were not able to be replaced under the post-fire BAER work. These are located on Rds 1210, 1234, and 1270. These culverts are typically in the 18 to 24 inch diameter. BAER work following the fire replaced or installed the larger diameter pipes or bridges that were deemed in immanent danger of blocking or plugging larger drainages and streams.

Access Management

Presently, within the fire area, a road and area closure order is currently in effect restricting motorized use to a few of the main roads. This order remains in effect but can and is modified periodically. The following internet web site always displays the most up to date status of this order. (www.fs.fed.us//r6/centraloregon/conditions/recreport).

Prior to the fires, all maintenance level 2 through 5 roads (about 257 miles) in the area were open to motorized use. Approximately 100 miles of road were in the maintenance level 1 category, (i.e., closed). In many areas, the low use maintenance level 2 roads had been closing themselves over time due to a lack of use, maintenance, blow down and brush such as manzanita and ceanothis encroaching into the roadway. These are objective maintenance level 2 roads (open for use) but have become operational maintenance level 1 roads since they are undriveable. Despite a temporary reopening due to the loss of vegetative obstructions from the fire, falling snags will soon create a similar situation. This will be especially true after 5 to 10 years as roots rot and give way, causing the dead trees to fall into the roadway in sufficient numbers to prevent the use of the road. A concern exists with these roads that prior to their self closing, assurance is needed that they are in a "self maintaining" mode, (i.e., have drainage features assessed, and structures such as culverts removed if appropriate and be deemed hydrologically stable). There have been a few level 1 roads that are not being proposed for use in this project that have been found to be driveable and these do need to be reclosed.

Also, prior to the fires, there were a number of user-created OHV trails within the project area. The heaviest used area, along Rd 12 had been closed several years before the fires. Due to the severity of the fire and the resulting reduction of natural barriers, there is a concern about potential increased use of OHVs and the associated potential resource damage both due to the reduced vegetative cover. Unmanaged recreation, particularly undesirable impacts from OHVs has been identified nationally by the Forest Service as a key threat to the Nation's Forests. It has therefore become a national emphasis item for the Forest Service. Policy development is currently focusing on moving to a general prohibition on cross-country travel by OHVs. A draft containing this policy is expected to be published in February, 2005. (www.fs.fed.us/recreation/programs/ohv).

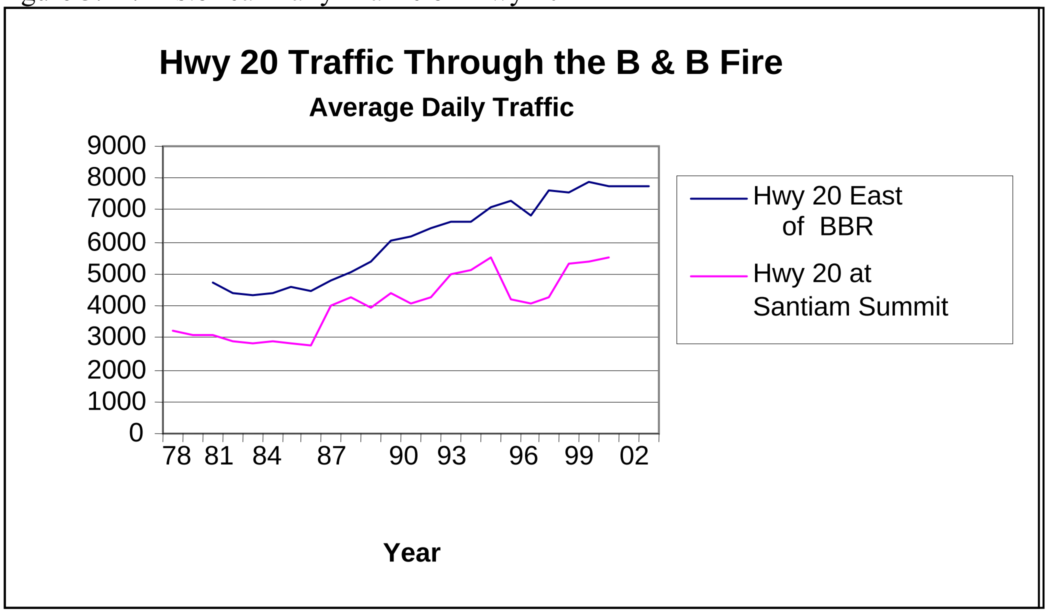
Traffic Volumes and Trends

Locally, forest roads are a popular driving experience. Typically an estimated 95% or more of forest road traffic is recreation traffic. Nationally, driving for pleasure is the number one recreation activity of forest visitors. Some areas in and near the project area have been experiencing new roads and trails being created by off road vehicles and high clearance vehicles for off-road recreation. Driving off-road was not in itself illegal, unless specifically prohibited (e.g., area closure) or if it was causing resource damage. Again within most of the project area, a road and area closure order is currently in effect restricting motorized use to a few of the main roads and national policy development is currently focusing on moving to a general prohibition on cross-country travel by OHVs.

State Highway 20, the Santiam Highway

Oregon Department of Transportation Volume tables show an 80% increase in 20 years (1982 to 2002), from 4300 to 7800 vehicles per day east of the Black Butte Ranch entrance. Over the summit traffic has increased 96% for the same period (2850 to 5600). These are year round daily averages, ADT (Average Daily Traffic)(see Figure 3.12).

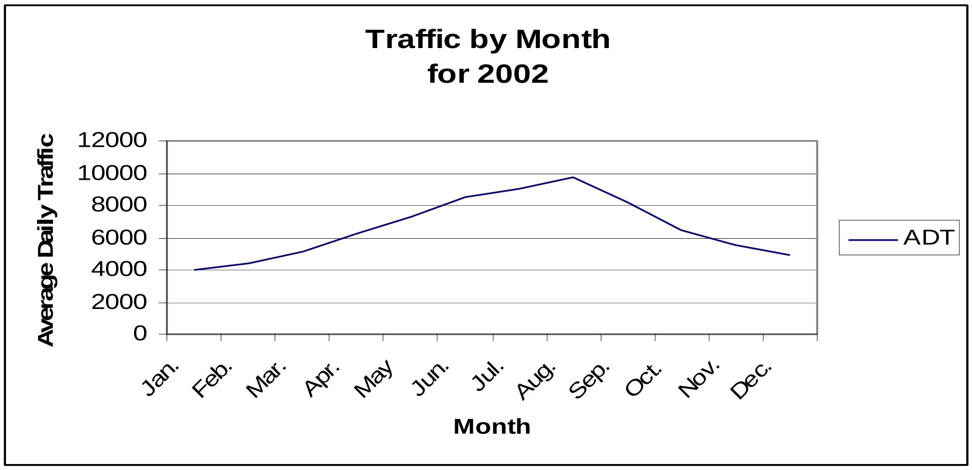
Figure 3.12. Historical Daily Traffic on Hwy 20



The area between the line representing "Hwy20 East of BBR" and the line for "Hwy 20 Santiam Summit" represents the traffic that comes and goes from Black Butte Ranch, the Camp Sherman and Metolius River area traffic, and the rest can be assumed to be forest traffic that leaves the highway and enters the forest at Rd 12, Rd 2070, and other forest roads along the highway.

There is a significant traffic volume change seasonally on the highway, from a January low of about 4000 vehicles per day to a high of over 9,000 per day in July and August. This is a typical yearly cycle (see Figure 3.13)

Figure 3.13. Seasonal Traffic



Of the 7763 vehicles per day on the highway in 2002, 90% were classified as passenger or light vehicles.

Road 12, Jack Lake Road (and Hwy 20 Intersection)

Traffic counts were conducted on this road in 1997, 1998, and 1999 showing ADTs of 165 to 190. The average has probably not changed greatly through 2003 until the fires. Of course during the B&B Fire and through 2004, traffic was still very restricted. During restoration activities nearly all of the timber haul volume generated will use Rd 12 to access Hwy 20. The intersection at the junction of those two roads could see additional traffic of up to 100 trucks per day. This intersection should be adequate to handle that additional traffic. It is in a good location with good site distance, etc. and it has handled large volumes of truck traffic during the 1980s. However, considering the increased traffic volume of the highway itself since the 1980s this will be discussed further with the Oregon Department of Transportation.

Road 2070, Suttle Lake Road

The traffic on the main road into and around Suttle Lake was last counted in 1997 and shows a 57% increase between 1982 and 1997. This road continues to serve resorts, campgrounds, organizational camps, and day use areas which are increasing in use. This road and a number of the campground roads have been recently resurfaced and access to the Suttle Lake Resort itself was reroute in 2002 from a very poor direct intersection with Hwy 20 to this road which has a good highway intersection. This intersection should be adequate for any additional project generated traffic.

No other significant traffic counts are available for roads in this area.

No Action Alternative

Direct and Indirect Effects

Under the No Action Alternative there would be no change to the current road system. Custodial maintenance such as surface blading and danger tree removal along high use, Highway Safety Act roads would continue. Low use, maintenance level 1 and 2 roads would continue to receive little or no maintenance as very few maintenance dollars are spent on these roads now.

No culvert or other identified drainage work would occur. No additional road closures would occur. No undersized or below standard culverts would be replaced. No deferred maintenance work would be accomplished and the backlog of deferred maintenance will continue to grow.

Cumulative Effects

Road conditions will continue to deteriorate over time as administrative, recreation, and other commercial traffic, outside of this project, take their toll on road surfaces. Snags will continue to fall, and brush will continue to encroach on roadways causing more and more roads that are presently open for high clearance use to become closed to that use.

Common to All Action Alternatives

Direct and Indirect Effects

No additional road surfacing has been proposed with this project. It is not expected that the value of the timber sold from this project would be able to cover the cost of any significant amount of road resurfacing. The various amounts of volume hauled over the road system under each action alternative will cause further wear and loss of existing surface and subgrade. This wear adds to the deferred maintenance backlog already existing and will eventually have to be made up. Surface Rock Replacement deposits may be collected under any resulting timber sales from this project which can offset part of this effect.

A number of design elements have been proposed for haul roads where there is an increased risk of sediment delivery to streams. Approximately 88 road segments or areas have some kind of identified drainage problem. Design elements are proposed under the action alternatives to address these concerns on roads used for haul in this project. These items include, but are not limited to, adding additional relief culverts, waterbars and the armoring of culvert and waterbar outlets. These items are a required to mitigate haul induced problems. If there is no haul, there is no maintenance need. Table 3.62 compares the estimated cost of the needed drainage improvements for each action alternative:

Table 3.62 Estimated Cost of Drainage Improvements By Alternative

Project Activity	**Alt. #2 Proposed Action** (Dollars)	**Alt. #3** (Dollars)	**Alt. #4** (Dollars)	**Alt. #5** (Dollars)
Total to Add Additional Relief Culverts	$29,280	$25,440	$7,200	$25,440
Total to Add Additional Relief Waterbars	$2,960	$1,920	$560	$2,080
Total Cost to Armor Outlets	$15,500	$10,900	$2,800	$10,900
Total Est. Relief Drainage with Armoring	**$47,740**	**$38,260**	**$10,560**	**$38,420**

Cumulative Effects

Road Surface Conditions

Deferred maintenance surveys indicate that the surfacing on many aggregate and cinder surfaced roads in the area is worn out or soon to become worn out. These surveys identify a need for additional or replacement surfacing on most cinder surfaced haul roads in the area. Reconstruction or heavy maintenance to replace surfacing may be needed if proposed activities concentrate haul volume onto localized segments of several roads in the project area. Roads 1210, 1220, 1230, 1232, and 1280 are projected to have over a million board feet hauled over each of them under the action alternatives.

Aggregate or cinder surfacing is usually placed on roads to protect the subgrade from wear and structural breakdown and the associated erosion, and provide a smoother running surface. The roads mentioned above are maintenance level 3 or less thus running surface smoothness is not a consideration. The structural strength (subgrade) of these roads is probably adequate to physically support the volumes for this project but adds to the accumulated wear over the number of projects which individually use them but economically cannot afford to add or replace surfacing. The erosion of worn out cinder (sand) is a concern. When there is enough rain, melting snow or thawing this sand ruts easily and channels water which can carry this worn out, light weight material to the roads edge if shaped and maintained correctly, or into ditches and drainages when not. Road conditions will continue to gradually deteriorate over time as other other administrative and recreation traffic, outside of this project, take their toll on road surfaces.

Action Alternatives 2, 3, and 4

Direct and Indirect Effects

Approximately 70 miles of existing roads would be closed or decommissioned under Alternatives 2, 3, and 4. Most of these roads, especially, the ones planned for decommissioning, are currently closed or otherwise undriveable. All of the roads proposed for decommissioning were rated as “low or moderate priority” for access under the B&B Roads Analysis.

Cumulative Effects

Approximately 257 miles of road would remain open as part of the long term management plan described in the B&B Roads Analysis.

Action Alternative 5

Direct and Indirect

Alternative 5 closes or decommissions a total of 77 miles of existing road. This includes an additional 7 miles to be closed or decommissioned to address wildlife concerns.

Cumulative Effects

Under alternative 5 approximately 255 miles of access would remain open as part of the long term management plan described in the B&B Roads Analysis.

3.9 Economic and Social Resources

Introduction

Under current Forest Service legislative guidelines, funding to help meet the purpose and need can primarily be found in the value of the trees killed or damaged by the fire. Additional economic value, over a longer time span, can be generated for local communities through tourism and forestry services. Jobs in these areas do help sustain local economies, but as this analysis shows, they are currently failing to provide high wage jobs prevalent less than a decade ago in two out of the three counties in Central Oregon.

"The importance of harvesting dead and dying trees, in a timely manner before it loses much more economic value, should be given a high priority in your alternative development."

"..we ask that the Forest Service seriously consider whether the project will provide any real economic benefit to local or regional economies."

These two quotes from the public scoping process echo the contrasting social attitudes of committed stakeholders to the restoration process. They also emphasize the importance of evaluating current economic and social conditions to help meet the purpose and need and evaluate the impact on the proposed salvage efforts on sustaining local communities.

Economic and social analysis of the activities proposed in the B&B Fire Recovery project focus on: 1.) the makeup of the communities surrounding the fire area in Central Oregon, 2.) a comparison of recent local work and unemployment data for both the local area and the state of Oregon as a whole, and 3.) a discussion of economic trends within the timber and tourism industries. As much as possible recent data sources have been used to update dated census data.

Due to economic changes in the past five years, much of the discussion about the current timber economy in Central Oregon is driven by the regional impact on the Oregon economy by recent salvage sales on the Davis Fire in spanning the border between Deschutes and Klamath Counties. Logs from the sale were trucked to mills in Gilchrist, Warm Springs, John Day and Prairie City. Logging operators participating in the salvage efforts came from Crescent, Gilchrist, La Pine, , Ashland, Medford, White City, Crescent and the Bend, Redmond , John Day and Prairie City areas. The Forest Service expects similar geographic distribution of reforestation, thinning contractors as the sale area is replanted and later thinned.

Environmental justice was another concern identified in comments, such as this one, during the scoping process:

"The EIS should disclose what efforts were taken to ensure effective public participation. In addition, if low income or people of color communities will be impacted by the proposed project, the EIS should disclose what efforts were taken to meet environmental justice requirements."

The report concludes with a discussion of the social factors tied to land and forest management in Central Oregon that affects the communities surrounding the B&B Fire Complex. These include the region's rural setting and its history of farming, forestry and ranching; the manner in which the local population utilizes resources for recreation; the collection of fuelwood, fish and game for sport; and the effect of an increasing and changing population on the region's job market and economy. Special emphasis is given to communities immediately surrounding the fire area: Sisters, Camp Sherman and Black Butte.

Economic and Social Analysis of Existing Conditions

Demographics

Three Central Oregon counties, Jefferson, Crook, and Deschutes are directly considered in this demographic analysis. The B&B project area is primarily located within Deschutes and Jefferson Counties, but, as noted earlier, the primary mills that may receive the timber from this salvage effort and the workforce that could play a role in both the salvage and restoration efforts could very well span both sides of the Cascade Range and extend into the Prairie City/John Day area.

The total population for the tri county area of Central Oregon through 2003 totaled approximately 170,700. Populations and change for the region and by each individual county are displayed in Table 3.63.

Table 3.63. Central Oregon Population Growth

	Population 1990	**Population 2003**	**Change**	**Percent**
Central Oregon (all)	**102,745**	**170,700**	**67,955**	**66%**
Jefferson	**13,676**	**19,900**	**6,224**	**45%**
Deschutes	**74,958**	**130,500**	**55,542**	**74%**
Crook	**14,111**	**20,300**	**6,189**	**44%**

Sources: 2004 Economic Development Report for Central Oregon

The major population centers within Central Oregon are: Prineville (8,500), Bend (62,900), Redmond (17,450), Madras (5,370), La Pine (6,000) and Sisters (1,430).

Future population projections are expected to exceed that of the past decade. Deschutes, Crook, and Jefferson Counties are expected to continue with aggressive population growth with an average 61% increase in population by 2025.

This population growth creates other impacts as well, ranging from increasing the risk of fire to structures adjacent to wildland forests to the ability of forest managers to effectively manage forest lands. Structure counts per square mile in the Bend area (Deschutes County) showed a 456% increase from 1975 to 2001 with the greatest increase occurring from 1975 to 1986.

Unfortunately, research shows that an increase in the population that drives this increase in the number of structures does not necessarily lead to better management of wildland forest lands. Research published by Dr. Wear in 1999 found that "…the probability of forest management approaches zero at about 150 people per square mile (psm). At 70 psm there is a 25 percent chance of commercial forestry. At about 45 psm the odds are 50:50 that commercial forestry will be practiced…" This does not bode well for communities adjacent to the B&B Fire Complex. According to the 2001 census, the population between 1975 and 2001 has risen from less than 20 people psm to 60 people psm in the Metolious Basin, Black Butte and Sisters area.

As with the Nation and Oregon as a whole, the population in the Central Oregon area is becoming both older and more diverse. But there are major differences within the area. For instance, population in the major cities, Bend, Redmond, Prineville, Madras, has lower medium ages than Oregon as a whole. The medium population age in Prineville, Madras, and Redmond age has actually decreased steadily since 1990. In contrast more rural unincorporated areas such as Sisters, are much older than the National or Oregon average and tend to be more retiree-heavy.

Although racial diversity is increasing, particularly with the arrival of new Hispanic immigrants, Central Oregon, with the notable exception of Jefferson County that has historically had a large Native American population, is less racially diverse than Oregon or the nation as a whole. According to the 2000 census, Crook is 93% white with the Hispanic population increasing 179% since the 1990 census, Deschutes is 95% white with the Hispanic population increasing 182% and Jefferson is 69% white with the Hispanic population increasing 133%.

The high school education attainment level in Central Oregon as a whole echoes Oregon's average of 53%. The percentage of population having graduated from high school ranges from lows of 44% in Jefferson County to a high of 56% in Deschutes County. Crook County is in the middle with 47%.

Employment

The increase in the population is also echoed in an increase in employment. According to the 2000 Census, estimated civilian labor force in Crook County is 7,525, up 12% since the 1990 census, Jefferson County, 8,570, up 31% since the 1990 census, and Deschutes County, 57,614, up 40 % since the 1990. In contrast, employment in the labor force in Oregon as a whole increased an average of 18% over the same period of time.

In Crook County the three largest sectors of the economy were wholesale trade with 1,640 jobs, lumber and wood products with 1510 jobs, and government with 1,180jobs. In Deschutes County the three largest sectors were Finance/Insurance/Real Estate with 14,170 jobs, trade with13,080 jobs, and government with 6,900 jobs. In Jefferson County the three largest sectors were government with 2,460 jobs, trade with 1250 jobs, and lumber and wood products with 1,150 jobs. It is noteworthy that wood products ranked third in both Crook and Jefferson counties, showing that, in 2000, they still played a major role in the regional economies.

A recovering national economy, population growth and increased economic activity has also been good for Central Oregon. In October 2004 unemployment rates in Crook County were 7.6, down from 8.7 percent in 2003; Deschutes was a low of 5.7 in 2004, down from 6.4 percent in 2003 and Jefferson's was 5.5%, down from 5.8% in 2003. In contrast, Oregon's seasonally adjusted rate was 7.2% in 2004, down from 7.9% in 2003.

The economies of Deschutes and Jefferson are the most robust in the zone. In Deschutes County, although there has been an increase in the number of jobs created, the huge increase in the labor force (up 74% between 1990 and 2000) has balanced out much of this success, at least in terms of the unemployment rate. But, due to their economic diversity, both counties' economies are expected to maintain their health. This is partially due to a diversification in the wood products industry where specialized woodworking shops focused on new home construction are playing a larger role in the industry as primary milling industries have declined. The downturn in the primary lumber industry, driven by a lack of consistent forest supplies, automation and a changing global economy, has impacted local forest workers, whose incomes have declined because of steep competition for fewer job opportunities.

On the other hand, in Crook County with its overall low economic diversity, dominated by either one manufacturing sector industry (lumber and wood products) or limited trade sectors company (Les Schwab), have had their economies lag behind Oregon's as a whole. Future projections call for continued slow growth and diversification in Crook county.

Per capita personal income in 1999, as reported by the U.S. Department of Commerce, Bureau of Economic Analysis by county were as follows: Jefferson, $18,808, Crook, $21,168 and Deschutes,

$26,077. Although the per capita income in the area is traditionally lower than Oregon's as a whole ($26,958), there has been a widening of the gap mainly due to the loss of relatively high paying jobs in the lumber and wood products industries.

The forest sector has also traditionally provided relatively high average wage level jobs. The statewide average wage in Oregon is $34,400 compared to a much higher average of $40,600 for the forestry sector as a whole. Primary products jobs annually average $49,800 or 45% above the average wage for all Oregonians. Secondary products, representing localized niches for manufacturing such as mill work, averages $37,000 annually. In contrast forestry services average a relatively low wage of $32,600 a year.

Overall, because of improved milling technology and decreased supplies of raw materials from federal lands we are seeing a gradual erosion of earning power of forestry sector employees. This is especially true in Central Oregon where in Deschutes County 84% of the land base is dominated by BLM and Forest Service managed lands.

Table 3.64, although dated, reflects average annual wages in various industries in Oregon. Primary and secondary products fall under lumber and wood products while forestry services fall under Agriculture, Forest and Fish.

Table 3.65. Average Annual Wages in Central Oregon 1990 – 1999 *

Industry	1990	1999	Change	Percent Change
All Industries	$25,152	$25,516	$363	1.4%
Private Coverage	$24,089	$24,617	$527	2.2%
Agriculture, Forest and Fish	$19,630	$17,983	($1,647)	-8.4%
Construction and Mining	$29,156	$28,532	($625)	-2.1%
Manufacturing	$30,633	$30,807	174	0.6%
Lumber and Wood Products	$31,251	$31,811	560	1.8%
Other Manufacturing	$29,028	$29,547	520	1.8%
Trans,, Comm., and Utilities	$33,963	$35.231	$1,267	3.7%
Wholesale and Retail Trade	$18,510	$19,415	$905	4.9%
Finance, Insurance and Real Estate	$26,286	$28,468	$2,181	8.3%
Services	$21,493	$23,264	$1,771	8.2%
Government	$30,760	$30,485	($274)	-0/9%

Sources: Oregon Covered Employment & Payrolls by County and Industry
Oregon Employment Department; US Bureau of labor Statistics

Over all the change from primarily a timber based economy a decade ago to a more diverse economy, with tourism as one of its main economic engines, has affected wage rates in Central Oregon. Average annual wage rates in Central Oregon are significantly lower than the $37,000 for the nation as a whole or $34,400 for the State of Oregon in 2002.

According to the 2000 census, Deschutes County has seen a slight increase in their annual wage rate between 1990 and 2000 from $25,707 to $27,859, but both Crook and Jefferson counties have seen their average wage rate plummet. Crook County has seen a drop from $28,377 to $27,596 and Jefferson County has seen a drop from $28,987 to $25,501 between 1990 and 2000. On the plus side, recent research by the Oregon Employment Department shows that low wage jobs in Oregon recovered far faster than high wage jobs after the 2001 recession thus helping explain how employment rates in Deschutes County is higher than Oregon as a whole.

Deschutes County's per capita income, which is the highest in the area, is attributable to a number of factors. The first being that although Deschutes County also lost significant jobs in the wood products industry they have been replaced by other relatively high-paying finance and real estate related jobs. In addition, the increase of high-paying "high" tech jobs and an influx of wealthy new comers have bolstered all income measures (per capita, total personal income, and medium family income) as compared to the other counties.

Another way to look at the health of local economies is to examine unemployment, medium household income (which usually involves more than one wage earner versus per capita income that addresses only one) and the poverty rate in Central Oregon compared to the State of Oregon at large. The most recent statistics on this come from the USDA Economic Research Service and are shown in Table 3.65 and 3.66.

Table 3.65 – Percent Unemployed 1997-2003 and Medium Household Income 2003

Location	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Medium Household Income 2003**	**% of State Medium Income**
Crook	10.1	9.7	8.9	8.4	9.7	10.4	10.8	$34,583	82.7%
Deschutes	8.0	7.2	6.4	5.3	6.4	7.7	7.7	$42,860	102.5%
Jefferson	6.7	6.7	6.5	5.7	7.9	7.6	7.4	$35,218	84.3%
Oregon	5.8	5.6	5.7	4.9	6.3	7.5	8.2	$41,789	100%

Table 3.66 - The Poverty Rate 2002

Location	**% of total population**	**% Children**
Crook County	12.4	16.0
Deschutes County	10.0	13.8
Jefferson County	14.5	20.2
Rural Oregon as a whole	11.3	15.1

These figures reflect the relative weakness of the less diverse economies in Crook and Jefferson Counties in comparison to Deschutes County, where significant population growth is helping residents of the county do better economically than the Oregon average. Medium Household income in Deschutes County is higher than the state average while its unemployment rate and poverty rates for both children and adults is lower.

Jefferson County's medium household income is a little over two fifths the state's average, but the county has more adults and significantly more children in poverty than comparable rural counties. On the plus side, Jefferson County also is maintaining an unemployment rate lower than the state average.

Crook County has a medium household income slightly less than Jefferson County while their unemployment is two points above the state average and their poverty rates is only slightly higher than the state average for rural counties. .

The Timber Economy:

In Oregon as a whole the forest sector directly accounts for 4% of the employment or over 85,000 direct jobs, nearly 5% of the wage income and over 6% of the total economic output value of the state. Primary forest products represent the single largest share of total output value, wages income and employment-followed by forestry services and then secondary products (Table 3.67).

Table 3.67 - Oregon Forest Sector Economic Impact Summary (2000)

Forest Sector Grouping	Output*	Wage Income	Jobs
Primary Products	$7.162	$1.756	35,300
Secondary Products	$2,331	$0.635	17,200
Forestry Services	$3.148	$1.078	33,100
Forest Sector Direct	$12.641	$3.469	33,100
Forest Sector w/Indirect	$22.373	$7.646	85,600
All Economic Sectors	$200.765	$73.430	2,133,500

*Note: In billions of dollars
Source: IMPLAN as adjusted by E. D. Hovee&Company. Estimates are preliminary and subject to revision. Numbers may not add precisely due to rounding.

When economic multiplier effects are considered, more than 190,000 jobs are directly and indirectly affected by Oregon's forest sector-9% of Oregon's economy. Multipliers reflect the additional spending and jobs created as companies and public agencies in core forest sector activities and their employees make second and subsequent round expenditures for goods and services throughout Oregon. The average job multiplier is 1.75 for all Oregon forest sectors, ranging from a high of 2.81 for primary products to a low of 1.64 for forest services. With this multiplier effect total output supported directly or indirectly by Oregon's forest sector increases to 11% of the output value contributed by all sectors of the state's economy.

Although the decade from 1990 to 2000 saw a 10% decrease in total forest sector employment in Oregon (with a loss of approximately 9,600 jobs statewide), the industry is still an important contributor to the local economies of Central Oregon. Also, as jobs in the primary and secondary forest product sectors have declined, there has been a reported employment growth in firefighting, ecological restoration and other contract services that fall within the forestry services sector.

Forest sector employment has far more impact in Central Oregon than for the State of Oregon as a whole. Wood products manufacturing is still the single largest industrial employer in Jefferson County and the second largest industries in both Crook County. In Deschutes County, according to a report in 2003 by the Oregon Employment Department, 1,920 people were employed in wood products manufacturing. This places it a distant third behind tourism (7,652 jobs) and Health and Social Assistance (5,908 jobs), but these jobs do represent the seventh highest average paying jobs in the county and 9.7 per cent of primary industrial jobs, a far higher average than for Oregon as a whole. .

Crook and Jefferson Counties, with smaller populations and a less diversified economic base, are much more dependent on the timber industry. In Crook County, 1,084 people were employed in wood products manufacturing in 2003 placing it second behind Distribution and Warehousing (Les Schwab). This accounts for 28 percent of all primary industrial employment in the county, and represents the third highest paying jobs in the county. In Jefferson County, 1,264 people were employed in wood products manufacturing in 2003. This accounts for a significant 47 percent of primary industrial employment in the county while also representing the third highest paying jobs in the county.

The timber manufacturing industry is the overall leading private sector employer in Central Oregon with the Bright Wood Corporation leading the list as the second largest employer (after St Charles Hospital) with 1,140 employees working in all three counties. Clear Pine Moldings, Inc in Prineville follows as the ninth largest employer with 525 employees. Other examples include American Pine Products in Prineville with 365 employees, Bend Millwork/Jeld-Wen of Bend with 220 employees and concluding with Warm Springs Forest Products with 128 employees, making it the 44th largest industry in Central Oregon and the largest private employer in Jefferson County.

Special Forest Products

A subset of the forestry services sector includes special forest products. Special forest products include such diverse harvesting activities as decorative florals and grasses, green bows, cones, mushroom, and huckleberry. Each is especially attractive to specific cultural groups, ranging from Native Americans to Southeast Asians.

Morels, a spring mushroom, often appear after soil disturbing activities and fires. Morels proved to be a temporary boom for the local communities in the spring of 2004 after the B&B Complex Fire. Over 3,000 free use mushroom permits were issued this year (up from 1,200 in 2003) for the Sisters Ranger District this past spring.

Within the past decade special forest products, specifically mushroom harvests, have also played a role in the economies of these communities. Harvesters have traditionally consisted Southeast Asian extended family groups, who migrate to the area from homes in the Sacramento valley. They traditionally camp each spring and fall in the local area, following the mushroom harvest through the Pacific Northwest.

This spring, for the first time in Central Oregon, large Hispanic crews from the Willamette Valley joined Southeast Asians in harvesting mushrooms in the B&B Complex Fire area. They were apparently hired by commercial mushroom harvesters when prices were relatively high. Wholesale mushroom prices collapsed this fall resulting in a dramatic decline in commercial harvest activity on the Sisters Ranger District..

In 2003 Matsutake mushroom permit sales from the Fremont-Winema, Deschutes, Umpqua and Willamette National Forests totaled $144,050 for 1,527 permits. This was significantly lower than the 1997 season when permit sales topped $365,000 for almost twice as many permittees.

Coordinated Resource Offering Protocol (CROP)

In order to help reduce the risk of wildfire and create a sustainable supply of biomass to accelerate the development of emerging and efficient energy projects in the Central Oregon corridor, local environmental groups, natural resource agencies and business leaders signed a Memorandum of Understanding called the Coordinated Resource Offering Protocol or CROP on January 20, 2005. The sustainable energy sectors show great promise to develop family-wage, meaningful employment in rural communities, as shown by the recent development of wind farms and their positive impacts in the communities of Fossil and Condon immediately to the east.

Driven by the Business Alliance for Sustainable Energy (BASE), CROP is designed to guarantee an annual amount of biomass from public and private timber lands in Central Oregon. This would include both the thinning of small diameter timber from existing forests and, after major wildfires, the salvaging of hazardous fuels from burned stands to create fire resistant ecosystems to help reduce the hazard of wildfire in local communities. The CROP agreement provides an opportunity for local timber manufacturers, like the mill at Warm Springs, to develop a business plan that they can the use to identify potential investors to help construct a local biomass energy plant. This plant will help reduce the costs of small diameter fuel treatments and post fire salvage activities on public and private lands throughout Central Oregon thus speeding up our ability to recreate the healthy forests and fire resistant communities that dominated this landscape a century ago.

The Tourism Economy

The Oregon State Tourism Commission reported that tourism is Oregon's 4th largest revenue source, generating $6.2 billion in business in 2002, $1.7 billion in earnings and providing 90,200 Oregonians with jobs.

In 2002 the Oregon Tourism Commission published a report* which estimates the total travel related spending and estimated employments from these expenditures in industries supporting recreation and tourism. For Central Oregon these are:

- In Crook County, at the low end, $25.3 million in travel related spending supported 520 people represents 7.6 percent of all wage and salary employment in the county.
- In Jefferson County, $54.2 million in travel related spending provided work for 1,070 people in the recreation and tourism industry, representing as significant 13.9 percent of all wage and salary employment in the county.
- In Deschutes County, in the middle as far as the percentage of tourism workers employed when compared to all the industries within the county. Even so, it far exceeds the other two counties in overall employment and spending numbers in tourism. $366.1 million in travel related expenses supported 5480 people, representing 7.1 per cent of salary employment.

*Employment and income statistical references do not specifically track recreation and tourism as a sector. Instead recreation and tourism contributes to several sectors, transportation, services (accommodations, eating and drinking, recreation), retail trade, and even government.

It is interesting to note that the Oregon Employment Department only tracks services related to tourism. Their data for 2003 differs from the 2002 Oregon Tourism report, but still underlines how important the tourism industry is for local communities in Central Oregon.

- In Crook County 425 people worked in the service industry, which represents 10.9% of primary private industrial employment in the county
- In Jefferson County 556 people worked in the service industry. This represents 19.2 per cent of primary private industrial employment in the county.
- In Deschutes County 7,652 individuals worked in the service industry. This represents a significant 38.8 percent of primary private industrial employment in the county.

Because of the seasonal nature of the tourism in Oregon, wages in the Oregon service industry are significantly lower than in other sectors of the economy, with an average income of $23,264 per year in 2002 (compared to an average income of $34,400 for the state as a whole or $40,600 in the timber sector). In Maine, where extensive research has focused on the tourism industry because it is the single largest employer in the state, one third of all tourism workers did not receive a livable wage which they defined as the minimum income needed for basic food, shelter, health care and other necessities for a family of two.

Social

Surrounding physical and biological environments influences human social life. This is most evident in rural areas where the variety and quality of available natural resources often determines the chief means of economic livelihood and what leisure activities people are likely to pursue and, therefore, influence local preferences for the use of public lands. From a historical prospectus it is evident that all of the local community's cultures were natural resource based and to a certain degree, especially in the more rural less populated areas, still are. Livestock, agriculture and timber were the backbone of the economic structure and as a result strongly shaped the social fabric that still defines the communities today. Since much of the surrounding land is administered by federal agencies, chiefly the Ochoco, Deschutes, and Willamette National Forests and the Prineville District of the BLM, changes in federal land use policies can impact the socioeconomic and socio-cultural way of life.

One needs to keep in mind that the various communities, and the individuals within them, contain a broad spectrum of perceptions and values related to the use of resources and access on the surrounding national forests. These same communities and individuals also have interests that span multiple geographic and political scales simultaneously.

The following descriptions portray communities only in the very most simplistic terms and do not capture the full community richness. Many of the communities (rural industrial, as defined in the Deschutes NF Forest Plan) within Central Oregon, such as Sisters and Camp Sherman, are closely tied to the Forests in work, subsistence, and play, and are directly affected by what happens on the Forests.

The relationship between the National Forests and these communities is based on trees which are used for harvesting and manufacturing businesses; catering to recreationalists and tourists drawn to the area by its scenic values: use of fuelwood, fish, special forest products and game for subsistence and/or recreational activities; and outdoor recreation as an important component of the life styles of the people living in these communities.

Bend (Central Oregon Urban Center, as defined in the Deschutes NF Forest Plan), is the dominant community in the zone. It has a large industrial sector with wood products playing a major role, and a large service sector based on recreation and tourism. In addition its' financial, real estate sectors, and economy as whole has increased substantially as people have moved into the area because of the amenities the surrounding area provides, much of which is associated with the national forests. It is also the major shopping and service center for most of the communities within the area. Because of its population size and density, and economic and social diversity, the health of the wood products and service sectors of the economy, along with environmental and amenity values, play an important role in defining what is important to the Bend community.

Communities such as Prineville, Redmond, and Madras from a historically perspective, better fit the "rural industrial" community described above. But with their exploding populations and diversifying economies, they are developing a more diverse set of interests more along the lines of Bend's. With the recent weakening of the economy, it is clear that these communities are still very much tied to the woods product industries both economically and culturally.

Other communities within the area (e.g. Culver/ Paulina) can generally be defined as ranching or farming communities. These communities are closely tied to the Forests in work, subsistence, and play, and are directly affected by what happens on the Forests. These communities are linked more economically because of the need for summer forage for livestock, not timber, and to provide services for recreation and tourists. . These communities generally have few manufacturing based industries and have small, undiversified economies. Like "rural industrial communities", the people who reside in these communities also use fuelwood, fish, and game for part of their subsistence and/or recreational activities.

Communities, such Camp Sherman, Black Butte and Sisters, are defined by their recreation opportunities and recreation residences (rural recreation and residential, as defined in the Deschutes NF Forest Plan). Environmental and scenic amenities and nearby recreational opportunities play a major role for their existence. Local service-oriented businesses are a major economic driver in these communities. These communities don't typically depend on extraction-based activities, instead scenic amenities, and recreation opportunities have more influence, both economically and socially on these communities.

The community of Sisters had an estimated population of 1,430 (2004 Economic Development Report for Central Oregon) in 2003 while the "greater Sisters area has over 8000 people (The Nugget, Sisters Oregon Guide, 1999.) The economic base of Sisters is centered on tourism and recreation along with some light industrial activity. Sisters is known as the summer playground for people from "the valley," that is, the Willamette Valley to the west. Summer homes are prevalent in the outlying communities like Black Butte Ranch and Camp Sherman.

Recreation values have helped drive up the price of housing throughout Central Oregon in the past decade, but this is especially true in Sisters. Sisters now ranks second only after Sunriver for the average price of a home in Central Oregon. In 2003 an average home in Sisters costs $363,488 compared to an average price of a home in Central Oregon of $201,763. In dramatic contrast a home in Madras in Jefferson County cost $98,239.

The one over-riding demographic trend in the area is that of rapid population increase through in-migration. With the general gentrification that is occurring through the area with an influx of retirees, many of whom are well to do, plus the addition of professionals to serve this population, the result is rapid economic and social change.

This gentrification is clearly occurring in the Sisters, Black Butte and Camp Sherman areas, three communities closest to the B&B Complex Fire. Camp Sherman consisted primarily of small parcels and/or Forest Service leased summer homes in the 1970s before land use laws temporarily took hold. According to local residents, it used to be that the majority of landowners were absentee and used their retreat cabins for summer vacations. Many of these residences are now occupied year round catering to semi-retired residents or individuals who commute to Sisters, Redmond and Bend for employment opportunities.

Communication in the Camp Sherman, Black Butte and Sisters communities is excellent. This is because there is a local media outlet (the Source), education levels are quite high and organizations, ranging from the Friends of the Metolious to the Black Butte Homeowners Association, keep local residents apprised of issues that affect their communities. In addition informal communication is effective and relied upon. Local stores, community halls, and restaurants are gathering places, as are the schools. Many people use e-mail. .

Effective community leadership has been emerging in recent years, in part because of the population shift from absentee to full-time residents. Sisters is an excellent example, with a number of community groups functioning to improve local conditions. Among the most important are CATS, SOAR and Habitat for Humanity. The Citizen Action Team was fostered by the Forest Service and credited for new leadership in the community and working through the polarized conflicts that stymied community development a few years ago. Community Action Teams (CATS) organized a community process for discussion, debate and strategic planning that clearly lays out future direction for the community. SOAR is the Sisters Organization for Activities and Recreation, which became a taxing district in 1999. It focuses on outdoor youth activities, before and after school programs and developing youth activity centers.

In a study entitled Citizen Tours of the B&B Complex Fire by Dr. Bruce Schindler and Christine Olsen from Oregon State University, only 20% of locals were greatly concerned about the economic loss of timber versus 62% of non local attendees. In this same questionnaire, filled out by 94% of 125 attendees who spent a full day touring the B&B fire on six bus tours hosted between October 2003 and October 2005, 80% of locals were confident that the Forest Service will incorporate citizen concerns into future plans versus only 66% of non locals who agreed with that statement. Studies like this reflect the increased gentrification of the Camp Sherman, Black Butte Ranch and Sisters communities and their generally positive relationship with adjacent federal land managers.

Changing attitudes, beliefs and values are summarized in quotes like these from the Sisters community are found in a report by Kevin Preister entitled “Preparing for Change in the High Desert of Central Oregon: Using Human Geographic Boundaries to Create Partnerships.”

“*The gap between low and high income in Sisters is widening.”*

“We need more diversity in the economy. Tourism is seasonal. People have to put money away for the winter. We need jobs that are not tourist jobs.”

Project Economics

Economic considerations of the alternatives include the recovery of economic value, which is analyzed as the value of the standing timber or net sale value, and economic efficiency (net return to federal government), which includes all inputs including Forest Service costs. This analysis uses recent available estimates of log prices, logging costs, and volumes of timber output. Log prices and logging costs are based on recent (2004/2005) appraisals of timber sales from the Eyerly Fire Salvage Project. Timber volume estimates were derived from field visits to the proposed units in conjunction with stand exam information taken prior to the fire. **Since there is uncertainty in any analysis of this type, the results are best used to compare the alternatives, and not to assign an absolute dollar value or cost to any given alternative.**

Reforestation is not considered in the analysis of net sale value or net return to federal government, because the salvage of the timber killed by the B and B Fire is not what created the need for reforestation- the fire created the need for reforestation. Planting of trees and associated activities could occur to some degree regardless of whether or not any salvage occurs; however, net revenues generated by the sale of this timber would provide a potential source of funding for reforestation (KV receipts), albeit not the only source of funding. Hazardous fuels treatments such as machine piling, which deal with the natural fuels created by the fire, are also not considered in the analysis of net sale value and net return to the federal government. Slash disposal costs, i.e. costs of treating fuels associated directly with logging activities, are the only fuels treatment costs considered. However, reforestation costs and hazardous fuels treatment costs are considered at the end of this section in order to show cost associated with the actions outlined in this EIS. Funding for these treatments will be from KV funds and appropriated funds, as they become available.

A summary of all costs associated with this project is included below under *Summary of Treatment Costs and Potential Funding.*

Recovery of Economic Value: The salvage harvest units under alternatives 2 through 5 have measurable economic recovery potential in terms of the volume of raw materials that could be salvaged. The biomass product units have some potential for economic recovery, but it is very limited. Posts, poles, firewood, and house logs could potentially be harvested from these units if there is interest from buyers of these products at the time they would become available. In both of these types of units, economic recovery is very time-dependent- the smaller the diameter of the trees to be salvaged, the less time the trees will have value. Most of the trees less than 16 in. dbh will have deteriorated to the point where they will have little or no economic value at the time an action alternative can be implemented (estimated Summer 2005). The remainder of the trees should retain at least some value up to two years from the date they were killed, with Douglas-fir and larch retaining the most value, followed by ponderosa pine and lastly, white fir.

The action alternatives are compared in terms of their net value (i.e. the price of the logs delivered at the mill minus the logging and transportation costs of moving the logs to the mill). Alternative 2 would harvest the most volume of the alternatives, and has the highest net value. Alternative 3 would yield about 47 percent of the salvage volume and about 26 percent of the net sale value of Alternative 2. Alternative 5 yields a similar volume as Alternative 3, but the net sale value is less than 10 percent of Alternative 2 due to the small diameters of the trees harvested (less than 20 in. dbh). Alternative 4, which has salvage harvest only in the matrix allocation, yields the least volume of the action alternatives, but has a higher net sale value than alternatives 3 and 5 (*See Table 3.68*).

Table 3.68. Comparison of Raw Material Recovery and Net Sale Value of the Alternatives

Alternative	Acres	Volume (mbf)	Stumpage (Net Sale Value)
1	0	0	0
2	6803	29,699	$3,185,509
3	3762	14,031	$827,829
4	1725	7496	$965,094
5	4633	13,317	$209,682

The differences in net sale value are due to the predicted differences in logging costs and delivered log prices among the alternatives, which in turn are due mainly to the amount of wildlife tree retention called for in the alternative. Higher wildlife tree retention equates to lower delivered log prices and higher logging costs (lower volumes per acre and less valuable species harvested). See *Table 3.69* for a comparison of expected logging costs and log prices by alternative.

Table 3.69. Comparison of Logging and Transportation Costs and Log Prices by Alternative

Alternative	Weighted Average Logging Cost ($/mbf)	Weighted Average Log Prices ($/mbf)
1	-	-
2	$218	$325
3	$217	$275
4	$197	$325
5	$230	$250
Note: Weighted average logging costs were weighted by the number of acres of ground-based, modified ground-based, and helicopter logging in the alternative. Weighted average log prices were weighted by the percentage of species from stand exams.		

<u>*Logging Costs*</u>**:** The logging costs shown in *Tables 3.70, 3.71, 3.72, and 3.73* were developed in consultation with local Forest Service timber appraisers and the regional logging engineer (Toupin, Dunaway, Longbom, Glover personal comm.), are based on recent appraisals of fire salvage from the Eyerly Fire of 2002 and Hash Rock Fire of 2000 and consider the following logging systems:

Ground-Based: A system consisting of track-mounted knuckle-boom (16 ft. reach) feller-bunchers for cutting and pre-bunching trees, and rubber-tired grapple skidders for skidding trees to landings located on system roads or temporary roads where they are processed into logs and loaded on trucks.

Ground-Based-Modified: Same as above, except trees would be hand-felled and pulled to skid trails with a cable winch. This eliminates the soil disturbance from the feller-buncher machines, although there may be some soil gouging from dragging logs to the skid trails with the winch. Costs for this system are expected to be about 15 percent higher than the standard ground-based.

Ground-based systems would be used on slopes ranging from 0-30 percent, with the allowance for occasional steeper pitches.

Skyline Yarding: Skyline yarding was considered in this EIS for slopes greater than 30 percent with existing road access, or where temporary roads would allow access. This method was not prescribed for any units, because of the concerns over safety with the desired wildlife tree retention strategies in the action alternatives. It was felt that helicopter yarding would allow more flexibility in meeting the retention levels while allowing for worker safety.

Helicopter: Helicopters would be used to yard logs on slopes generally greater than 30 percent, or where road access does not exist and temporary road construction was not deemed feasible or cost-effective.

Table 3.74 lists the logging systems employed in the action alternatives.

Table 3.74- Logging Systems

Logging System	Acres	Total Vol. (mbf)
Alt. 2		
Ground-based	5638	23,435
Ground-based Modified*	210	859
Helicopter	955	5405
Total	**6803**	**29,699**
Alt. 3		
Ground-based	3762	14,031
Total	**3762**	**14,031**
Alt. 4		
Ground-based	1694	7370
Ground-based Modified*	31	126
Total	**1725**	**7496**
Alt. 5		
Ground-based	4633	13,317
Total	**4633**	**13,317**

*Trees would be hand-felled, and logs winched to designated skid trails

Cost assumptions common to all action alternatives are as follows:

- Timber would be hauled approximately 75 miles to Springfield, Oregon at the rate of $60 per mbf.
- Average yarding distance for ground-based whole-tree yarding would be 600 feet.
- Average yarding distance for helicopter yarding would be 1500 feet.

Cost assumptions specific to Alternatives 3 and 5 are as follows:

- Stump-to-truck costs were increased by 20 percent in Alternative 3 and 35 percent in Alternative 5 to reflect the lower per acre volumes removed as a result of increased retention of wildlife trees.

Table 3.70. Expected Logging Costs of Alternative 2 ($/mbf)

System	Acres	Vol. (mbf)	Stump-Truck	Haul	Road Maint.	Slash Disposal	Misc.*	Total($/mbf)
Ground-based	**5638**	**23,435**	$110	$60	$7	$4	$10	**$191**
Ground-based-modified	**210**	**859**	$125	$60	$7	$4	$10	**$206**
Helicopter	**955**	**5405**	$250	$60	$7	$3	$15	**$335**
Total/Wt. Average	**6803**	**29,699**	**$136**	**$60**	**$7**	**$4**	**$11**	**$218**

*Miscellaneous costs- Temp. road construction and post-sale reclamation, soil rehabilitation (subsoiling), and environmental protection costs

Table 3.71. Expected Logging Costs of Alternative 3 ($/mbf)

System	Acres	Vol. (mbf)	Stump-Truck	Haul	Road Maint.	Slash Disposal	Misc.*	Total($/mbf)
Ground-based	**3762**	**14,031**	$130	$60	$12	$4	$10	**$216**

*Miscellaneous costs- Temp. road construction and post-sale reclamation, soil rehabilitation (subsoiling), and environmental protection costs

Table 3.72. Expected Logging Costs of Alternative 4 ($/mbf)

System	Acres	Vol. (mbf)	Stump-Truck	Haul	Road Maint.	Slash Disposal	Misc.*	Total($/mbf)
Ground-based	**1694**	**7370**	$110	$60	$12	$4	$10	**$196**
Ground-based-modified	**31**	**126**	$125	$60	$12	$4	$10	**$211**
Total/Wt. Average	**1725**	**7496**	**$110**	**$60**	**$12**	**$4**	**$10**	**$196**

*Miscellaneous costs- Temp. road construction and post-sale reclamation, soil rehabilitation (subsoiling), and environmental protection costs

Table 3.73. Expected Logging Costs of Alternative 5 ($/mbf)

System	Acres	Vol. (mbf)	Stump-Truck	Haul	Road Maint.	Slash Disposal	Misc.*	Total($/mbf)
Ground-based	**4633**	**13,317**	$150	$60	$9	$5	$10	**$234**

*Miscellaneous costs- Temp. road construction and post-sale reclamation, soil rehabilitation (subsoiling), and environmental protection costs

Net Value of Timber: The timber species harvested under the action alternatives would be primarily Douglas-fir, ponderosa pine and white fir. Incense-cedar, western larch, and other minor species are present, but account for only about 10 percent of the volume. Diameters of trees harvested would generally range from 16-32 inches for Douglas-fir and ponderosa pine, and 16-24 inches for white fir, although trees larger than this that are in excess of snag requirements would also be available for removal, except in Alternative 5. Pond values (value of logs delivered at the mill) for these species were established by contacting local mills and asking what they are paying for this material. This was cross-checked by reducing the Oregon Dept. of Forestry (ODF) pond values (*Tables 3.75* and *3.76*) by 40 percent for ponderosa pine, 20 percent for Douglas-fir, 30 percent for white fir, and 20 percent for incense-cedar to account for staining and other quality degradations due to natural decay processes after fire.

Table 3.75. Pond Values for Green Timber

Pond Values ($/mmbf) ODF, 2nd Quarter 2004, Klamath Unit			
Species	**8-14 in.**	**14-22 in.**	**22 in.+**
PP	$315	$525	$620
DF	$500	$510	$510
WF	$325	$330	$330
IC	$600	$600	$600
Note: Diameters are measured as diameter inside bark (dib).			

Table 3.76. Pond Values for Fire-Killed Timber: Adjusted for Degrade (Stain, etc.)

Pond Values ($/mmbf) ODF, 2nd Quarter 2004, Klamath Unit			
Species	**8-14 in.**	**14-22 in.**	**22 in.+**
PP	$189	$315	$372
DF	$400	$408	$408
WF	$220	$230	$230
IC	$480	$480	$480
Note: Diameters are measured as diameter inside bark (dib).			

Based on this information and the estimated mix of species and diameters, an average pond value, or delivered log price, was established for each species for Alternative 2, the Proposed Action (*see Table 3.77*). These values were used as a basis for comparing the alternatives.

Table 3.77. Average Pond Values of Fire-Killed Timber for Alternative 2 (Proposed Action)

Species	Value/mbf	Percent of Harvest*
Ponderosa Pine	$292	24%
Douglas-fir	$405	32%
White Fir	$227	33%
Other	$450	11%
Weighted Average	**$325**	**100%**
Note: Weighted average value based on percentage of species in units from stand exams. *As estimated from stand exams.		

To account for the higher amounts of wildlife tree retention in Alternatives 3 and 5, the pond values for Alternative 2 were adjusted downward by 15 and 30 percent, respectively, to reflect the increased wildlife tree retention of these alternatives. Reasons for the magnitude of these reductions in value are the following:

- **Lower value white fir would become the predominant species harvested**
- Smaller diameter ponderosa pine has lower selling values due to a higher proportion of blue-stained wood
- Smaller diameter Douglas-fir has a lower value due to the increased proportion of sapwood which carries the higher risk of decay and turning to an off-color appearance

Stumpage values of the action alternatives (residual value of standing timber after subtracting logging, hauling, slash disposal, road maintenance, and other miscellaneous costs) are given in *Table 3.78*, *Table 3.79*, *Table 3.80*, and *Table 3.81*. All of the alternatives would generate positive stumpage under the assumptions used in this analysis. However, it should be kept in mind that the numbers generated by this analysis are probably less useful in absolute terms than they are as a means to compare the alternatives.

The helicopter units in Alternative 2 would be economically viable only if markets improve. Total net value of the salvage would be approximately 3 million dollars for Alternative 2, the Proposed Action. The other action alternatives range from 7 to 30 percent of the value of Alternative 2. The stumpage value equates closely to the receipts that would be expected from the sale of the timber in the alternative, and is money that could be used to offset costs incurred in project planning, sale preparation and administration, additional hazardous fuels treatments, soil rehabilitation, and reforestation.

Table 3.78. Expected Stumpage Value (Net Value) of Alternative 2

Logging System	Acres	Total Volume (mbf)	Pond Value ($/mbf)*	Total Logging Cost ($/mbf)	Stumpage Value ($/mbf)	Total Stumpage
Ground-based	**5638**	**23435**	$325	$191	$134	$3,137,947
Ground-based-modified	**210**	**859**	$325	$206	$119	$102,155
Helicopter	**955**	**5405**	$325	$335	($10)	($54,592)
Total/Wt. Ave.	**6803**	**29,699**	**$325**	**$218**	**$107**	**$3,185,509**

*Assumes equal ratios of DF, WF, and PP would be harvested.
Note: ( ) denotes a negative value

Table 3.79. Expected Stumpage Value (Net Value) of Alternative 3

Logging System	Acres	Total Volume (mbf)	Pond Value ($/mbf)*	Total Logging Cost ($/mbf)	Stumpage Value ($/mbf)	Total Stumpage
Ground-based	**3762**	**14,031**	$275	$216	$59	$827,829
Total	**3762**	**14,031**	$275	$216	$59	**$827,829**

*Assumes 3:1:1 ratio of WF:DF:PP would be harvested

Table 3.80. Expected Stumpage Value (Net Value) of Alternative 4

Logging System	Acres	Total Volume (mbf)	Pond Value ($/mbf)*	Total Logging Cost ($/mbf)	Stumpage Value ($/mbf)	Total Stumpage
Ground-based	**1694**	**7370**	$325	$196	$129	$950,730
Ground-based-modified	**31**	**126**	$325	$211	$114	$14,364
Total	**1725**	**7496**	$325	**196**	**129**	**$965,094**
*Assumes equal ratios of DF, WF, and PP would be harvested						

Table 3.81. Expected Stumpage Value (Net Value) of Alternative 5

Logging System	Acres	Total Volume (mbf)	Pond Value ($/mbf)*	Total Logging Cost ($/mbf)	Stumpage Value ($/mbf)	Total Stumpage
Ground-based	**4633**	**13,317**	$250	$234	$16	$209,682
Total	**4633**	**13,317**	**$250**	**$234**	**$16**	**$209,682**
*Assumes 3:1:1 ratio of WF:DF:PP and smaller diameter trees would be harvested						

<u>Net Return to Federal Government</u>: The net return to the federal government is the total net sale value of the timber (stumpage value) minus the costs of project planning and preparing and administering the sales. Project planning, sale preparation, and sale administration costs are give in *Table 3.82*. *Table 3.83* displays the expected net return to the federal government for the action alternatives. Discounting of all costs and revenues to a base year was not done in this analysis, because all inputs and outputs for all alternatives will occur over only a three-year period, making discounting insignificant. Alternative 2 is the only alternative that yields a positive return to the federal government.

Table 3.82. Forest Service Costs

Activity	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Project Planning	$950,000	$950,000	$950,000	$950,000	$950,000
Sale Preparation	$0/mbf	$40/mbf	$45/mbf	$40/mbf	$50/mbf
Sale Administration	$0/mbf	$17/mbf	$17/mbf	$17/mbf	$20/mbf

Table 3.83. Net Return to Federal Government

Alternative	Total Volume (mbf)	Total Sale Net Value	Total Project Planning Costs	Total Sale Preparation Cost	Total Sale Admin. Cost	Net Return to Federal Government
1	0	0	$950,000	0	0	**($950,000)**
2	29,699	$3,185,509	$950,000	$1,187,974	$504,889	**$542,646**
3	14,031	$827,829	$950,000	$631,395	$238,527	**($992,093)**
4	7496	$965,094	$950,000	$299,840	$127,432	**($412,178)**
5	13,317	$209,682	$950,000	$665,850	$266,340	**($1,672,509)**
Note: ( ) denotes a negative value.						

<u>Costs of Fuels Treatments</u>: Fuels treatments include activities to deal with the fuels generated from logging, as well as the natural dead fuel loadings on the site. The logging costs shown above include slash disposal costs expected as a result of the logging operations. *Table 3.84* through *3.87* show the additional costs of treating the natural dead fuels as described in Chapter 2.

Underburning costs reflect what is expected to be more of a "jackpot burning" scenario, i.e. the burning of fuel concentrations. Machine piling costs reflect the treatment of non-merchantable small dead trees by a machine with a grapple arm used for piling along existing skid trails (approx. 60% of unit area).

Table 3.84. Alternative 2 Fuels Treatment Costs

Fuels Treat.	Acres	Cost/Acre	Total Cost	Total BD Deposits	Additional Cost
WTY/PB	**3584**	$14.43	$51,703	$59,739.47	($8,037)
WTY/PB,MP	**2702**	$163.03	$440,544	$45,044.76	$395,499
PB,WF,JPB	**516**	$102.10	$52,723	$8,607.96	$44,115
Total	**6803**		**$544,970**	**$113,392**	**$431,577**
Note: ( ) denotes a negative value.					

Table 3.85. Alternative 3 Fuels Treatment Costs

Fuels Treat.	Acres	Cost/Acre	Total Cost	Total BD Deposits	Additional Cost
WTY/PB	**2053**	$14.43	$29,620	$30,621	($1,001)
WTY/PB,MP	**1710**	$163.03	$278,717	$25,503	$253,214
Total	**3762**		**$308,338**	**$56,124**	**$252,214**

Note: ( ) denotes a negative value.

Table 3.86. Alternative 4 Fuels Treatment Costs

Fuels Treat.	Acres	Cost/Acre	Total Cost	Total BD Deposits	Additional Cost
WTY/PB	**1456**	$14.43	$21,004	$25,296	($4,293)
WTY/PB,MP	**270**	$163.03	$43,974	$4,688	$39,286
Total	**1725**		**$64,977**	**$29,984**	**$34,993**

Note: ( ) denotes a negative value.

Table 3.87. Alternative 5 Fuels Treatment Costs

Fuels Treat.	Acres	Cost/Acre	Total Cost	Total BD Deposits	Additional Cost
WTY/PB	**2542**	$14.43	$36,679	$36,534.41	$145
WTY/PB,MP	**2091**	$163.03	$340,855	$30,050.59	$310,805
Total	**4633**		**$377,535**	**$66,585**	**$310,950**

Costs of Reforestation Treatments: The estimated reforestation costs for acres subject to the NFMA 5-year reforestation requirements are displayed in *Table 3.88.*

Table 3.88. Reforestation Costs

Alternative	Acres NFMA 5-year Req.	Planting ($/ac)	Exams/Monitor. ($/ac)	Reforestation Cost/Acre	Total Reforestation Cost
2	6316	$406	$70	$476	**$3,006,416**
3	3762	$406	$70	$476	**$1,790,712**
4	1238	$406	$70	$476	**$589,288**
5	4146	$406	$70	$476	**$1,973,496**

Summary of Treatment Costs and Potential Funding: The following tables (Tables 3.89 – Tables 3.92) disclose the estimated costs of the major activities associated with each alternative:

Table 3.89. Alternative 2 Treatment Costs

Alt. 2					
Activity	**Cost/Unit**	**Unit of Measurement**	**Number of Units**	**Total Cost**	**Funding Source**
Temp. Rd. Constr./Obliteration	$10,000	Mile	5.1	$51,000	T.S. Contract
Subsoiling	$110	Acre	117	$12,870	T.S. Contract
Whole Tree Yard/Burn Landing Piles	$14	Acre	6286	$88,004	T.S. Contract
Sum of T.S. Contract				**$151,874**	
Grapple Piling	$150	Acre	2702	$405,300	Appropriated/KV
Small Tree Felling/Burn Fuel Concentrations	$100	Acre	516	$51,600	Appropriated/KV
Weed Treatment/Monitoring	$350	Day	60	$21,000	Appropriated/KV
Road Inactivation	$1,150	Mile	20	$23,000	Appropriated/KV
Road Decommission	$2,800	Mile	51	$142,800	Appropriated/KV
Conifer Planting	$406	Acre	6316	$2,564,296	KV/Appropriated
Reforestation Exams/Monitoring	$70	Acre	6316	$442,120	KV/Appropriated
Animal Damage Protection/Control	$200	Acre	6316	$1,263,200	KV/Appropriated
Sum of Appropriated and KV				**$4,913,316**	

Table 3.90. Alternative 3 Treatment Costs

Alt. 3					
Activity	**Cost/Unit**	**Unit of Measurement**	**Number of Units**	**Total Cost**	**Funding Source**
Temp. Rd. Constr./Obliteration	$10,000	Mile	3.9	$39,000	T.S. Contract
Subsoiling	$110	Acre	77	$8,470	T.S. Contract
Whole Tree Yard/Burn Landing Piles	$14	Acre	3762	$52,668	T.S. Contract
Sum of T.S. Contract				**$100,138**	
Grapple Piling	$150	Acre	1710	$256,500	Appropriated/KV
Weed Treatment/Monitoring	$350	Day	45	$15,750	Appropriated/KV
Road Inactivation	$1,150	Mile	20	$23,000	Appropriated/KV
Road Decommission	$2,800	Mile	51	$142,800	Appropriated/KV
Conifer Planting	$406	Acre	3762	$1,527,372	KV/Appropriated
Reforestation Exams/Monitoring	$70	Acre	3762	$263,340	KV/Appropriated
Animal Damage Protection/Control	$200	Acre	3762	$752,400	KV/Appropriated
Sum of Appropriated and KV				**$2,981,162**	

Table 3.91. Alternative 4 Treatment Costs

Alt. 4					
Activity	**Cost/Unit**	**Unit of Measurement**	**Number of Units**	**Total Cost**	**Funding Source**
Temp. Rd. Constr./Obliteration	$10,000	Mile	1.7	$17,000	T.S. Contract
Subsoiling	$110	Acre	46	$5,060	T.S. Contract
Whole Tree Yard/Burn Landing Piles	$14	Acre	1725	$24,150	T.S. Contract
Sum of T.S. Contract				**$46,210**	
Grapple Piling	$150	Acre	270	$40,500	Appropriated/KV
Weed Treatment/Monitoring	$350	Day	30	$10,500	Appropriated/KV
Road Inactivation	$1,150	Mile	20	$23,000	Appropriated/KV
Road Decommission	$2,800	Mile	51	$142,800	Appropriated/KV
Conifer Planting	$406	Acre	1238	$502,628	KV/Appropriated
Reforestation Exams/Monitoring	$70	Acre	1238	$86,660	KV/Appropriated
Animal Damage Protection/Control	$200	Acre	1238	$247,600	KV/Appropriated
Sum of Appropriated and KV				**$1,053,688**	

Table 3.92. Alternative 5 Treatment Costs

Alt. 5					
Activity	**Cost/Unit**	**Unit of Measurement**	**Number of Units**	**Total Cost**	**Funding Source**
Temp. Rd. Constr./Obliteration	$10,000	Mile	3.7	$37,000	T.S. Contract
Subsoiling	$110	Acre	76	$8,360	T.S. Contract
Whole Tree Yard/Burn Landing Piles	$14	Acre	4633	$64,862	T.S. Contract
Sum of T.S. Contract				**$110,222**	
Grapple Piling	$150	Acre	2091	$313,650	Appropriated/KV
Weed Treatment/Monitoring	$350	Day	45	$15,750	Appropriated/KV
Road Inactivation	$1,150	Mile	22	$25,300	Appropriated/KV
Road Decommission	$2,800	Mile	55	$154,000	Appropriated/KV
Conifer Planting	$406	Acre	4146	$1,683,276	KV/Appropriated
Reforestation Exams/Monitoring	$70	Acre	4146	$290,220	KV/Appropriated
Animal Damage Protection/Control	$200	Acre	4146	$829,200	KV/Appropriated
Sum of Appropriated and KV				**$3,311,396**	

3.10 Snag Habitat

Dead wood (standing or down) plays an important role in overall ecosystem health, soil productivity and numerous species' habitat. It is crucial in the continuation of species that depend on snags for all or parts of their life cycle (Laudenslayer 2002). Bird and mammal species rely on the structure for dens, nests, resting, roosting, and/or feeding on the animals and organisms that use dead wood for all or parts of their life cycle. Snags come in all sizes and go through breakdown and decay processes that change them from standing hard to soft, then on the ground to continue decaying into soil nutrients.

Not every stage of the snag's demise is utilized by the same species, but rather a whole array at various stages or conditions. In forested environments, 93 wildlife species are associated with snags. This includes 4 amphibians, 63 birds, and 26 mammal species (Rose et al. 2001). Uses of snags include nesting, roosting, preening, foraging, perching, courtship, drumming, and hibernating. There were 86 vertebrate wildlife species associated with down wood. Of those, 58 were exclusively associated with down wood (Rose et al. 2001).

Fires are a unique habitat, creating a boom and bust cycle of post-fire dead wood habitat, when looking across a large landscape and this habitat represents only a small percentage of a total area. Therefore, analysis will be conducted on a larger area than just the fire area to help determine how this fire area is contributing to habitat at the larger scale. Snags and down wood levels are best analyzed at scales of subwatersheds or greater (Mellen et al. 2003). The analysis provided includes stand information gathered for the Upper Metolius 5th field watershed. This will include information from both within and outside the fire perimeter and for differing temporal and spatial scales. Snags and down wood will be addressed as they relate to size, density, and distribution by habitat type.

There are four general habitat types found within the watershed; eastside mixed conifer, ponderosa pine/Douglas-fir, montane mixed conifer, and lodgepole pine. Ponderosa pine/Douglas-fir habitat types are generally found on low elevation flats and are comprised primarily of ponderosa pine with minor amounts of white fir and Douglas-fir. The eastside mixed conifer habitat type is found on the slopes of the Cascades down to the flatter areas of pure pine stands. This habitat type has moderate annual precipitation amounts (20-60" per year) and consists of several different tree species (e.g. ponderosa pine, Douglas-fir, white fir, western larch, lodgepole pine). The mixed conifer montane habitat type is very complex and includes portions of the ponderosa pine/Douglas-fir and eastside mixed conifer habitat types as well as high elevation types. Tree species found in this habitat type include those mentioned previously as well as subalpine fir, whitebark pine, and western white pine. The lodgepole pine habitat type is generally found at higher elevations and most stands are comprised primarily of lodgepole pine with little variation.

Certain wildlife species are highly associated with the above mentioned habitat types. The species we will focus on in this analysis are representative primary cavity excavators and insect foraging species that may be found in this area. They include: Lewis' woodpecker, white-headed woodpecker, pygmy nuthatch, Williamson's sapsucker, pileated woodpecker, flammulated owl, mountain bluebird, northern flicker, and black-backed woodpecker – see Table 3.93. Species were chosen from the NWFP former survey and manage species (USDA 2001), USFWS Species of Conservation Concern (USFWS 2002), and *A Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon* (Altman 2000).

When compromising habitat for one species in order to develop or maintain habitat for another, it is important to know the status of each species to target conservation towards those species and habitats in greatest need (NatureServe 2004). NatureServe was used to determine the conservation status of each of the species. Rankings are based on the Oregon Natural Heritage program. With member programs across the country, they developed a consistent method for evaluating the "relative imperilment" of species.

Table 3.93. Species with dead wood or fire created habitat as a primary habitat feature.

Species	Status*	Behavior	Habitat Feature/ Conserva-tion Focus	Habitat	Presence in Watershed	Oregon State Heritage Status Ranking
Lewis' Woodpecker	ESC BCC MIS	Primary Cavity Excavator	Patches of burned old forest	Old Growth Ponderosa Pine	Documented	S3
White-headed Woodpecker	ESC BCC SM MIS	Primary Cavity Excavator	Large patches of old forest with large snags	Old Growth Ponderosa Pine	Documented	S3
Pygmy Nuthatch	SM MIS	Primary Cavity Excavator	Large trees	Pine Forest	Documented	S4
Williamson's Sapsucker	ESC BCC MIS	Primary Cavity Excavator	Large snags	Mixed Conifer	Documented	S4
Pileated Woodpecker	MIS	Primary Cavity Excavator	Large snags/down wood	Mixed Conifer	Documented	S4
Flammulated Owl	ESC BCC SM MIS	Secondary Cavity Nester	Large snags	Old Growth Ponderosa Pine	Documented	S4
Mountain Bluebird	MIS	Secondary Cavity Nester	Burned areas	Mixed, Mosaic	Documented	S4
Northern Flicker	MIS	Primary Cavity Excavator	Snags and down wood	Mixed, Mosaic	Documented	S5
Black-backed Woodpecker	SM MIS ESC	Primary Cavity Excavator	Old Growth	Lodgepole Pine	Documented	S3

*ESC – East-Slope Cascades bird species
MIS – Management Indicator Species
BCC – Bird of Conservation Concern
SM - Former Survey and Manage Species

In addition to the above mentioned species, there are other woodpecker species not included in the table like hairy and downy woodpeckers. These species are considered widespread, abundant, and secure. The American marten and olive-sided flycatcher are also associated with dead wood habitat. However, these species will be discussed under the Management Indicator Species section.

The desired future condition for snags and downed wood is to retain a diversity of snag densities across the landscape to provide for a diversity of species, but still enable maintenance of the stands with fire, in the future. The goal is to retain sufficient snags for wildlife until stands reach an age that snag (20 inch plus dbh) recruitment is occurring. Snags at this point should reflect natural levels.

Explanation of the DecAID advisory tool and how it was applied to the B&B Fire Recovery Project

Snag management guidelines were developed for the B&B Fire Recovery project using a variety of information including scientific literature, standards and guidelines outlined in the Forest Land and Resource Management Guide and subsequent implementation documents, local knowledge of the area, and information contained in the DecAID advisory tool. DecAID is a web-based advisory tool to help managers evaluate effects of forest conditions and existing or proposed management activities on organisms that use snags and down wood. It is a summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. It utilizes information from vegetation plots taken across the Region for a given habitat type. DecAID is intended to provide information regarding snags and down wood across a large area (i.e. 5th field watershed or greater). It is not intended to provide snag levels on a unit by unit basis.

Snag retention strategies were developed to leave a wide range of snag densities across the landscape. Several strategies were designed to meet a wide array of issues and different combinations of these strategies may be applied to each alternative.

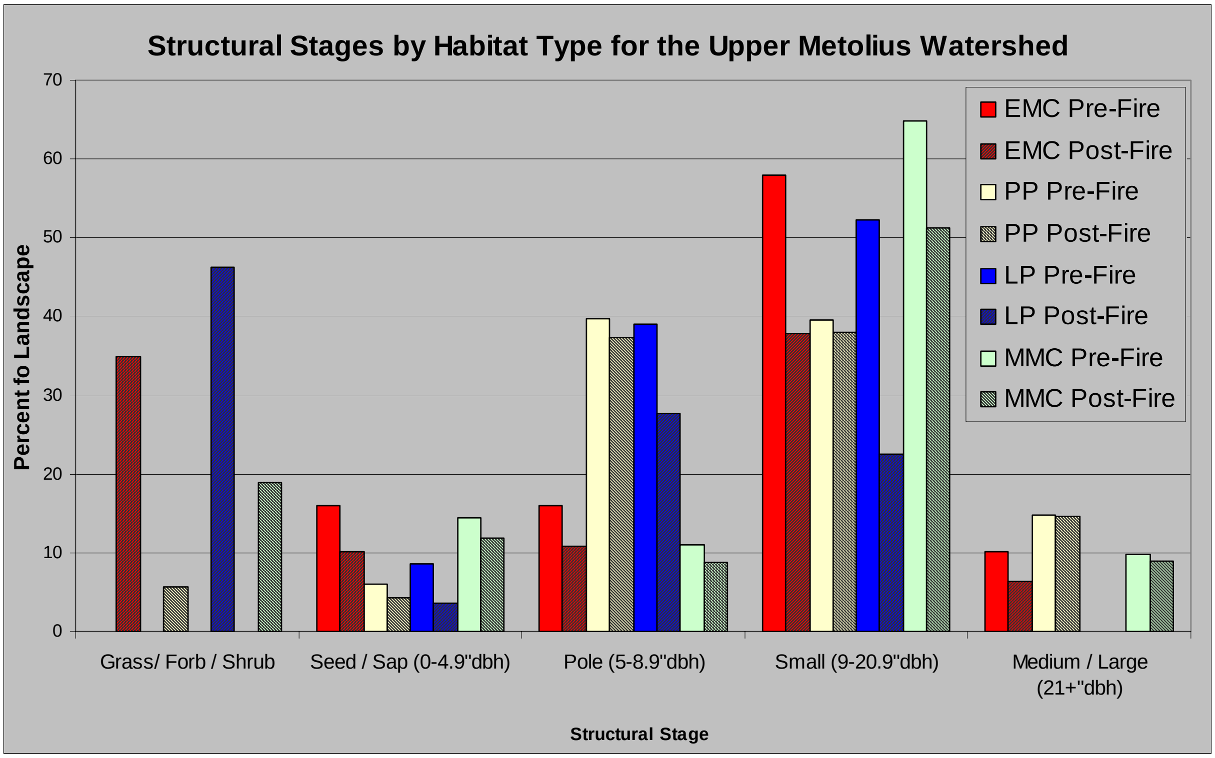
Affected Environment and Environmental Consequences

Existing Condition

Large portions of the watershed have been harvested. Treatments varied across the watershed from removing only the largest trees in the early 1900s, and clearcuts in the 1970s, to most recently understory thinning that left the largest trees. Harvest regimes along with fire suppression resulted in varying conditions across the landscape. Prior to the fire the majority of the watershed was in a multi-story mid to late stage with some large trees (Figure 3.14). There was a lack of single story mid-late and old forest structure. The Metolius Watershed Analysis Update (USDA 2004b) found that in 1953, 64% of the watershed was dominated by large trees (>21"dbh). In 1996 that was reduced to 9% of the watershed and after the fires the watershed is now at 7% large trees. The original watershed analysis (USDA 1996a) found tree densities above historic ranges putting the area at risk for insects, disease, and wildfire.

The fire burned intensely over much of the area. The northern and southern sections of the project area experienced a stand replacement burn primarily resulting in little to no mosaic in these areas. A mixed burn occurred in the central section where back burns took place during favorable weather conditions. This central area provides green areas in a landscape of dead trees.

Figure 3.14. Pre and post fire structural stages by habitat type for the Upper Metolius Watershed.



Ponderosa Pine/Douglas-fire Habitats – Lewis' Woodpecker, White-headed Woodpecker, Pygmy Nuthatch

Habitat for the Lewis' woodpecker, a migrant in this part of its range, includes old-forest, single-storied ponderosa pine. Burned ponderosa pine forests created by stand-replacing fires provide highly productive habitats as compared to unburned pine (Wisdom et al. 2000). Lewis' woodpeckers feed on flying insects and are not strong cavity excavators. They require large snags in an advanced state of decay that are easy to excavate, or they use old cavities created by other woodpeckers. Nest trees generally average 17 inches to 44 inches (Saab and Dudley 1998, Wisdom et al. 2000).

In evaluating landscape predictor variables for the Lewis's woodpecker, Saab et al. (2002) found a negative relation to burned ponderosa pine/Douglas-fir stands with high crown closure (>70%) but was positively associated with low snag densities overall. However, although it selects for more open stands, this species selected nest sites with higher densities of large snags (≥20"dbh) (Saab and Dudley 1998). Lewis' woodpeckers are different than other woodpeckers. They are aerial insectivores during the breeding season and use lower densities of smaller snags but rely more heavily on large snags (Saab and Dudley 1998). It is possible that snag densities, primarily smaller sized snags are too high for Lewis's in much of the fire area at this time.

White-headed woodpeckers and pygmy nuthatches share similar habitat of large open ponderosa pine, low shrub levels and large snags. The white-headed woodpecker is a primary cavity excavator of soft snags, while the pygmy nuthatch is a secondary cavity nester and can take advantage of natural cavities as well as woodpecker created cavities. The white-headed woodpecker is the only woodpecker species to rely heavily on seeds of ponderosa pine for food (Marshall et al. 2003 p. 364).

A long term study on the white-headed woodpecker has occurred on the Deschutes and Winema National Forests from 1997-2004 with several Deschutes study sites occurring within or adjacent to the project area. Both species prefer similar diameter trees as the Lewis' woodpecker for nesting, averaging 23 inches for the pygmy nuthatch and 31 inches for the white-headed woodpecker (Wisdom et al. 2000). Frenzel (2000) calculated the mean diameter for white-headed woodpecker nest trees to be 26.2"dbh while Dixon (1995) found similar results (mean diameter of 25.6"dbh). Frenzel (2003) found nests at sites with a high density of large diameter trees had a higher survival rate than nests in recently harvested sites. Unharvested sites or sites with greater than12 trees per acre >21"dbh had a success rate of 63.1% while nests at previously harvested sites or lower densities of large trees had a success rate of 39.8%. Therefore, white-headed woodpeckers were positively associated with higher densities of large trees. On the Winema National Forest, white-headed woodpeckers were found to be using small-diameter trees, logs in a slash pile and upturned roots (6-13" dbh) where large snags were uncommon (Frenzel 2002). There are numerous sightings of white-headed woodpeckers and pygmy nuthatches in the watershed. Lewis's woodpeckers have also been sighted.

Although there are approximately 20,000 acres of ponderosa pine dominated plant associations, there was little habitat for Lewis' woodpecker, white-headed woodpecker, and pygmy nuthatches in the watershed prior to the fire. Ponderosa pine stands have had shade tolerant trees come into the understory, creating dense multi-story stands. Fire suppression had also resulted in increased shrub cover which has led to an increase in small mammal and avian predation on white-headed woodpeckers in particular (Frenzel 1999).

The fires created habitat for the these species where stands were underburned or experienced mixed burn intensities in ponderosa pine or mixed conifer habitats where the resulting structure is single story or open canopy. Moderate and high intensity burn areas could provide habitat for the Lewis's woodpecker as snag densities become favorable. Saab and Dudley (1998), Haggard and Gaines (2001), and Saab et al. (2002) found that Lewis' woodpeckers selected nest sites with low to moderate snag densities (3-14 snags/ac) but used areas with higher densities of larger snags (ave. 17"dbh). They also noted that this species was rarely found in unlogged areas or high density snag patches (>15-37 snags/ac). It is questionable how suitable these acres would be for white-headed woodpeckers or pygmy nuthatches. White-headed woodpeckers were found in both study areas of Ponderosa Pine/Douglas-fir in Washington and Idaho, but densities were to low for statistical analyses. Pygmy nuthatches were not found in either study area. This may be in part on the reliance of pine seed sources for the white-headed woodpecker, or leaf insects for the nuthatch as a seasonal part of their diets (Dixon 1995, Frenzel 1999, and Marshall et al. 2003 pp. 364 and 452-453).

DecAID lists the following species using recently burned ponderosa pine/Douglas-fir and Eastside Mixed Conifer E. Cascades/Blue Mtns. vegetation: black-backed woodpecker, hairy woodpecker, Lewis' woodpecker, mountain bluebird, northern flicker, western bluebird, and white-headed woodpecker. DecAID also lists the pileated woodpecker and white-headed woodpecker using green stands of ponderosa pine/Douglas-fir vegetation.

Mixed Conifer Habitats – Williamson's Sapsucker, Pileated Woodpecker

Williamson's sapsuckers, a summer resident, prefer large decadent snags in mixed conifer or ponderosa pine forests. They feed mostly on sap from "wells" they drill in ponderosa pine or Douglas-fir trees, phloem fibers, cambium, and insects. They are not strong cavity excavators and select soft decayed wood in about any tree species for nesting (Marshall et al. 2003 pp. 355-356). They favor larger trees, generally averaging 27"dbh but have been shown to utilize snags ranging from 21"dbh to 37"dbh (Mellen et al. 2003).

Pileated woodpeckers share similar habitats in denser mixed conifer forests. Bull and Holthausen (1993) found pileateds selected stands for nesting with old growth, grand fir, no logging, and ≥60% canopy closure. They are rarely found in pure ponderosa pine forests. The largest woodpecker in the U.S., it needs large snags for nesting, generally averaging 25-35 inches in diameter in green forests and slightly larger snags in open habitats (24-45"dbh) (Mellen et al. 2003). Snags, live trees, and down logs (at least 15"dbh) are needed for foraging (Bull and Holthausen 1993). A major food source for the pileated woodpecker includes carpenter ants found in decaying snags and logs (Bull et al. 1997). Pileateds also utilize roosts, primarily at night. These tend to be cavities in dead or hollow trees with hollow trees used more often (Bull, Holthausen, and Henjum 1990). Both woodpeckers have been found in the watershed.

Approximately 56% (~73,000 acres) of the watershed is comprised of mixed conifer habitats and of that, about 68% (~49,740 acres) of mixed conifer stands contained structural stages potentially suitable for these two species. Due to the spruce budworm outbreak of the 1990s, abundant snag levels occurred throughout the watershed. However, this also reduced canopy closure which may have left areas unsuitable, especially for the pileated woodpecker.

The fires reduced habitat for these species especially where stands experienced stand replacement or mixed burn intensities. Approximately 70% of the potentially suitable habitat prior to the fire was impacted by the burn. Softer snags, likely existing from the insect and disease outbreaks of the early 1990's, were probably consumed. Marshall et al. (2003) also noted pileated woodpeckers need large logs for foraging and dense canopy to protect against predators. These habitat features were also reduced or affects of the fire may have left them unsuitable for the short term (i.e. fire-hardened logs). Potentially suitable habitat still occurs outside the fire perimeter however. Although many woodpecker species are found within burned areas, none of the literature regarding species presence mentions pileated woodpeckers or Williamson's sapsuckers as species found among dead trees.

DecAID lists the following species using recently burned ponderosa pine/Douglas-fir and Eastside Mixed Conifer E. Cascades/Blue Mtns. vegetation: black-backed woodpecker, hairy woodpecker, Lewis' woodpecker, mountain bluebird, northern flicker, western bluebird, and white-headed woodpecker. DecAID also lists the American marten, long-legged myotis, pileated woodpecker, silver-haired bat, and white-headed woodpecker using green stands of eastside mixed conifer habitat.

Mosaic Habitats – Flammulated Owl, Mountain Bluebird, and Northern Flicker

This habitat type includes a mix of forested conditions in relation to open habitats. Many of the species included in this type require a mix of habitat elements including green trees, snags, down logs, and open habitats to meet their needs for foraging and nesting.

Flammulated owls are found in a mosaic of open forests containing mature and old growth ponderosa pine or mixed conifer plant associations. More specifically ponderosa pine dominated stands with interspersed dense thickets and grassy openings. They utilize cavities in live or dead trees created by pileated woodpeckers or northern flickers. Average diameter of snags and trees used for nesting were 6 and 52 inches (Mellen et al. 2003). It forages primarily on arthropods and other insects. (USDA 1994b).

Mountain bluebirds are the most diverse species in this group utilizing all forest types for nesting and openings for foraging. It is associated with burned areas that have openings and fairly high snag densities. Saab and Dudley (1998) found that mountain bluebirds preferred unlogged sites (snags >9" to <20" averaged 33/acre and snags >20" averaged 7/acre) where Haggard and Gaines (2001) found mountain bluebirds nested the most frequently in stands with medium snag densities (6-14 snags/acre). A secondary cavity nester, it prefers cavities created by the northern flicker. Nest size for open habitats averaged 23”dbh while in post-fire habitats, nest size ranged from 7-22”dbh (Mellen et al. 2003). The northern flicker is a most unconventional woodpecker. This species is generally most abundant in open forests and forest edges adjacent to open areas (Marshall et al. 2003 p. 371). It feeds on ants, beetles and other insects on the ground. Saab and Dudley (1998) found northern flickers used nest sites with the highest densities of large trees and selected for larger snags for nesting (average 17.2”dbh) while preferring lower densities of smaller snags similar to the Lewis’ woodpecker. Haggard and Gaines (2001) found flickers nested most often in stands with medium snag densities. DecAID reports varying ranges of average nest tree sizes depending on the type of habitat it is using. In post-fire habitats, nest trees ranged from 10-24”dbh, while in open mixed conifer habitat, nest trees ranged from 18-41”dbh. And where large trees dominated, nest trees ranged from 17-31”dbh (Mellen et al. 2003). Key habitat features for all these species are down logs and snags.

Prior to the fires, habitat for two of these species (flammulated owl and northern flicker) occurred scattered across the watershed in stands of multi-story mid, late and old forest. Approximately 60,000 acres occurred in the eastside mixed conifer and ponderosa pine habitat types while an additional 16,618 acres occurred within the montane mixed conifer habitat type. Little habitat was available for the mountain bluebird except for areas of previous harvest and some beetle-killed areas that were open enough. Existing snag levels varied across the landscape.

The fires reduced habitat for the flammulated owl but increased habitat for the northern flicker and mountain bluebird. These species are less dependent on a contiguous green component or canopy cover. Marshall et al. (2003 pp. 477-478) noted that mountain bluebird populations increased after a fire. This was based on a mosaic of green trees scattered throughout the fires, so habitat could be over-estimated and limited to edges with green trees or mixed intensity areas.

Lodgepole Pine Habitats/Recent Post-fire Habitats – Black-backed Woodpeckers

The black-backed woodpecker is a unique species. Altman (2000) identified it as a focal species for old-growth lodgepole pine. However, it is also highly associated with post-fire environments. Therefore, it will be discussed as it relates both to green lodgepole pine forests and post-fire environments regardless of plant association.

Lodgepole Pine Habitat

Wisdom et al. (2000) describes source habitats for black-backed woodpeckers as a year round resident that occurs in various forest types. Within its range it is most abundant in recently burned forests, but in Oregon, bark-beetle killed forests are frequently occupied. Marshall et al. (2003 pp. 368-370) reports for this species the “center of abundance” in Oregon is the “lodgepole pine forest east of the Cascade crest between Bend and Klamath Falls”. Endemic levels of mountain pine beetles, common in lodgepole pine (10”+ dbh and 170 tpa), provide a constant food source. In a study conducted on the Deschutes National Forest, Goggans et al. (1989) suggested management for black-backed woodpeckers is tied to the maintenance of decay and disease. They found black-backed woodpeckers used stands with a mean diameter of 8”dbh for nesting with a mean nest tree diameter of 11”dbh suggesting selection for single-storied mature/overmature stands. All nests in the study were in lodgepole pine stands and 93% of foraging took place in lodgepole pine forests. Goggans found mountain pine beetles had infested 81% of the trees used for foraging. Recent dead trees were used most often (68%) for foraging.

Post-fire Habitat

Black-backed woodpeckers are highly associated with stand replacement fire. Saab, Dudley and Thompson (2004) found black-backed woodpeckers rapidly colonize stand replacement burns within 1-2 years post-fire but are rare within 5 years which may be due to a decrease in prey of larval bark and wood boring beetles. Several studies found that black-backeds are found primarily in unlogged sites or clumps of high density trees/snags for both nesting and foraging (Saab and Dudley 1998, Hejl and McFadzen 2000, Haggard and Gaines 2001, and Saab et al. 2002). These stands may provide greater foraging opportunities since this species feeds primarily on bark and wood boring beetles (Saab et al. 2002, and Saab, Dudley and Thompson 2004). In addition, black-backed woodpeckers select for small diameter snags (12.7” ± 1.1”dbh) for nesting and nest in hard snags with little decay (Saab and Dudley 1998 and Saab et al. 2002). They also select nest sites with the highest densities of snags >9”dbh (Saab and Dudley 1998).

Approximately 4,133 acres of mature lodgepole pine stands occurred within the watershed prior to the fire. The Metolius Watershed Analysis (USDA 1996a) estimated 63% of the Lodgepole Pine PAG met the definition of Potential Old Growth as defined by the Region 6 interim old growth definitions. This occurred primarily in the higher elevations and this PAG was considered to be within the range of historic variability.

The fires reduced the green base lodgepole habitat but created acres of burned habitat for the black-backed woodpecker, with an abundance of insects. Potential lodgepole pine old growth decreased from an estimated 63% in 1996 to 21% in 2004 according to the Metolius Watershed Update (USDA 2004b). This was somewhat expected as lodgepole pine occurs within Fire Regime 4. Fire intensity was estimated to be within the historic range but the size of the stand replacement burn may be outside (USDA 2004b).

Wood boring insects that come in with fire differ from mountain bark-beetle outbreaks. Marshall et al. (2003) warns that burned forests and bark-beetle outbreaks should not be considered equivalent habitats. Wisdom contrasted nesting success of 68.5 percent in bark beetle infested forests in Oregon with 100 percent success in burned forests of western Idaho and northwestern Wyoming. Squirrel predation accounted for nest losses in Oregon. In the Idaho fire recolonization of large burn areas by squirrels did not take place during the first 3 years after the fire. It should be noted however that black-backed population increases in fire areas lasts for 5 years (Saab and Dudley 1998), whereas large infestations of mountain bark-beetle in the lodgepole pine forests on the Deschutes National Forest last 10 years. In small-scale infestations of mountain bark-beetles in lodgepole pine or mixed conifer forests occur on a never ending cycle. Snag densities in this habitat type vary widely.

There is no information in DecAID for the lodgepole pine habitat type. However, there is wildlife data for the black-backed woodpecker for recent post-fire environments.

Summary

Cavity nesters likely respond positively to stand replacement burns for a number of reasons. Bark beetles and wood boring beetles often colonize fire-killed or injured trees in high densities. Subsequently, this is followed by an increase in the abundance of *Picoides* woodpeckers, which are strongly associated with dying or recently killed trees. Bark and wood boring insects form the prey base for certain woodpeckers. The appearance of *Picoides* woodpeckers in stand replacement burns typically coincides with the emergence of adult wood borers (Harris 1982, Hoffman 1997, Murphy and Lehnhausen 1998). Also stand replacement fires create large expanses of standing dead trees in an open setting, which is important for secondary cavity nesters that are aerial foragers (Taylor and Barmore 1980, Hutto 1995, Sallabanks 1995, Johnson and Wauer 1996). Finally, stand replacement fires provide a multitude of potential nesting sites as snags soften with decay introduced by the multitude of insects (Raphael and White 1984, Hughes 2000). Although temporary, stand replacement fires create a rich and concentrated foraging resource in areas where nest site potential also increases. It is thought that many cavity nesting species are dependent upon both the spatial and temporal occurrence of severe burns to maintain their populations (Hutto 1995, Caton 1996, Hoffman 1997, and Machmer 2000).

As indicated in DecAID, the work of Saab and Dudley (1998) and Saab et al. (2002) should be consulted when planning management activities in post fire habitats (Mellen et al. 2003). This research recommends managing for that range of post fire habitat conditions characteristic of black-backed and Lewis' woodpeckers would likely incorporate habitat features necessary for nest occurrence of other cavity nesting birds (Saab et al. 2002). In addition, habitat should be managed at multiple spatial scales to incorporate the continuum of habitat used by black-backed and Lewis' woodpeckers (Johnson et al. 2000, Saab et al. 2002). This suggests that developing salvage logging prescriptions that maintain habitat characteristics for both black-backed and Lewis' woodpeckers, while considering both the microhabitat and landscape scale, would likely retain habitat for the entire assemblage of cavity nesting birds.

Environmental Consequences

To assess effects to species, information contained within the wildlife data found in DecAID for recent post-fire environments was used. "Wildlife data" as used in DecAID refers to the data collected in a variety of wildlife studies conducted in specific vegetation types found in the West. Most of the data collected is for bird species, primarily cavity nesters such as woodpeckers. The wildlife data in DecAID is provided in the form of tolerance levels of 30 percent, 50 percent, or 80 percent.

Referring to the array of wildlife data collected (for all habitats, not just post-fire habitats) DecAID notes:

"The wildlife studies, on which the wildlife portion of DecAID is based, were conducted in a variety of landscapes and site conditions. Typically, the studies (a) did not report how the general study areas and specific study sites were chosen relative to others, and (b) did not describe how the vegetation conditions within the general study areas and specific study sites differed from conditions within a broader area, especially within the wildlife habitat and vegetation condition classes used in DecAID. Thus, there is no way to know to what degree the study areas and sites varied from conditions generally present, and thus no way to gauge the bias in study area and site selection. In turn, this means there is no way to estimate the degree of bias in the wildlife data summarized in DecAID (Mellen 2002).

Therefore, it is important to consider how plant communities and conditions at the local site differ from plant communities and conditions in the studies used in DecAID.

Tolerance Level

Data is displayed by **tolerance level** for both wildlife data and inventory data. A tolerance level as it relates to wildlife data is defined as follows: "tolerance intervals are estimates of the percent of all individuals in the population that are within some specified range of values" (Mellen et al. 2003). For example, we'll use data from the wildlife species curves for black-backed woodpeckers.

Snag density (≥10"dbh) for black-backed woodpeckers:
30% tolerance level = 62.2 snags/acre
50% tolerance level = 88.3 snags/acre
80% tolerance level = 126.1 snags/acre

The above data from 35 nests in post-fire habitats indicate (Mellen pers.com):

- Areas with <62.2 snags/acre are used for nesting by only 30% of the population of black-backed woodpeckers, and conversely 70% of the population would be expected to nest in areas with ≥62.2 snags/acre.
- Half the population would nest in areas with <88.3 snags/acre and the other half would nest in areas with ≥88.3 snags/acre.

- 80% of black-backed woodpeckers would be expected to nest in areas with <126.1 snags/acre and conversely 20% of the population would be expected to nest in areas with ≥126.1 snags/acre.

Effects Common to All Alternatives including No Action

Green stands with little mortality and a low proportion of white fir will not be treated and snag levels will remain the same. Therefore, stands will continue to provide habitat for species that require live canopy along with snag habitat (e.g. pileated woodpecker, Williamson's sapsucker, and white-headed woodpecker).

A large percentage of the fire area will not be treated benefiting species who utilize high density snag patches. This includes all lodgepole pine habitats which occur within Fire Regime 4. Saab and Dudley (1998), Haggard and Gaines (2001), Saab et al. (2002), and Kotliar et al. (2002) reported that hairy woodpeckers, black-backed woodpeckers, and mountain bluebirds prefer high density areas ranging from 64-126 snags/acre.

Snag habitat, occurring within the fire area particularly, is serving as intermittent habitat for most cavity excavators (Saab, Dudley, and Thompson 2004). Snag numbers do not continually increase over time because the process of tree mortality and snag recruitment are balanced by the processes of snag decay and fall (Everett et al. 1999). Over time, snag habitat will decrease creating a gap in time when little snag habitat exists (primarily in stand replacement areas) because there are no green trees of sufficient size to provide recruitment. Dahms (1949) found 10 years post-fire, 50% of fire-killed ponderosa pine snags remained standing but this declined to 22% standing after 22 years. It is estimated that about 75% of all snags may fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). This will lead to a reduction in available habitat and a decrease in local populations.

Snag size, tree species, cause of mortality, and micro-environment determine snag fall rates. Most small snags (10"dbh) in the montane mixed conifer and eastside mixed conifer habitat types will fall by year 2030 reducing foraging habitat and reducing snag densities. Since most of the ponderosa pine/Douglas-fir habitat type occurs outside the fire area, small snags continue to be present on the landscape due to overstocked stands and mortality from insects and competition. The montane mixed conifer and eastside mixed conifer habitat types show a precipitous decline in large snags (20"dbh) until year 2050 when levels show to be very low. Fall down rates exceed recruitment rates from 2006 to 2050 at which time stands are beginning to recover. Again large snags continue to be present in the ponderosa pine/Douglas-fir habitat type as most of the area lies outside the fire area. Keen (1929), Dahms (1949), Parks et al. (1999), and Everett et al. (1999) all found that smaller snags (<9"dbh) fell sooner than larger snags (>16"dbh) and Everett and Keen both reported rapid snag fall 3 to 15 years post-fire. In addition, Dahms (1949) reported that fire-killed snags tended to stand longer than insect killed snags. Everett et al. (1999) reports that thick-barked species like Douglas-fir and ponderosa pine >16"dbh remained standing longer than thin-barked species (e.g. lodgepole pine, Engelmann spruce, white/grand fir).

Forest structure and avian communities will change fairly rapidly after a fire depending on differences in prey availability, size, distribution and age of snag habitat. Kotliar et al. (2002) reports in a review of literature associated with effects of fire and post-fire salvage logging that black-backed and three-toed woodpeckers rapidly colonize stand replacement burns within 1-2 years and are rare within 5 years due to declines in bark and wood boring beetles. In contrast, Lewis' woodpeckers have been found to be abundant in both recent (2-4 year) and older burns (10-25 years) which may be associated with arthropod prey availability and their preference for low density snag areas. Hairy woodpeckers and northern flickers have shown mixed responses but usually decline within the first 25 years post-fire while mountain and western bluebirds commonly nest in recently burned forests but decline in mid-successional stages. Maintenance of varied snag retention levels will provide for a suite of species and account for their differences in snag densities, sizes, and structure.

Snag recruitment will not occur for several decades. The montane mixed conifer and eastside mixed conifer habitat types show a small amount of recruitment by 2050 for small snags (≥10"dbh) and by 2060, increases in recruitment of small snags is much greater. Most of the ponderosa pine/Douglas-fir habitat type occurs outside the fire perimeter and green stands highly influence the pattern of snag densities over time. Recruitment of small snags continues to increase for approximately 25 years then levels out due to over-stocked stands and mortality from insects and competition. Recruitment of small snags will begin to provide foraging habitat for some species, however nesting habitat is still limited. Without nesting habitat, benefits of increased foraging habitat may not be fully realized and these areas may act as sink habitats until such time as snags capable of meeting minimum requirements for nesting are present.

Larger snags (≥20"dbh) will remain on the landscape longer than smaller snags however recruitment will be prolonged. The montane mixed conifer and eastside mixed conifer habitat types begin to show recruitment of 20"dbh snags around year 2090. Prior to this, stands are developing and trees are either not large enough or natural processes triggering mortality are still suppressed. However, in green stands not affected by the fire, recruitment has continued but at low levels. Fall down rates were exceeding recruitment rates. By 2090, natural processes like insect and competition mortality are occurring at levels to provide snag recruitment. At this time nesting habitat is available and populations of species dependent on snags should begin to recover and stabilize.

Mixed mortality stands and white fir dominated underburn stands will see continued snag recruitment over the next few years as trees damaged or stressed by the fire continue to die. This will provide elevated snag levels within green stands benefiting species that prefer more open stands adjacent to snag habitat like the northern flicker and mountain bluebird. Snag recruitment of larger snags will occur more continuously within these stands as well due to green tree replacements.

Danger tree removal will occur with the implementation of any alternative. Snag levels will be decreased however this is limited to a linear strip along roadways and concentrated use areas. Decreases will be neglible and will vary by alternative.

Effects Common to All Action Alternatives

Treatment will result in a decrease in snag densities, primarily snags ≥16"dbh. This will result in a decrease in habitat for species that require high density patches within units (e.g. black-backed woodpecker, hairy woodpecker). It will increase habitat for those species who utilize moderate to low density patches like Lewis' woodpeckers, northern flickers, and western bluebirds (Haggard and Gaines 2001, Saab and Dudley 1998, Saab et al. 2002, and Hejl and McFadzen 2000). However, habitat created by the fire is short term regardless of treatment or not.

Activity fuels will be cleaned up reducing risk within treatment stands. This reduction will be slight however, since only fuels generated by the activity will be reduced while non-merchantable material (typically <16"dbh) will still remain.

Treated areas would result in recovery of desired habitat components due to the planting of desired tree species. Ponderosa pine and Douglas-fir would dominate stand composition. Establishment of habitat in the mixed conifer and ponderosa pine/Douglas-fir habitat types would be most beneficial for species like the white-headed woodpecker, flammulated owl, pileated woodpecker, Williamson's sapsucker, and pygmy nuthatch. Ponderosa pine and Douglas-fir are preferred in most areas by cavity excavators (Hejl and McFadzen 2000, Hutto 1995, Haggard and Gaines 2001, and Lehmkuhl et al. 2003). These tree species tend to stand the longest, can accommodate cavities of any woodpecker species, and provide the most stable microclimate because of wood thickness (Bull et al. 1997, Everett et al. 1999). Sapwood decay in thick-barked species like ponderosa pine and Douglas-fir occurs more rapidly than thin-barked species which may provide suitable conditions for nesting sooner (Everett et al. 1999, Laudenslayer 2002, and Lehmkuhl et al. 2003). And larger diameter snags (>20"dbh) were found to be preferred for nesting for most cavity excavators as a group with the exception of the black-backed woodpecker (Bull et al. 1997, Hutto 1995, Saab and Dudley 1998, Hejl and McFadzen 2000, Laudenslayer 2002, and Saab et al. 2002).

Modeling included a thinning in 40 years post-fire, which would allow for the reintroduction of a more natural fire regime and aid in maintaining desired stand composition. Low density areas will have reduced fuel levels and will allow for the reintroduction of fire to maintain open stand conditions which will reduce competition to the remaining trees, accelerate growth, and lead to larger snags. Providing desired tree species on the acres treated will move stands closer to historic stand compositions and structure which will benefit species like the white-headed woodpecker, Williamson's sapsucker, and pileated woodpecker.

In addition to activity fuels treatments, supplemental fuels treatments are proposed for units where fuel levels exceed desired amounts. These would be prioritized for units occurring within defensible space zones, areas identified as fuel breaks, or units adjacent to existing spotted owl nesting, roosting, and foraging (NRF) habitat. Treatments would occur in units when overall fuel loadings exceed 40 tons per acre or where <3"dbh material exceeds 10 tons per acre. Treatment would aid in decreasing risk and would help in the reintroduction of fire which would help maintain desired stand composition and keep shrub levels low.

Approximately 71-77 miles of roads are proposed to be closed. This will lessen fragmentation and reduce the need for danger tree felling over time retaining additional habitat.

Table 3.94 displays the types of treatment, the mortality of the stand and the acres by alternative proposed for the action alternatives.

Table 3.94. Proposed treatments by alternative for the B&B Fire Recovery project area.

Treatment	Alternative 2	Alternative 3	Alternative 4	Alternative 5
HSV-SR	5,132	2,962	869	2,032
HSV-M	108	105	108	108
HSV-M-WF	867	553	565	857
HSV-UB-WF	260	142	142	260
SFP-SR	404	0	41	404
SFP-M	31	0	0	31
Total	**6,802**	**3,762**	**1,725**	**3,693**

HSV – Harvest by Salvage; SR – Stand Replacement; WF – White fir
SFP – Special Forest Product Removal; M - Mixed Mortality; UB - Underburned

Different snag retention strategies will be incorporated into each alternative. The approach described in Alternative 2 was designed to incorporate some needs of species who utilize low to moderate snag densities (i.e. Lewis' woodpecker, northern flicker, and western bluebird) in relation to a landscape of moderate to high snag densities resulting in a mosaic of snag densities across the landscape. The 2 most likely to persist snags will most likely be Douglas-fir or ponderosa pine since they remain standing the longest and consist of the larger size classes. Douglas-fir and ponderosa pine were found to be preferred by most cavity excavators (Hejl and McFadzen 2000, Hutto 1995, Haggard and Gaines 2001, and Lehmkuhl et al. 2004).

The approach in Alternative 3 would result in a mosaic of low density areas scattered between high density clumps and untreated areas where snags are more evenly distributed across the area. Low density areas will be less than Alternative 2 and may result in the reduced potential for reintroduction of fire to maintain stand densities and composition over time. Alternative 4 will use the same approach to snag retention as in Alternative 2 but harvest is only proposed for matrix lands. Alternative 5 will use a combination of snag retention strategies across the project area which varies by NWFP allocation (Matrix and LSR). By incorporating different approaches to snag retention, varied retention levels will provide for the array of species that depend on snag and down wood habitat while balancing the need for the development of more stable suitable habitat for other species like the spotted owl, American marten, pileated woodpecker, and bald eagle.

Ponderosa Pine Habitats – Lewis' Woodpecker, White-headed Woodpecker, and Pygmy Nuthatch

Alternative 1 – No Action
Direct and Indirect Effects

Snags will be retained at high densities throughout the project area. These densities may be too high for use by Lewis' woodpeckers in the short term (5-10 years). Saab et al. (2002) found that Lewis' woodpeckers favor stands with moderate canopy cover (40-70%) in a burned condition or selected nest sites with moderate densities of snags of large sizes. As time progresses, smaller snags will begin to fall (1-15 years) and large snags begin to decay increasing habitat suitability for the Lewis' woodpecker. Shrub levels will increase providing abundant foraging habitat but may prolong the establishment of the new stand. Habitat for the Lewis' woodpecker will increase until large snags are absent on the landscape (approx. 40-45 years).

Foraging and nesting opportunities exist where adjacent to green ponderosa pine dominated stands for the white-headed woodpecker and pygmy nuthatch. Stand replacement burned areas are not considered optimal habitat for these two species. Mixed mortality and underburned areas will continue to provide habitat as these areas will have decreased shrub levels and existing snag habitat in relation to foraging habitat for the short term. Shrub levels will continue to increase, especially in stand replacement burned areas decreasing habitat suitability and may result in increased predation risk by small mammals, especially for white-headed woodpeckers (Frenzel 2003).

It is estimated to take at least 200-300 years before nesting habitat develops in stand replacement areas largely due to the lack of a remaining conifer seed source prolonging the establishment of mature single-storied stands of ponderosa pine. In some stand replacement areas, field reconnaissance has found there is little to no conifer regeneration and brush species dominate. Shrub fields are likely to dominate for long periods of time further prolonging habitat establishment.

Fuel loadings are expected to increase, especially in 10-30 years as snags fall, putting remaining large snags and green stands at risk to loss resulting in reduced habitat availability. In addition, existing road densities will allow for the continued removal of danger trees reducing potential nesting and foraging habitat.

Tolerance levels found in DecAID for recent post fire habitat for ponderosa pine/Douglas-fir and Eastside Mixed Conifer habitat types were used to predict potential habitat across the project area within stand replacement areas and as a comparison between alternatives. Snag densities fall within the 80 percent tolerance level for the white-headed woodpecker on 16% of the project area and 20% of the project area for the Lewis' woodpecker. There are no tolerance levels available for the pygmy nuthatch.

Common to All Action Alternatives
Direct and Indirect Effects

Salvage will reduce large snag habitat. Areas outside the ponderosa pine PAG will provide post-fire habitat conditions for the Lewis' woodpecker. Large snag removal will reduce potential nesting habitat in addition to foraging habitat for the Lewis' woodpecker. However, Lewis' were found to be more abundant in partially logged burned forests and relatively rare in unlogged stands (Saab and Dudley 1998, Haggard and Gaines 2001, and Saab et al. 2002).

Only minimal acres of the ponderosa pine PAGs potentially impacting white-headed woodpeckers and pygmy nuthatches are proposed for treatment in each alternative. Treatment ranges from 9% (343 acres) of the ponderosa pine PAG in the project area for Alternative 2 to less than 1% (29 acres) for Alternative 4. Salvage in stands not adjacent to green ponderosa stands will likely have neglible effects to white-headed woodpeckers or pygmy nuthatches. These stands would be used primarily for foraging and abundant open foraging habitat will remain.

Treatments will not occur within mixed mortality and underburned ponderosa pine stands with minor exceptions. Treatments range from approximately 54 acres (Alternatives 2 and 5) to 17 acres (Alternatives 3 and 4). Trees in excess of those needed to meet snag retention guidelines with a low probability of survival will be harvested. This treatment will lessen habitat suitability by removing potential nest trees and foraging habitat particularly for the white-headed woodpecker and pygmy nuthatch. However, treatment will also result in lowered stand densities preferred by these species. This will likely not have as much impact on Lewis' woodpeckers due to the amount of post-fire habitat available.

Long-term, by planting desired tree species, more suitable habitat will be developed. This habitat will be more stable and resilient providing for longer term habitat. Planting and subsequent treatments (fuels treatments) will decrease shrub levels leading stands in a trajectory for the reintroduction of fire and the development of single-storied ponderosa pine stands. Decreased shrub levels will likely reduce the habitat quality for Lewis' woodpeckers by reducing foraging opportunities but will enhance habitat conditions for white-headed woodpeckers. Fuels treatments will also reduce the risk to remaining large snags and green stands.

Danger trees are proposed to be removed along haul routes and within high use recreation areas. This has the potential to remove large trees suitable for nesting and foraging. This impact is expected to be minor in scope as it is limited to a linear strip along roadways and within high recreation areas. Alternative 2 treats the most miles of haul routes and acres of high use areas resulting in the most potential impact to habitat while Alternative 4 treats the least. In addition, road closures are proposed under each alternative (approximately 71 miles for Alternatives 2-4 and 77 miles for Alternative 5). This will decrease the miles of road requiring danger tree removal retaining more snags for nesting and foraging. Wisdom et al. (2000) noted that roads lead to snags being cut for both safety concerns and for firewood use and suggests reducing road densities to reduce the need for snag removal for the white-headed woodpecker and pygmy nuthatch.

Alternative 2
Direct and Indirect Effects

The snag retention approach in this alternative will provide for clumped habitat preferred by Lewis' woodpecker for nesting adjacent to more open habitat for foraging increasing the available habitat. Saab and Dudley (1998) found Lewis' woodpeckers used the most open nest sites (24.7 $\pm$ 2.3 trees >9"dbh per acre) however selected nest sites with higher tree densities than measured at random unlogged controls suggesting they select for clumped areas rather than uniformly spaced snags. Nesting habitat initially may be limited to those pre-existing snags that survived the fire and have the decay conditions Lewis' woodpeckers prefer.

Planting 289 acres within ponderosa pine stand replacement units to develop open ponderosa pine habitat with little understory will benefit the white-headed woodpecker and pygmy nuthatch.

Tolerance levels found in DecAID for recent post fire habitat for ponderosa pine/Douglas-fir and Eastside Mixed Conifer habitat types were used to predict potential habitat across the project area within stand replacement areas and as a comparison between alternatives. Snag densities fall within the 80 percent tolerance level for the white-headed woodpecker on 14% of the project area and 17% of the project area for the Lewis' woodpecker. There are no tolerance levels available for the pygmy nuthatch. Although snag densities meet levels described for white-headed woodpeckers in DecAID, stand replacement habitat is not preferred by this species as it lacks green canopy.

Alternative 3
Direct and Indirect Effects

The snag retention approach in this alternative would provide habitat for the Lewis' woodpeckers but will not be as preferred as Alternative 2. As mentioned earlier, Lewis' woodpeckers were found to be more abundant in partially logged burned forests than in unlogged forests (Saab and Dudley 1998). Therefore, reducing snag densities within harvest units will provide for more suitable habitat conditions. However, snags will be more uniformly distributed across the area and will not provide for clumping per se unless naturally arranged in that fashion. Lewis' woodpeckers may not use these areas for nesting as they have been found to select for higher density clumps (Saab and Dudley 1998, Saab et al. 2002).

Fewer stand replacement acres are proposed for harvest under this alternative and will not result in as much benefit as Alternative 2 to white-headed woodpeckers and pygmy nuthatches. Approximately 95 acres will be planted to achieve long term suitable habitat conditions.

Snag densities fall within the 80 percent tolerance level for the white-headed woodpecker on 15% of the project area and 19% of the project area for the Lewis' woodpecker. There are no tolerance levels available for the pygmy nuthatch.

Alternative 4
Direct and Indirect Effects

The snag retention approach for Alternative 4 is the same as in Alternative 2 with the only difference being Alternative 4 only treats stands within matrix. The snag retention approach in this alternative will provide for clumped habitat preferred by Lewis' woodpecker for nesting adjacent to more open habitat for foraging increasing the available habitat. Saab and Dudley (1998) found Lewis' woodpeckers used the most open nest sites (24.7 $\pm$ 2.3 trees >9"dbh per acre) however selected nest sites with higher tree densities than measured at random unlogged controls suggesting they select for clumped areas rather than uniformly spaced snags. Nesting habitat initially may be limited to those pre-existing snags that survived the fire and have the decay conditions Lewis' woodpeckers prefer.

There are very few acres of stand replacement habitat proposed for planting in this alternative due to harvest within matrix allocations only. Approximately 12 acres of stand replacement are proposed having the least benefits to white-headed woodpeckers and pygmy nuthatches of all action alternatives.

Snag densities fall within the 80 percent tolerance level for the white-headed woodpecker on 15% of the project area and 20% of the project area for the Lewis' woodpecker very similar to the No Action Alternative. There are no tolerance levels available for the pygmy nuthatch.

Alternative 5
Direct and Indirect Effects

There are two snag retention approaches included in Alternative 5. For stands within matrix, the approach is the same as in Alternative 2. However, for stands within the LSR, all Douglas-fir and ponderosa pine snags greater than 20"dbh will be retained.

The snag retention approach in the Matrix allocation will provide for clumped habitat preferred by Lewis' woodpecker for nesting adjacent to more open habitat for foraging increasing the available habitat. Saab and Dudley (1998) found Lewis' woodpeckers used the most open nest sites (24.7 ± 2.3 trees >9"dbh per acre) however selected nest sites with higher tree densities than measured at random unlogged controls suggesting they select for clumped areas rather than uniformly spaced snags. Nesting habitat initially may be limited to those pre-existing snags that survived the fire and have the decay conditions Lewis' woodpeckers prefer.

The snag retention approach in LSR would provide for Lewis' woodpecker habitat as well. Several studies have shown that Lewis' woodpeckers select for the largest snags out of all cavity excavators that use post-fire habitat (Saab and Dudley 1998, Saab et al. 2002). Wildlife data for recent post-fire habitat found in DecAID (PPDF_O.sp.20) show nest trees used by Lewis' woodpeckers ranged from 13.9"dbh to 25.7"dbh. Therefore, by retaining all large snags of tree species more likely to remain on the landscape for a longer time, we are providing for longer lasting nesting habitat for the Lewis' woodpecker. However, clumped conditions preferred by Lewis's woodpeckers may not be at optimal levels and will reflect the natural distribution of large snags within harvest units.

Approximately 70 acres of stand replacement acres are proposed for planting in this alternative having fewer benefits to white-headed woodpeckers and pygmy nuthatches than Alternatives 2 and 3.

Snag densities fall within the 80 percent tolerance level for the white-headed woodpecker on 14% of the project area and 18% of the project area for the Lewis' woodpecker. There are no tolerance levels available for the pygmy nuthatch.

Mixed Conifer Habitats – Williamson's Sapsucker and Pileated Woodpecker

Alternative 1 – No Action
Direct and Indirect Effects

Habitat for the Williamson's sapsucker and pileated woodpecker will remain limited over the watershed, especially within the fire area, for a long time. Stand replacement areas are estimated to take in excess of

300-400 years to reach suitable habitat conditions. Mixed severity and underburned stands will take shorter time periods to achieve suitable habitat conditions, taking approximately 100-200 years. Further declines in potentially suitable habitat are expected in white fir dominated stands as they will continue to experience mortality where stands were impacted by fire at all due to the thin bark of white fir and its intolerance to damage.

It is estimated to take at least 300-400 years before nesting habitat develops in the stand replacement areas largely due to the lack of a remaining conifer seed source prolonging the establishment of suitable habitat conditions. In some stand replacement areas, field reconnaissance has found there is little to no conifer regeneration and brush species dominate. Shrub fields could dominate for long periods of time further prolonging habitat establishment. In other areas, white fir was the dominant species and seed source. Habitat may never be achieved as white fir dominated stands are short-lived (80-120 years), vulnerable to insects, disease, and fire, and most trees never reach the sizes needed for nesting for these species.

There is no recent post fire data in DecAID for Williamson's sapsuckers and pileated woodpeckers as these species have not been documented to use post fire habitat. While snag levels may be high across the watershed it does not mean there would be habitat for these two species. Foraging habitat would be present but it is questionable if nesting habitat would be available. And although some snags may remain standing for a longer period, they probably will not persist until stands become habitat for these two species.

All Action Alternatives
Direct and Indirect Effects

Habitat for the Williamson's sapsucker and pileated woodpecker will remain limited over the watershed, especially within the fire area, for a long time. Stand replacement areas are estimated to take approximately 200-300 years to reach suitable habitat conditions, sooner than the No Action alternative due to the planting of desired tree species. Mixed severity and underburned stands will take shorter time periods to achieve suitable habitat conditions, approximately 100 to 200 years.

Further declines in potentially suitable habitat are expected in white fir dominated stands as they will continue to experience mortality where stands were impacted by fire at all due to the thin bark of white fir and its intolerance to damage. Harvest of low probability of survival trees (all species in matrix and only white fir <28"dbh in LSR) will occur in identified white fir dominated stands resulting in more open stands. This may decrease potential habitat suitability in the short term but the overall result will be a decrease in risk to existing habitat components and a shift to more desired species composition which will promote long term habitat development. Retention of larger snags (i.e. white fir ≥28"dbh) will retain potential nesting and foraging habitat in the short term lessening impacts.

Alternative 4 (because it treats fewer acres overall) and LSR units in Alternative 5 would retain more short-term foraging habitat (retention of low probability of survival Douglas-fir and ponderosa pine) but may result in the reduced potential for reintroduction of fire to maintain stand densities and composition over time due to higher fuel levels. Matrix units would result in a mosaic of low density areas in a landscape of high density snags. However, although they may remain standing for a longer period, these probably will not persist until stands become habitat for these two species. Alternatives 2 and 5 treat the most acres of white fir dominated stands (1127 acres) while Alternatives 3 and 4 treat less acres (695 and 707 acres respectively).

Planting of desired tree species will occur with the implementation of these alternatives. This will result in more stable, long-lived habitat. Low density areas will have reduced fuel levels and will allow for the reintroduction of fire to maintain open stand conditions which will reduce competition to the remaining trees, accelerate growth, and lead to larger snags. Providing desired tree species on the acres treated will move stands closer to historic stand compositions and structure which will benefit these species. Alternative 2 would plant the most acres (6802 acres) resulting in the development of more long term habitat while Alternative 4 plants the fewest acres (1,725 acres).

While snag levels may be high across the watershed that does not mean there would be habitat for these two species. Foraging habitat would be present but it is questionable if nesting habitat would be available. Therefore, there should be no short-term impacts to these species.

Fuels treatments will occur in proposed units resulting in reduced downed wood levels. Down wood is an important source of food for pileated woodpeckers as it decays and supports carpenter ant and insect populations. DecAID reported levels of down wood used by pileated woodpeckers generally exceeded what was found across the landscape in CVS plots. Therefore retention of dense pockets of down material will benefit pileated woodpeckers by providing additional foraging areas. These areas should be balanced with the need to reintroduce fire and to reforest. Contiguous high fuel levels could contribute to future high intensity fires.

Mosaic Habitats – Flammulated Owl, Mountain Bluebird, and Northern Flicker

Alternative 1 – No Action
Direct and Indirect Effects

Habitat for the flammulated owl would remain limited over the project area, especially within stand replacement areas for a long time. It is estimated to take at least 300-400 years before nesting habitat develops in the stand replacement areas largely due to the lack of a remaining conifer seed source prolonging the establishment of suitable habitat conditions. In some stand replacement areas, field reconnaissance has found there is little to no conifer regeneration and brush species dominate. Shrub fields could dominate for long periods of time further prolonging habitat establishment. In other areas, white fir was the dominant species and seed source. Habitat may never be achieved as white fir dominated stands are short-lived (80-120 years), vulnerable to insects, disease, and fire, and most trees never reach the sizes needed for nesting for these species. Mixed severity and underburned stands will take shorter time periods to achieve suitable habitat conditions, taking approximately 100-200 years.

Further declines in potentially suitable flammulated owl habitat are expected in white fir dominated stands as they will continue to experience mortality where stands were impacted by fire at all due to the thin bark of white fir and its intolerance to damage. These stands may provide short term potential habitat if existing snags are large enough. Further mortality will result in more open stands reducing overall stand densities. Grassy understories will also be present for the short term providing potential habitat. White fir is expected to regenerate in these stands (as shown by field reconnaissance) and in 30-60 years may provide suitable habitat resulting in stands with large snags, dense regeneration and some open understory habitat.

Snags will be retained at high densities throughout the project area providing habitat for both the mountain bluebird and northern flicker. As snags begin to fall creating diverse habitats, habitat quality will increase slightly for both species. These species can utilize a wide range of snag densities but as shrubs and stands begin to recover, habitat will decrease. Saab, Dudley, and Thompson (2004) found that approximately 70% of original nest cavities were created by northern flickers and hairy woodpeckers. The flicker is a strong excavator and strong excavators are needed to provide cavities for weak excavators (i.e. Lewis' woodpecker) and non-excavators (i.e. mountain bluebird) (Saab, Dudley, and Thompson 2004). Therefore, providing habitat for the northern flicker will also benefit other primary and secondary cavity excavators.

Fuels loadings will increase as snags fall. This will provide for ample foraging opportunities for these species in the short term, however, as shrubs levels increase, foraging habitat will be decreased. High fuel loadings will also put existing habitat elements (green trees) at increased risk of loss.

Existing road densities will allow for continued danger tree removal along roads and within recreation use areas. This will reduce potential nest trees, especially where these snags are within green habitat or adjacent.

Tolerance levels found in DecAID for recent post fire habitat for ponderosa pine/Douglas-fir and Eastside Mixed Conifer habitat types were used to predict potential habitat across the project area within stand replacement areas and as a comparison between alternatives. There is minimal habitat meeting the 80 percent tolerance level for either the mountain bluebird or northern flicker. This may be in part to the number of snags >20"dbh required per acre for both species (12.4 to 38.0 snags/ac for the mountain bluebird and 2.2 to 39.6 snags/acre for the northern flicker). Snags per acre listed for the 80 percent level may be from plots containing inclusions of high density snags. These site-specific conditions are difficult to capture since our analysis based on stand averages. These high snag densities may be outliers and a condition of the area and habitat type the research study was conducted in. In addition, snags per acre was extrapolated from a small plot size (0.04 ha) centered on the nest site which may have captured an inclusion of high density large snags within a larger burned area. In excess of 30 snags per acre greater than 20"dbh is not a normal occurrence for our landscape.

Snag densities fall within the 50 percent tolerance level for the mountain bluebird on 36% of the project area and 21% of the project area for the northern flicker. There are no tolerance levels available for the flammulated owl.

Common to All Action Alternatives
Direct and Indirect Effects

Suitable habitat for the flammulated owls will still remain limited across the project area however habitat could be achieved sooner (estimated to take 200-300 years as opposed to 300-400 years for the No Action Alternative) due to the planting of desired tree species. The immediate goal and objective will be to grow the large trees first and foremost. Reforestation will focus on providing a mix of Douglas-fir and ponderosa pine at densities that will ultimately provide large trees and large snags. Moving stands toward more historic conditions of open grown stands may allow for greater occupancy in the project area especially for the flammulated owl and northern flicker. Non-treated areas are expected to remain as early seral habitat for a long period of time especially where dominated by shrubs. This juxtaposition of habitat may be suitable for bluebird occupancy as well. In addition, fuels treatments will occur reducing shrub levels, reducing risk, and providing more potential for the establishment and maintenance of grassy openings which will allow for ground foraging opportunities providing foraging habitat for a longer period of time.

Further declines in potentially suitable habitat are expected in white fir dominated stands as they will continue to experience mortality where stands were impacted by fire at all due to the thin bark of white fir and its intolerance to damage. Harvest of low probability of survival trees (all species in matrix and only white fir <28"dbh in LSR) will occur in identified white fir dominated stands resulting in more open stands. This may decrease potential habitat suitability in the short term by removing potential nest trees but the overall result will be a decrease in risk to existing habitat components and a shift to more desired species composition which will promote long term habitat development. Retention of larger snags (i.e. white fir ≥28”dbh) will retain potential nesting and foraging habitat in the short term lessening impacts. Alternatives 2 and 5 treat similar amounts (1,235 and 1,225 acres respectively) while Alternatives 3 and 4 treat are similar (800 and 815 acres respectively).

Danger trees are proposed to be removed along haul routes and within high use recreation areas. This has the potential to remove large trees suitable for nesting and foraging. This impact is expected to be minor in scope as it is limited to a linear strip along roadways and within high recreation areas. Alternative 2 treats the most miles of haul routes and acres of high use areas resulting in the most potential impact to habitat while Alternative 4 treats the least. In addition, road closures are proposed under each alternative (approximately 71 miles for Alternatives 2-4 and 77 miles for Alternative 5). This will decrease the miles of road requiring danger tree removal retaining more snags for nesting and foraging.

Alternative 2
Direct and Indirect Effects

The snag retention approach in this alternative would provide for open foraging habitat in relation to high density snag patches. Overall snag densities will be reduced on treatment acres. However 15% retention patches will provide high density clumps adjacent to openings providing diverse habitat conditions (i.e. edge in relation to high densities) sooner than the No Action alternative for the mountain bluebird providing potential habitat. However, Saab and Dudley (1998) found mountain bluebirds preferred unlogged sites. This retention strategy will provide foraging habitat primarily within treatment units for the northern flicker. High densities of large snags will not occur as found by Saab and Dudley (1998) to be preferred by flickers for nesting.

Snag densities fall within the 80 percent tolerance level for the mountain bluebird and northern flicker on less than 1% of the project area. Snag densities fall within the 50 percent tolerance level for the mountain bluebird on 31% of the project area and 18% of the project area for the northern flicker.

Alternative 3
Direct and Indirect Effects

The snag retention approach in this alternative would provide primarily foraging habitat for the mountain bluebird. High density snag patches will not occur with this alternative and therefore, will not provide preferred nesting habitat conditions reported for the bluebird. Habitat will be provided for the northern flicker. Haggard and Gaines (2001) reported that flickers nested most often in stands with medium snag densities (6-14 snags/acre). Therefore, snag densities will range from 6.5 snags/acre to 12.9 snags/acre for most of the project area. It is probable that more snags per acre will be retained since <12”dbh material will not be harvested. However, Saab and Dudley (1998) found that flickers select nest sites with a higher density of large trees. This snag retention strategy focuses on leaving a range of size classes to provide for an array of species needs. And although densities will be within the desired range, the number of large snags retained may be too low for nesting in many of the proposed units.

Snag densities fall within the 80 percent tolerance level for the mountain bluebird and northern flicker on less than 1% of the project area. Snag densities fall within the 50 percent tolerance level for the mountain bluebird on 33% of the project area and 20% of the project area for the northern flicker.

Alternative 4
Direct and Indirect Effects

The snag retention approach in Alternative 4 is the same as in Alternative 2 with the only difference being Alternative 4 only treats stands occurring within matrix. The snag retention approach in this alternative will provide for open foraging habitat in relation to high density snag patches. Overall snag densities will be reduced on treatment acres. However 15% retention patches will provide high density clumps adjacent to openings providing diverse habitat conditions (i.e. edge in relation to high densities) sooner than the No Action alternative for the mountain bluebird providing potential habitat. However, Saab and Dudley (1998) found mountain bluebirds preferred unlogged sites. This retention strategy will provide foraging habitat primarily within treatment units for the northern flicker. High densities of large snags will not occur as found by Saab and Dudley (1998) to be preferred by flickers for nesting.

Snag densities fall within the 80 percent tolerance level for the mountain bluebird and northern flicker on less than 1% of the project area. Snag densities fall within the 50 percent tolerance level for the mountain bluebird on 36% of the project area and 21% of the project area for the northern flicker.

Alternative 5
Direct and Indirect Effects

There are two snag retention strategies included in Alternative 5. The snag retention approach in the matrix allocation in this alternative will provide for open foraging habitat in relation to high density snag patches. Overall snag densities will be reduced on treatment acres. However 15% retention patches will provide high density clumps adjacent to openings providing diverse habitat conditions (i.e. edge in relation to high densities) sooner than the No Action alternative for the mountain bluebird providing potential habitat. However, Saab and Dudley (1998) found mountain bluebirds preferred unlogged sites. This retention strategy will provide foraging habitat primarily within treatment units for the northern flicker. High densities of large snags will not occur as found by Saab and Dudley (1998) to be preferred by flickers for nesting.

The snag retention approach in the LSR allocation will provide potential nest sites for the mountain bluebird and northern flicker. Wildlife data for recent post-fire habitat found in DecAID (EMC_O.sp-20) show nest trees used by mountain bluebirds ranged from 6.7" to 21.5"dbh and nest trees used by northern flickers ranged from 10.1" to 23.8"dbh. Similar findings occur for ponderosa pine/Douglas fir post-fire habitat (PPDF_O.sp-20) types as well (3.4" to 26.6"dbh for the bluebird and 11.5" to 24.4"dbh for the flicker) (Mellen et al. 2003). Therefore, retaining large snags will provide potential nesting habitat for these two species. However, high density snag patches will not occur within treatment units for this alternative potentially reducing habitat suitability for the mountain bluebird. Depending upon the arrangement of large snags, habitat will be provided for the flicker. Saab and Dudley (1998) found the flicker to select for high densities of large snags.

Snag densities fall within the 80 percent tolerance level for the mountain bluebird and northern flicker on less than 1% of the project area. Snag densities fall within the 50 percent tolerance level for the mountain bluebird on 33% of the project area and 20% of the project area for the northern flicker.

Lodgepole Pine Habitats – Black-backed Woodpecker

All Alternatives
Direct and Indirect Effects

Natural succession will occur throughout this habitat type. Development of mature or old growth lodgepole pine to the size and density where it would again host bark beetle populations is expected to take approximately 60-100 years. Therefore there will be a decline in local populations for approximately 50-90 years until stands recover providing a more constant food supply on a smaller percentage of the area.

There is no harvest prescribed for the lodgepole pine habitat type as this habitat type is considered to be within the range of historic variability (Fire Regime 4). Snag densities will be retained at high densities providing short term habitat (5 years) for the black-backed woodpecker. High density patches outside the lodgepole pine habitat type will also provide short term habitat. Black-backed woodpecker populations are expected to increase over the next 5 years until bark beetle and wood borer larvae decline.

Recent Post-fire Habitats – Black-backed Woodpecker

Alternative 1 – No Action
Direct and Indirect Effects

Existing snag densities will be retained throughout the project area including areas considered highly suitable for black-backeds (i.e. high density patches with >126.1 snags/acre >10"dbh) (Saab and Dudley 1998). It is expected that populations will erupt following the emergence of larval bark and wood boring beetles. As insect populations decline, woodpecker populations will follow shortly after declining over much of the project area.

Snag densities fall within the 80 percent tolerance level for the black-backed woodpecker on 7% of the project area.

Common to All Action Alternatives
Direct and Indirect Effects

A slight reduction in the amount of high density snag patches occurs with treatments proposed in the action alternatives with the exception of Alternative 4. Alternative 4 does not harvest any habitat meeting the 80 percent tolerance level as in the No Action Alternative. This reduction is slight; however it may result in slightly reduced population levels occurring within the project area.

Snag densities fall within the 80 percent tolerance level for the black-backed woodpecker on 6% of the project area for Alternatives 2, 3, and 5 and on 7% of the project area for Alternative 4.

Comparison of Alternatives

Post harvest there is little difference in snag distribution across the watershed from the existing condition for each habitat type. After 40 years there are virtually no differences. In montane mixed conifer and lodgepole pine habitat types there are no differences as there is no harvest occurring in these habitat types.

Alternative 4 provides the greatest density of snags over a greater percentage of the area. However, this difference is very slight. At 40 years post-harvest, this difference is virtually non-existent. And when comparing benefits realized long-term by planting desired tree species and treatment of associated fuels resulting in reduced risk, Alternative 2 would provide the greatest overall benefits albeit these may not be realized for several decades.

SNAGS
Comparison of Alternatives

Figures 3.15 through 3.18 compare snag density distributions by Alternative. Year 2006 is used to represent post-harvest conditions. There is no harvest within Montane Mixed Conifer Stands so alternatives are identical.

Figure 3.15. Upper Metolius Watershed Snag Distributions (10 Inches or Greater) for Eastside Mixed Conifer Stands

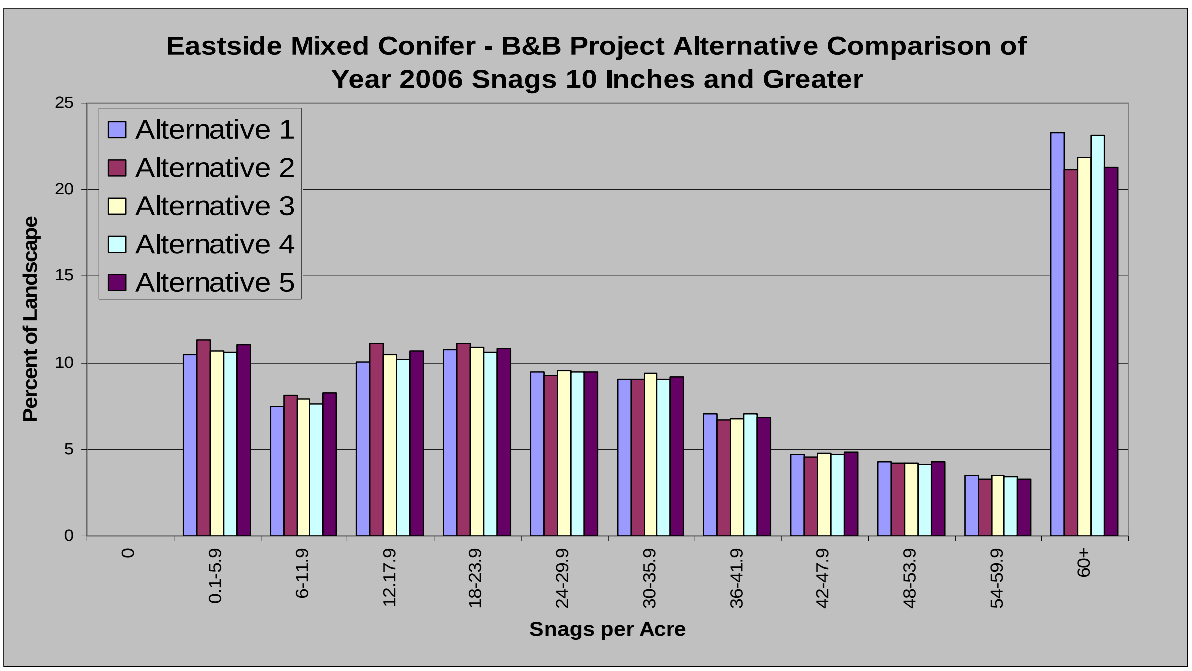


Figure 3.16. Upper Metolius Watershed Snag Distributions (20 Inches or Greater) for Eastside Mixed Conifer Stands.

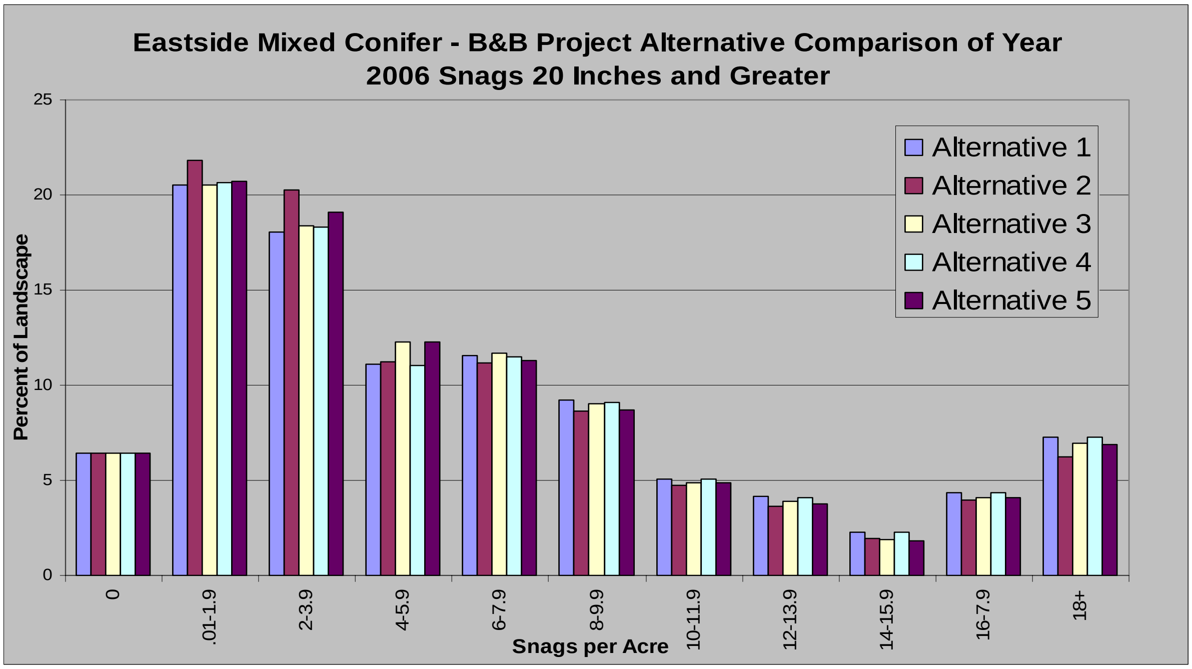


Figure 3.17. Upper Metolius Watershed Snag Distributions (10 Inches or Greater) for Ponderosa Pine/Douglas-fir Stands.

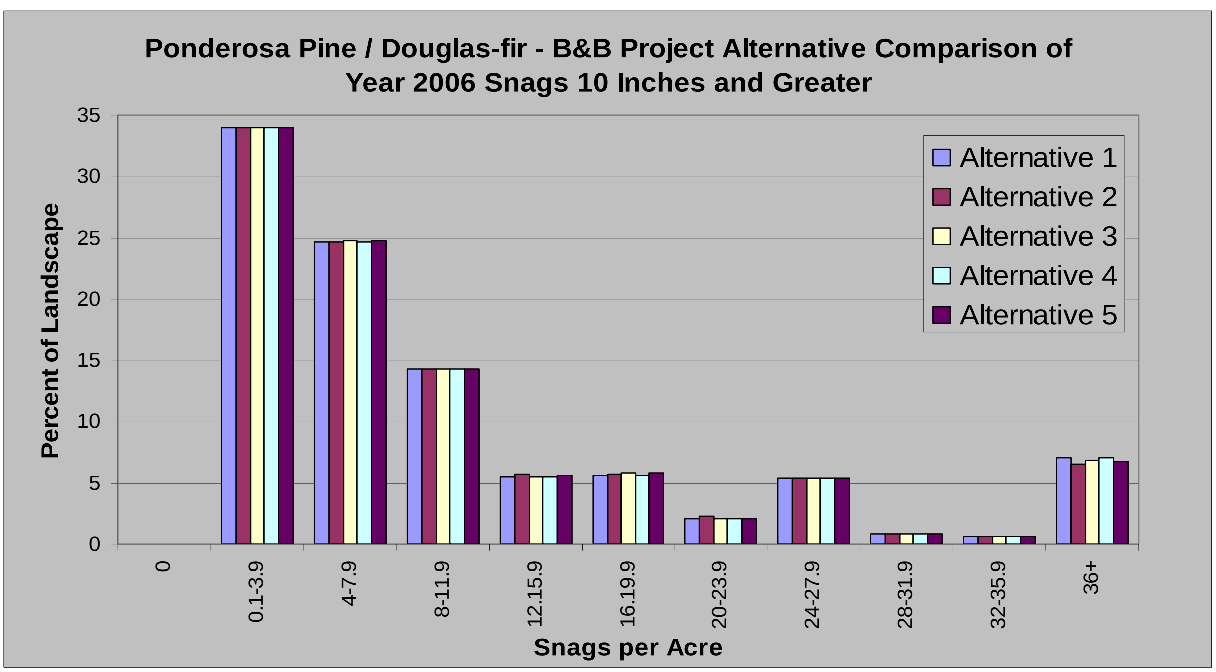
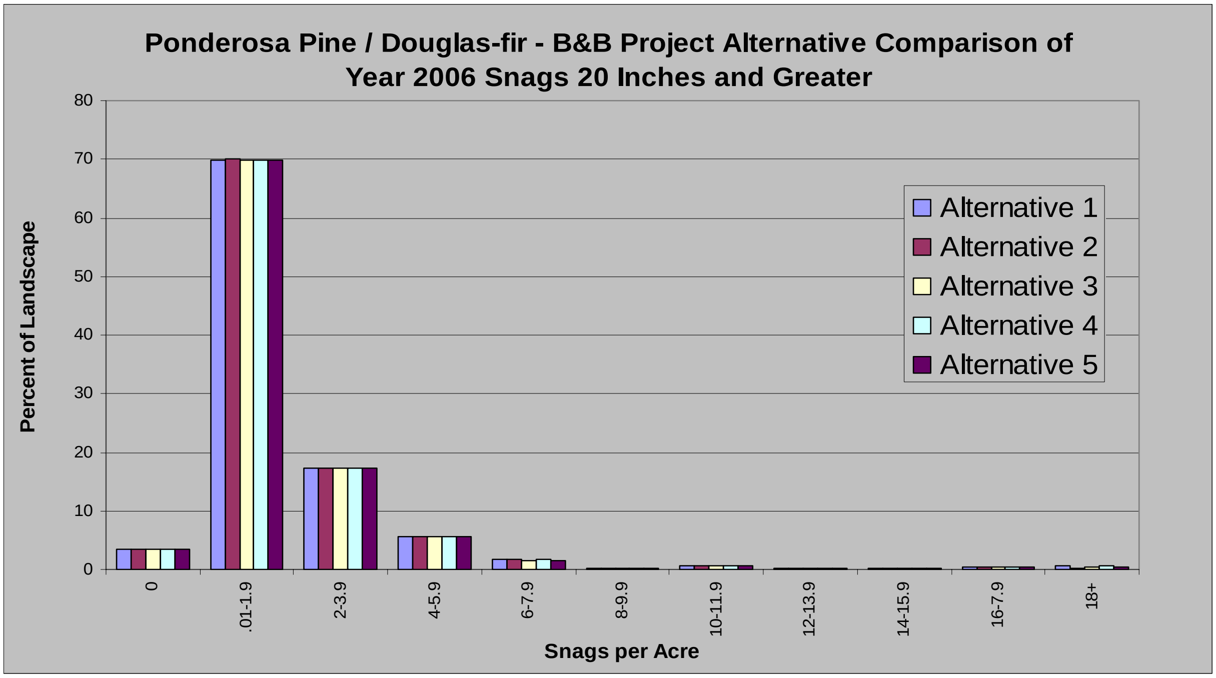


Figure 3.18. Upper Metolius Watershed Snag Distributions (20 Inches or Greater) for Ponderosa Pine/Douglas-fir Stands.



Utilizing FVS-FFE model runs snag dynamics overtime can be projected. Figures 3.19 through 3.26 show the comparison of alternatives using the 50% and greater tolerance level and 80% or greater tolerance level for small and medium trees by habitat type. The 50 and 80 percent tolerance levels are shown to illustrate the differences in high snag densities over time as most cavity excavators have been shown to need this unique habitat to sustain populations. The small and medium tree structural condition is used as it best represents the condition of the Upper Metolius Watershed.

Alternatives will have some short term effects on snag densities up to 2030 when smaller snags begin to fall for eastside mixed conifer. Larger snags will remain for a longer period of time (2050) but effects are similar across the watershed (Figures 3.19-3.22). A different pattern is shown for ponderosa pine/Douglas-fir habitat. Most of the ponderosa pine/Douglas-fir habitat type occurs outside the fire perimeter and green stands highly influence the pattern of snag densities over time. Recruitment of small snags continues to increase for approximately 25 years then levels out due to over-stocked stands and mortality from insects and competition. For the larger snags in the ponderosa pine/Douglas-fir habitat type, a bark beetle epidemic was modeled at year 2050 and a sharp increase results (Figures 3.23-3.26). Appendix X describes how snag modeling was accomplished.

Figure 3.19. Upper Metolius Watershed Snag Densities (> 50% tolerance level) through time (10 Inches or Greater) for Eastside Mixed Conifer Stands. Tolerance Levels acquired from unharvested inventory plots containing measurable snags (Figure EMC_ECB_S.inv-2).

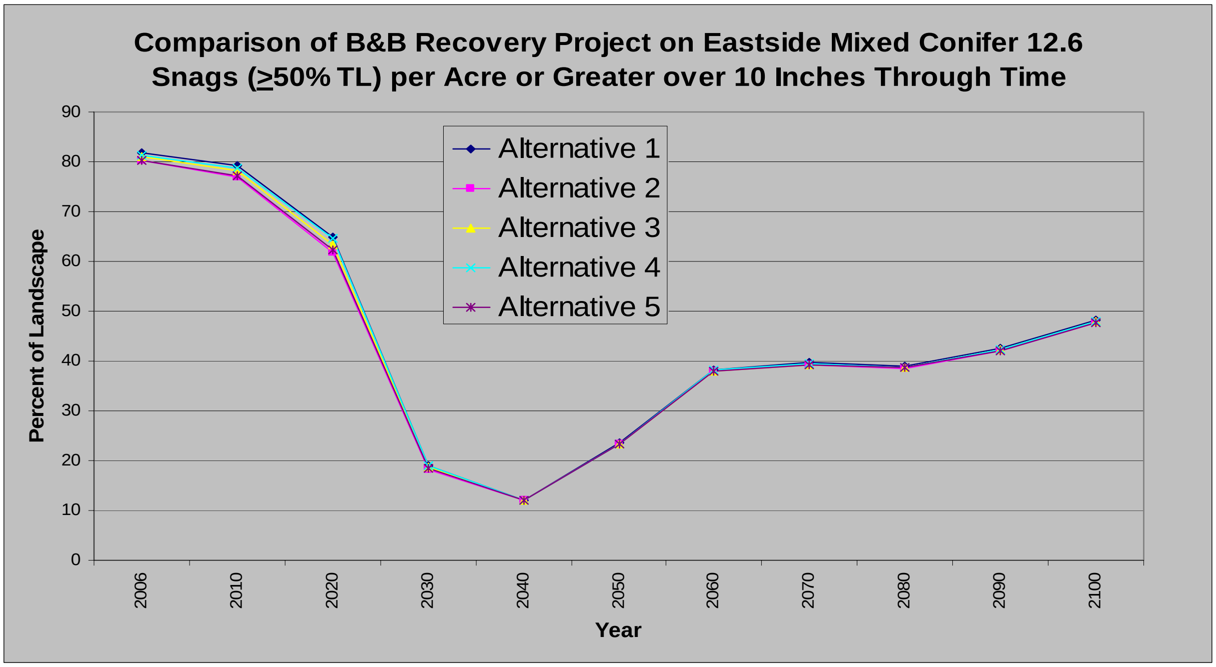


Figure 3.20. Upper Metolius Watershed Snag Densities (> 80% tolerance level) through time (10 Inches or Greater) for Eastside Mixed Conifer Stands. Tolerance Levels acquired from unharvested inventory plots containing measurable snags (Figure EMC_ECB_S.inv-2).

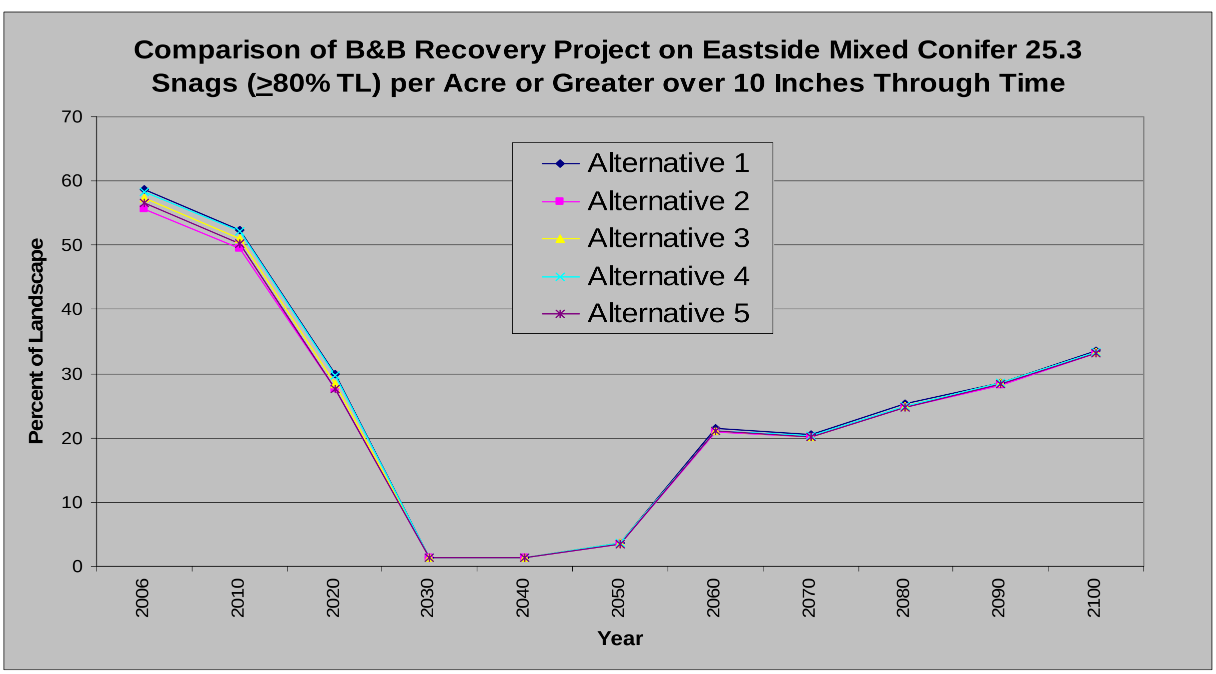


Figure 3.21. Upper Metolius Watershed Snag Densities (≥ 50% tolerance level) through time (20 Inches or Greater) for Eastside Mixed Conifer Stands. Tolerance Levels acquired from unharvested inventory plots containing measurable snags (Figure EMC_ECB_S.inv-3).

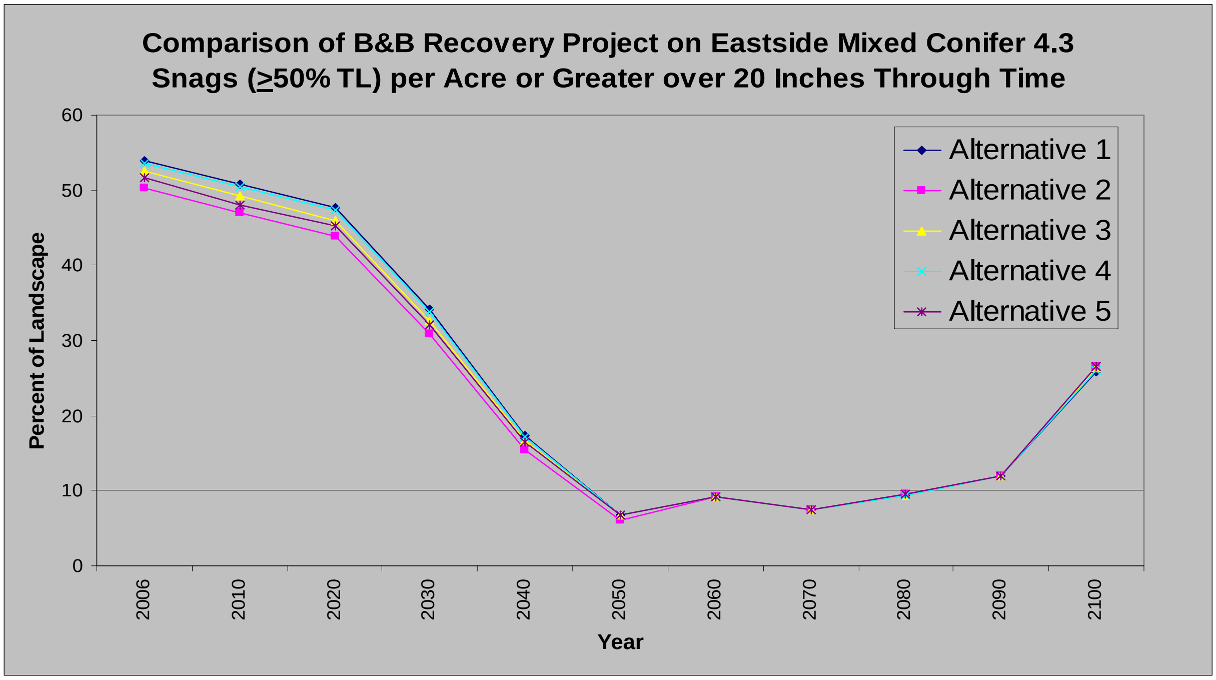


Figure 3.22. Upper Metolius Watershed Snag Densities (≥ 80% tolerance level) through time (20 Inches or Greater) for Eastside Mixed Conifer Stands. Tolerance Levels acquired from unharvested inventory plots containing measurable snags (Figure EMC_ECB_S.inv-3).

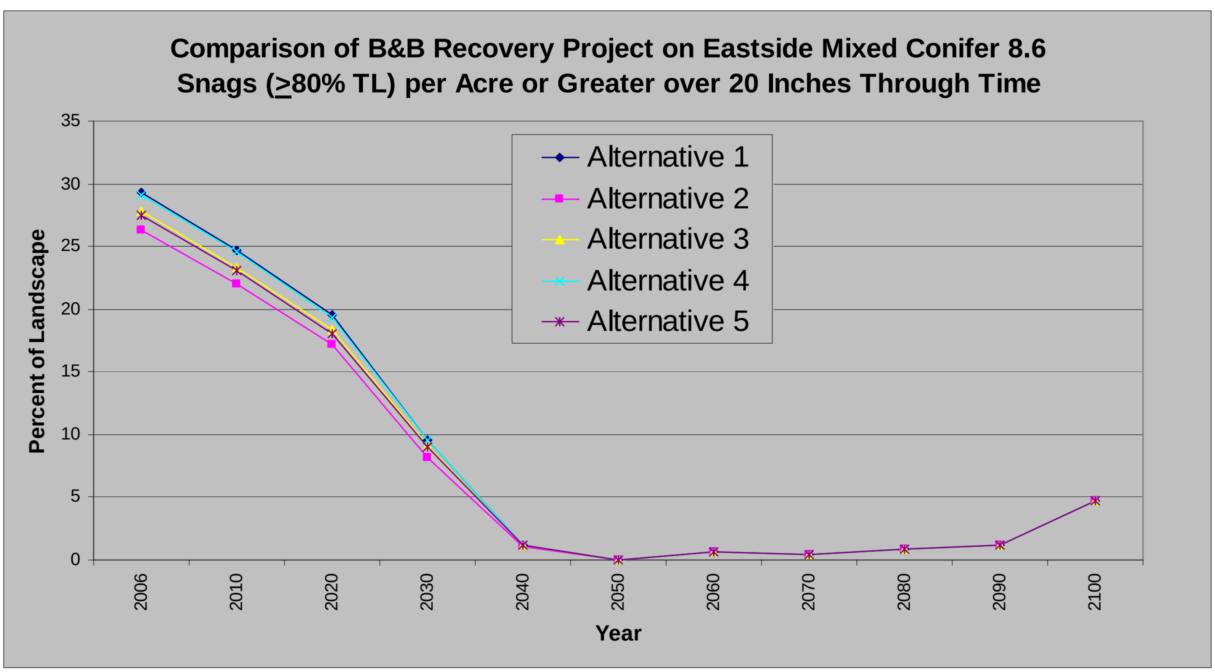


Figure 3.23. Upper Metolius Watershed Snag Densities (≥ 50 % tolerance level) through time (10 Inches or Greater) for Ponderosa Pine / Douglas-fir Stands. Tolerance Levels acquired from unharvested inventory plots containing measurable snags (Figure PPDF_S.inv-2).

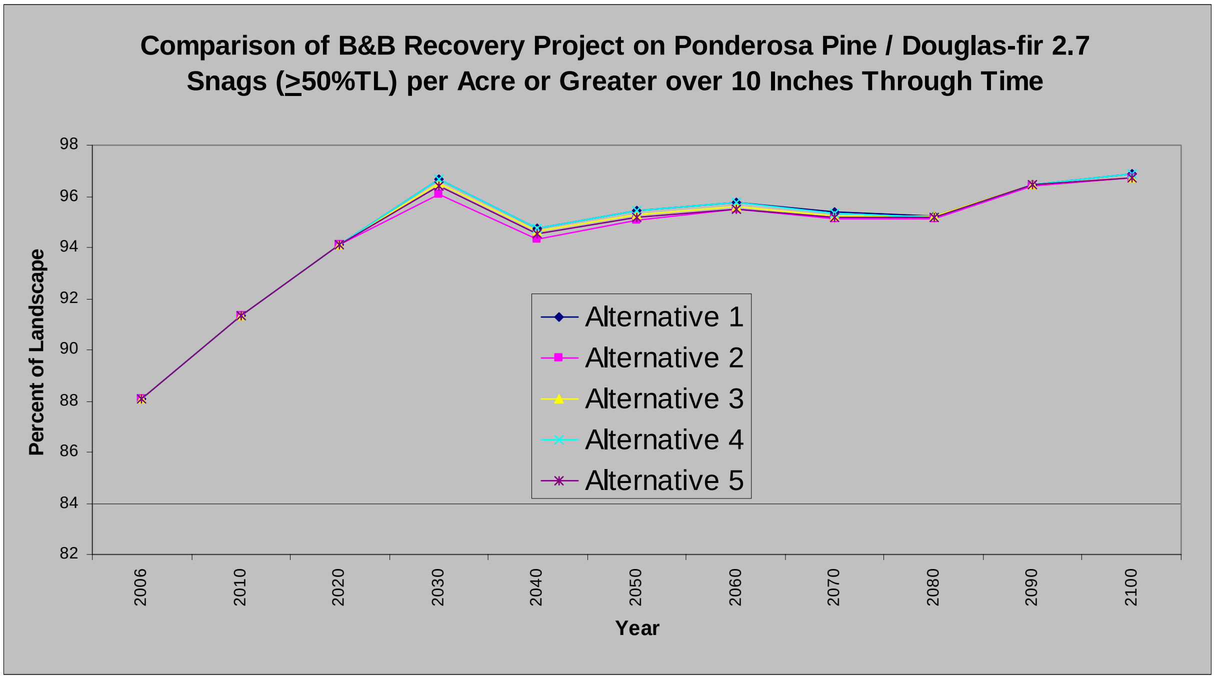


Figure 3.24. Upper Metolius Watershed Snag Densities (≥ 80 % tolerance level) through time (10 Inches or Greater) for Ponderosa Pine / Douglas-fir Stands. Tolerance Levels acquired from unharvested inventory plots containing measurable snags (Figure PPDF_S.inv-2).

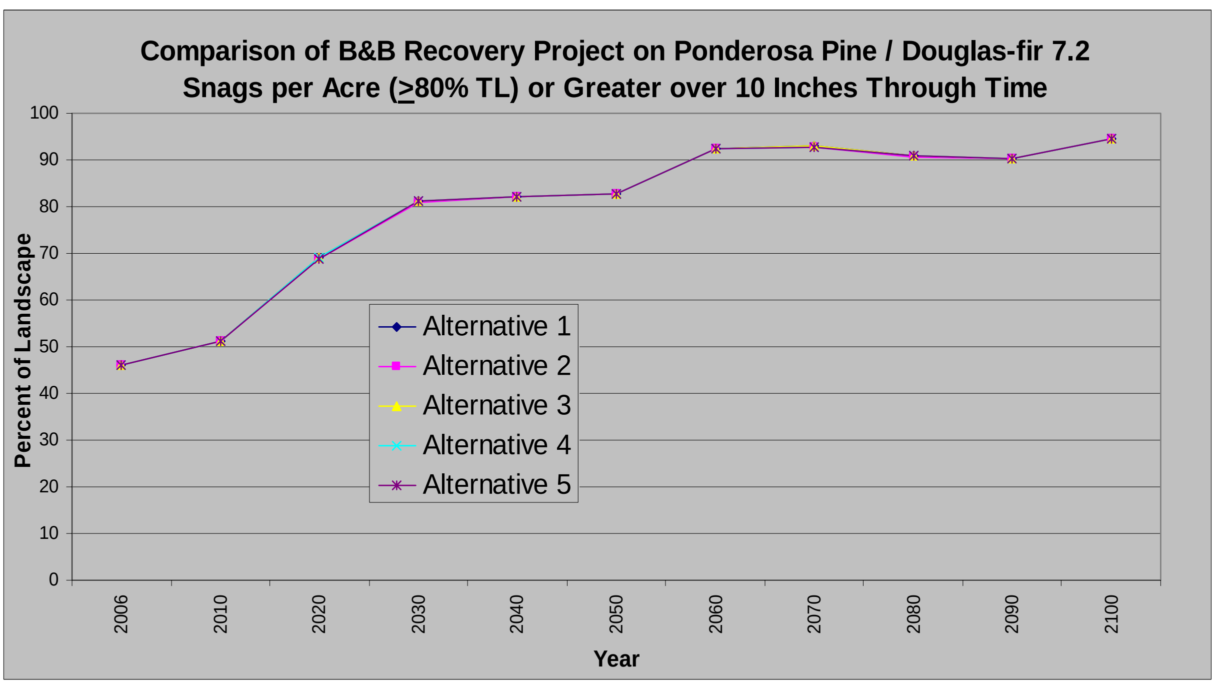


Figure 3.25. Upper Metolius Watershed Snag Densities ($\geq$ 50% tolerance level) through time (20 Inches or Greater) for Eastside Mixed Conifer Stands. Tolerance Levels acquired from unharvested inventory plots containing measurable snags (Figure PPDF_S.inv-3).

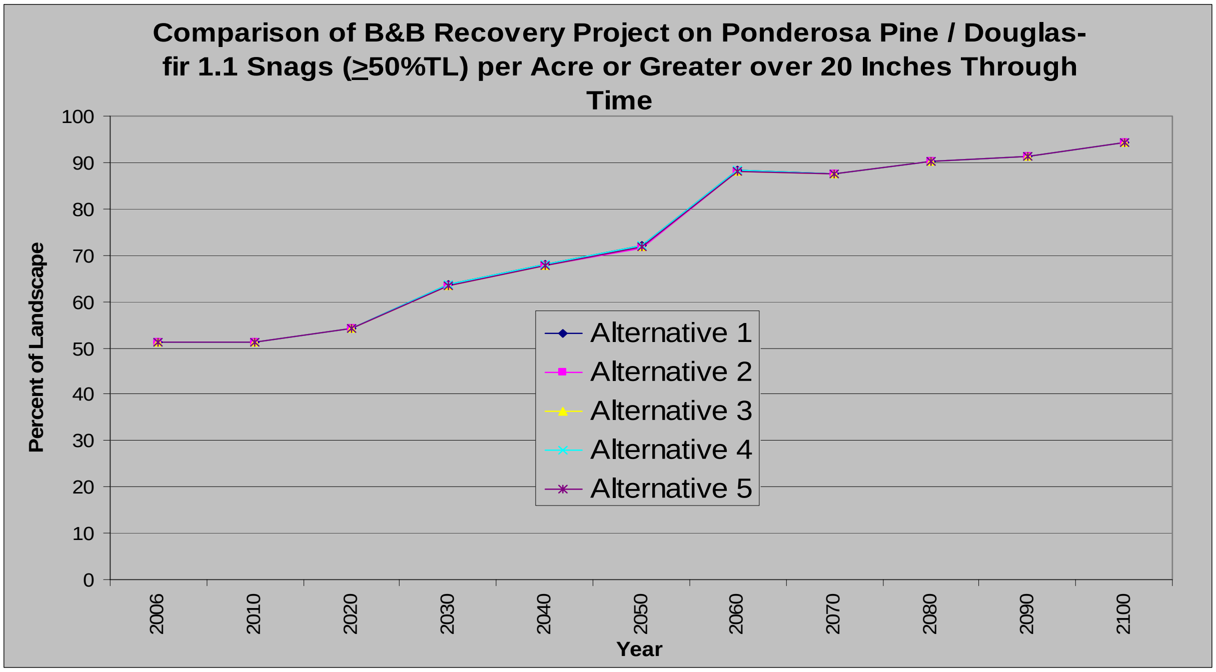
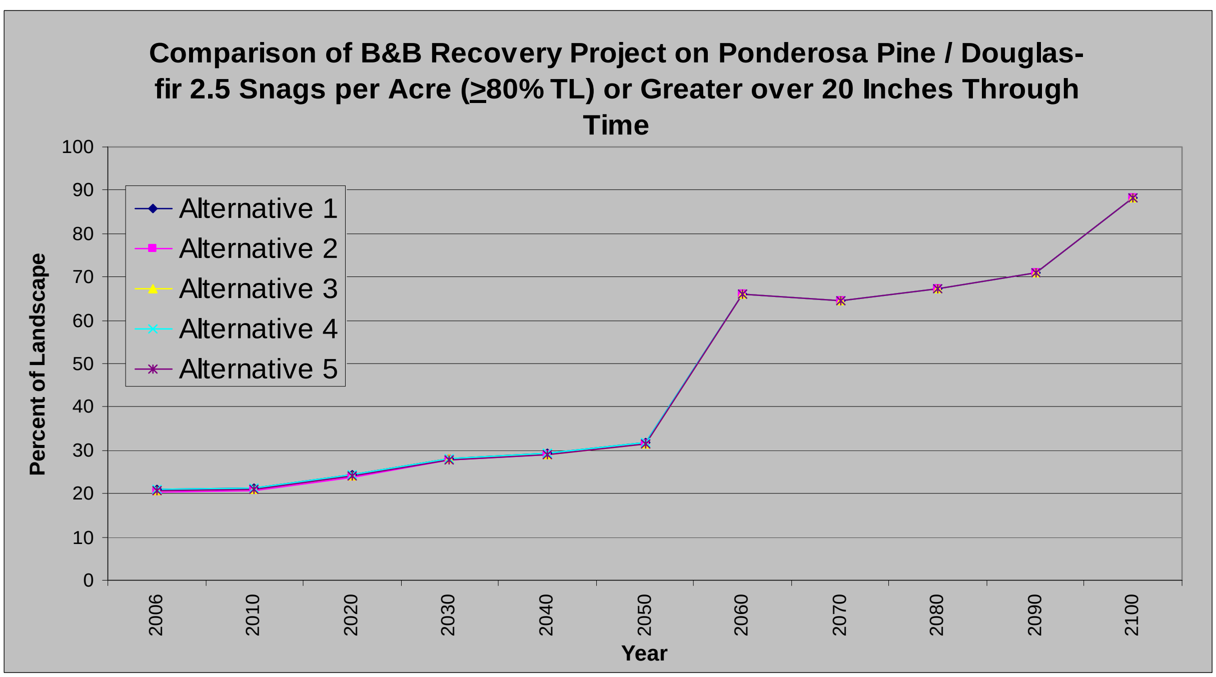


Figure 3.26. Upper Metolius Watershed Snag Densities ($\geq$ 80% tolerance level) through time (20 Inches or Greater) for Eastside Mixed Conifer Stands. Tolerance Levels acquired from unharvested inventory plots containing measurable snags (Figure PPDF_S.inv-3).



Utilizing FVS-FFE model runs snag dynamics overtime can be projected. Figures 3.27 through 3.30 display estimated snag projections on the landscape over time. Small and medium tree inventory data from DecAID was used to compare watershed snag densities with unharvested inventory data to illustrate how the fire area will influence snag densities into the future. Forested vegetation inventory data found in DecAID is used to represent the "natural condition".

At year 2006 for 10"dbh snags in the Eastside Mixed Conifer type, Figure 3.27 shows a large influx of snags as a result of the fire. By year 2030, a large proportion of these snags have fallen. However, by year 2060, snag recruitment is occurring. Figure 3.28 shows the same results for year 2006. Pockets of large density snags still remain in the watershed but levels are reduced by year 2030 for >20"dbh snags. Most large snags have fallen by year 2060 and by year 2090, recruitment is beginning. Again the ponderosa pine/Douglas-fir habitat type shows a different pattern. This again is influenced by the green stands within the watershed and the by the mortality from overstocked stands, competition, and insects in the absence of fire (Figures 3.29 and 3.30).

Figure 3.27. Upper Metolius Watershed Snag Distribution (10" or Greater) for Eastside Mixed Conifer over time. DecAid data for eastside mixed conifer from unharvested inventory plots (Figure EMC_ECB_S.inv-14).

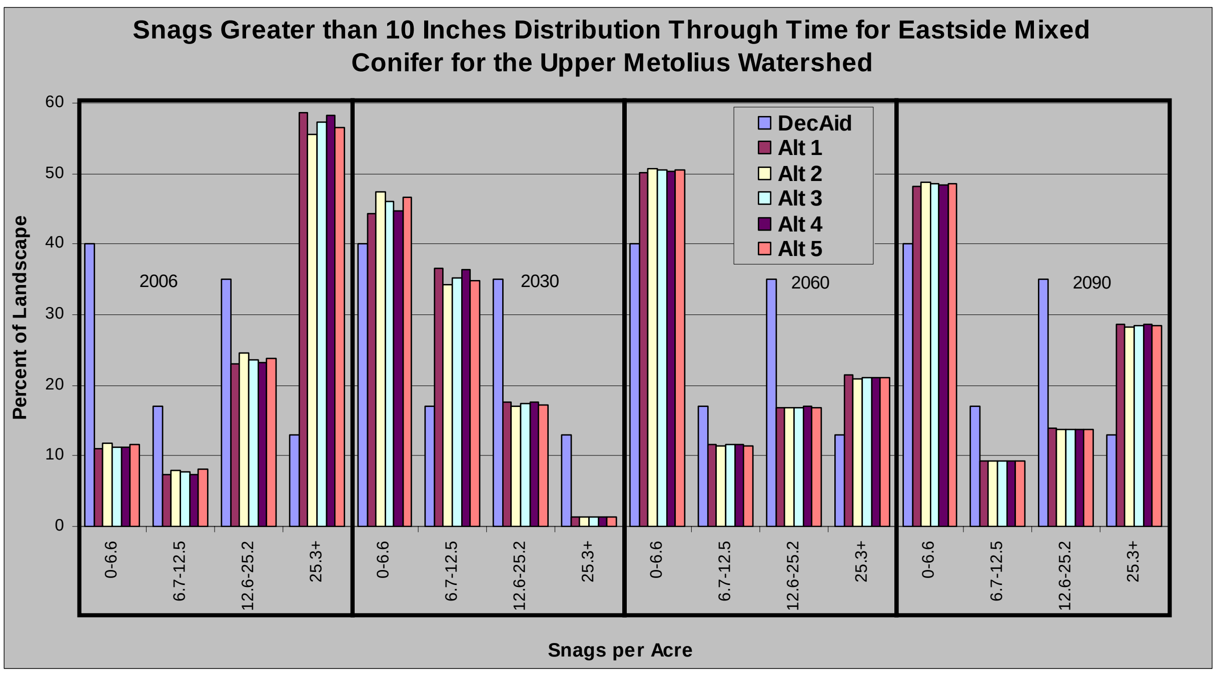


Figure 3.28. Upper Metolius Watershed Snag Distribution (20" or Greater) for Eastside Mixed Conifer over time. DecAid data for eastside mixed conifer from unharvested inventory plots (Figure EMC_ECB_S.inv-15).

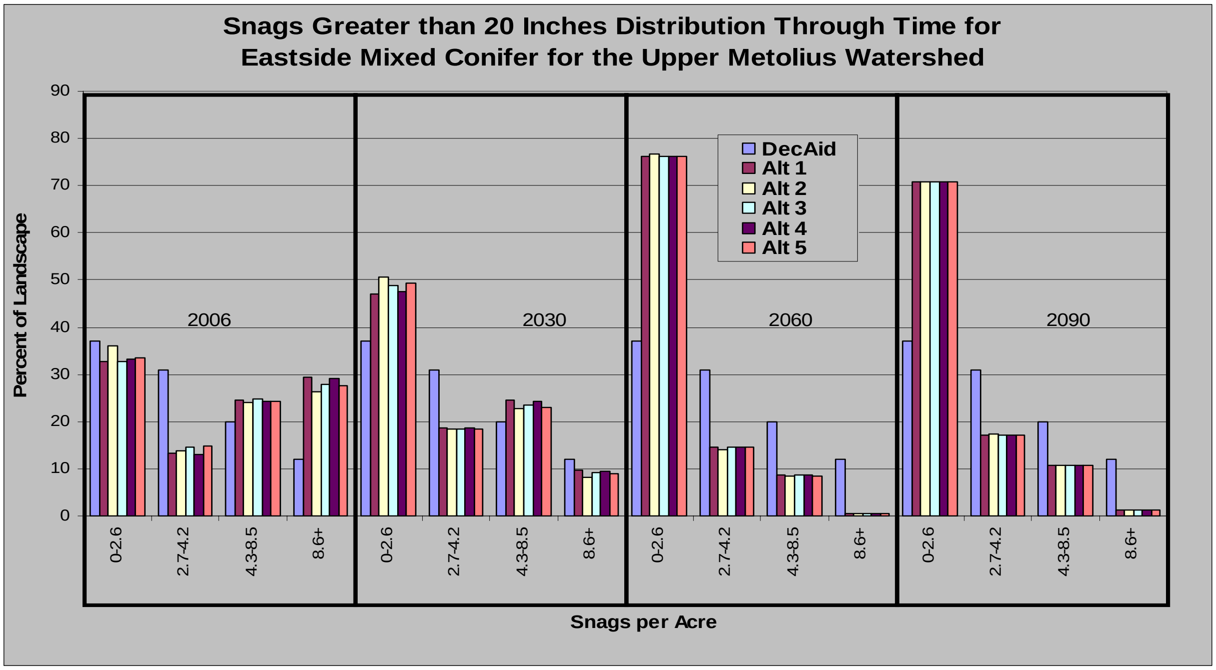


Figure 3.29. Upper Metolius Watershed Snag Distribution (10" or Greater) for Ponderosa Pine/Douglas-fir over time. DecAid data for ponderosa pine/Douglas-fir from unharvested inventory plots (Figure PPDF_S.inv-14).

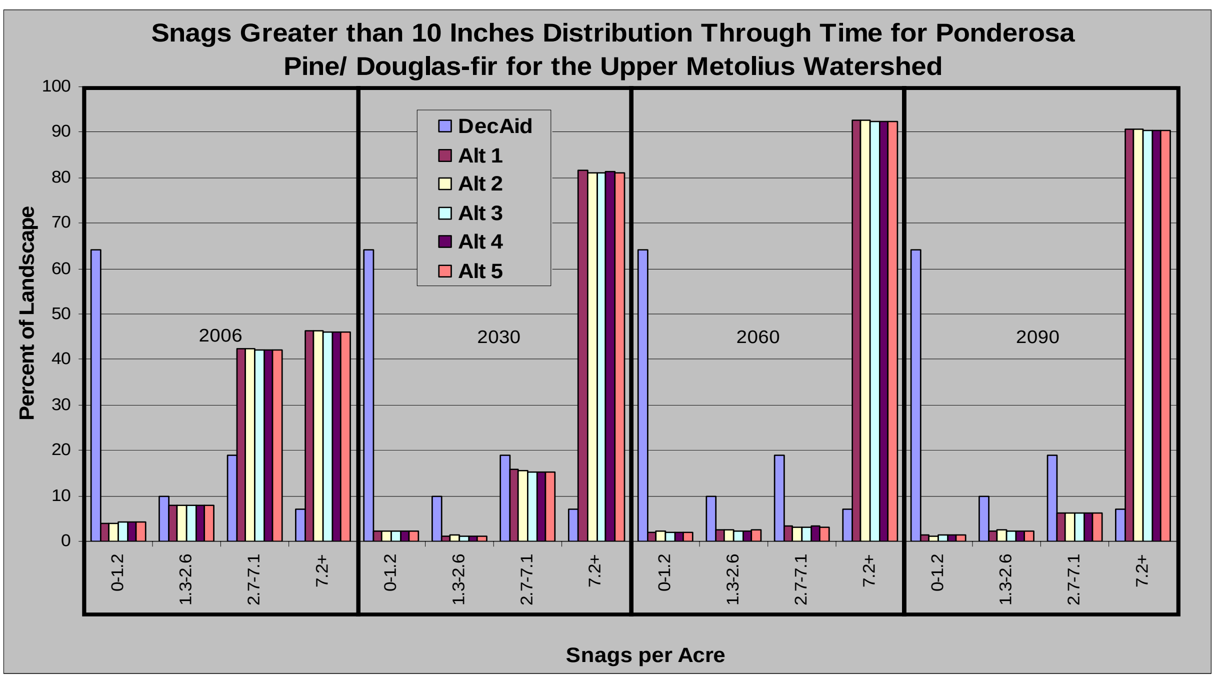
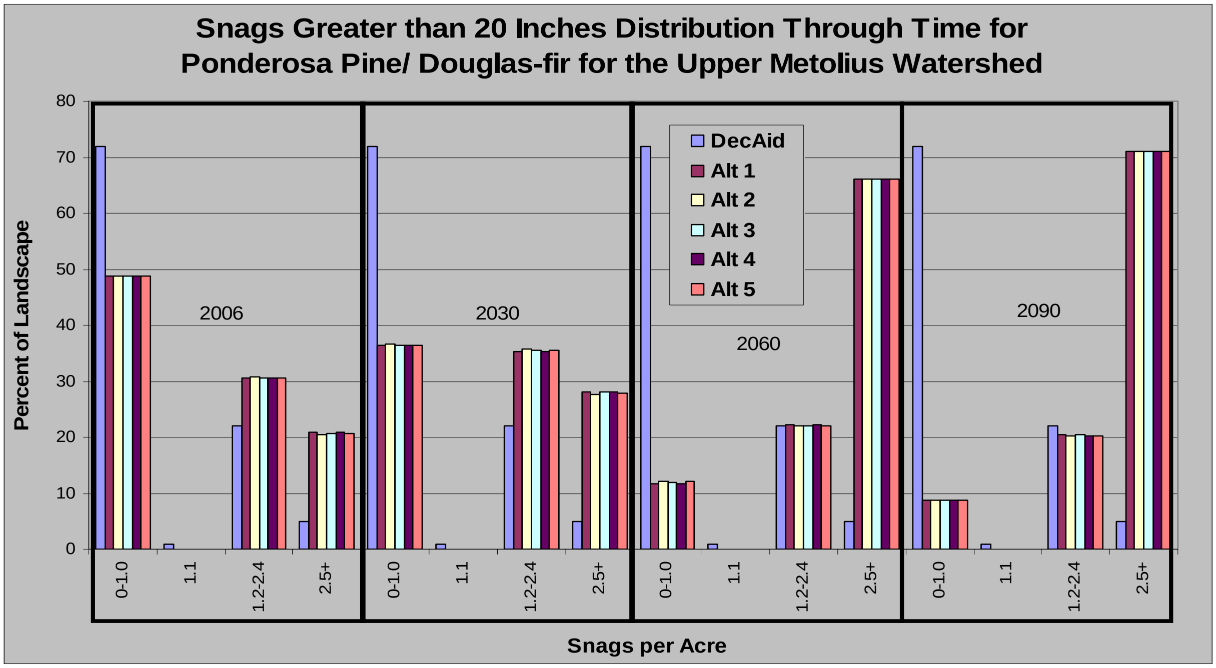


Figure 3.30. Upper Metolius Watershed Snag Distribution (20” or Greater) for Ponderosa Pine / Douglas-fir over time. DecAid data for ponderosa pine/Douglas-fir from unharvested inventory plots (Figure PPDF_S.inv-15).



Using Tables from the DecAID advisory tool and estimates of average snag density by size class, watershed acres of existing habitat were calculated. Species DecAID predicts to use post-fire habitats are included in Table 3.95 and 3.96 to compare the alternatives.

Post-fire habitat refers to stand replacement areas within the Eastside Mixed Conifer and ponderosa pine/Douglas-fir habitat types (29,348 acres). Wildlife data found in DecAID for wildlife use of recent post-fire habitat was used to determine acres of specific snag densities (i.e. tolerance levels) required by each species. For example, Tables EMC_O.sp-23 and PPDF_O.sp-23 in DecAID report 126.1 snags/acre >10”dbh are needed to meet the 80 percent tolerance level for black-backed woodpeckers. There are 2,012 acres meeting these criteria in Alternative 1 while there are 174 acres less in Alternative 2.

Table 3.95. B&B Recovery Project Alternative Comparison of habitat for cavity nesters. Only eastside mixed conifer and ponderosa pine/Douglas-fir stand replacement acres are included.

Species	Alternative	0 - 29 % tolerance (acres)	30 - 49 % tolerance (acres)	50 - 79 % tolerance (acres)	≥ 80 % tolerance (acres)
Black-backed Woodpecker (29,348 acres)	1	14,905	7,029	5,402	2,012
	2	16,410	6,171	4,929	1,838
	3	15,900	6,449	5,094	1,905
	4	15,043	6,949	5,343	2,012
	5	16,357	6,268	4,835	1,888
Hairy Woodpecker (29,348 acres)	1	360	8,619	11,657	8,712
	2	1,248	9,656	10,423	8,020
	3	684	9,257	11,155	8,251
	4	486	8,684	11,525	8,653
	5	846	9,468	11,061	7,973
Lewis Woodpecker (29,348 acres)	1	1,984	4,692	16,873	5,799
	2	2,655	6,512	15,260	4,921
	3	2,171	5,678	16,037	5,462
	4	2,100	4,781	16,674	5,793
	5	2,397	5,950	15,589	5,412
Mountain Bluebird (29,348 acres)	1	1,802	16,965	10,562	19
	2	2,276	18,091	8,961	19
	3	1,989	17,618	9,721	19
	4	1,875	16,987	10,466	19
	5	2,111	17,672	9,545	19
Northern Flicker (29,348 acres)	1	2,629	20,423	6,277	19
	2	4,203	19,805	5,320	19
	3	2,735	20,621	5,973	19
	4	2,802	20,285	6,241	19
	5	3,093	20,339	5,897	19
Western Bluebird (29,348 acres)	1	264	4,068	12,054	12,961
	2	907	5,345	11,407	11,691
	3	452	4,732	12,056	12,108
	4	352	4,120	12,009	12,867
	5	648	4,819	12,184	11,697
White-headed Woodpecker (29,348 acres)	1	1,083	11,321	12,365	4,579
	2	2,773	11,431	11,144	4,000
	3	1,776	11,612	11,702	4,258
	4	1,211	11,366	12,231	4,541
	5	2,091	11,803	11,309	4,145
DecAid data was acquired from Tables EMC_O.sp-23 and PPDF_O.sp-23.					

Table 3.96. B&B Recovery Project Alternative Comparison of habitat for cavity nesters. Only ponderosa pine / Douglas-fir stand replacement acres are included.

Species	Alternative	0 - 49 % tolerance (acres)	≥ 50 % tolerance (acres)
Cavity Nesting Birds (982 acres)	1	627	355
	2	705	276
	3	654	328
	4	627	355
	5	671	311
DecAid data was aquired from Table PPDF_O.sp-23.			

Habitat exists for other species outside of stand replacement areas within the watershed. Mixed mortality, underburned, and unburned areas (47,025 acres) represent a different suite of species. Differences in alternatives reflected in Table 3.97 are a result of the mixed mortality and white fir treatments.

Wildlife data found in DecAID for wildlife use of small and medium trees was used to determine acres of specific snag densities (i.e. tolerance levels) required by each species. Only the mean snag density was reported in DecAID for the American marten, cavity nesting birds, long-legged myotis, pileated woodpecker, and silver-haired bat. However, all tolerance levels were reported for the white-headed woodpecker.

Table 3.97. B&B Recovery Project Alternative Comparison of habitat for species that use eastside mixed conifer small and medium structural stages. Only eastside mixed conifer mixed mortality, underburned, and unburned acres are included.

Species	**Alternative**	**0 - 49 % tolerance (acres)**		**≥ 50% tolerance (acres)**	
American Marten (47,025 acres)	1	35,764		11,260	
	2	35,998		11,025	
	3	35,837		11,188	
	4	35,858		11,165	
	5	36,134		10,890	
Cavity Nesting Birds (47,025 acres)	1	20,061		25,369	
	2	20,335		26,689	
	3	20,067		26,956	
	4	20,216		26,808	
	5	20,216		26,808	
Long-legged Myotis (47,025 acres)	1	11,039		35,985	
	2	11,238		35,786	
	3	11,206		35,818	
	4	11,121		35,903	
	5	11,483		35,541	
Pileated Woodpecker (47,025 acres)	1	42,852		4,172	
	2	43,005		4,019	
	3	42,876		4,148	
	4	42,869		4,155	
	5	42,940		4,083	
Silver-haired Bat (47,025 acres)	1	46,906		118	
	2	46,906		118	
	3	46,906		118	
	4	46,906		118	
	5	46,906		118	
Species	**Alternative**	**0 - 29 % tolerance (acres)**	**30 - 49 % tolerance (acres)**	**50 - 79 % tolerance (acres)**	**≥ 80 % tolerance (acres)**
White-headed Woodpecker (47,025 acres)	1	4,614	8,600	15,767	18,041
	2	4,614	8,600	16,033	17,775
	3	4,614	8,600	16,033	17,775
	4	4,614	8,600	16,033	17,775
	5	4,614	8,600	15,983	17,826
DecAid data was aquired from Table EMC_S/L.sp-22.					

There are no treatments within mixed, underburned, and unburned stands of ponderosa pine/Douglas fir and montane mixed conifer. Therefore, there is no alternative comparison for Tables 3.98 and 3.99.

Table 3.98. B&B Recovery Project Alternative Comparison of habitat for species that use ponderosa pine/Douglas-fir small and medium structural stages. Only ponderosa pine/Douglas-fir mixed mortality, underburned, and unburned acres are included.

<table>
<tr><th>Species</th><th colspan="2">0 - 49 % tolerance (acres)</th><th colspan="2">≥ 50% tolerance (acres)</th></tr>
<tr><td>Pileated Woodpecker (17,393 acres)</td><td colspan="2">17,391</td><td colspan="2">0</td></tr>
<tr><td colspan="5"></td></tr>
<tr><th>Species</th><th>0 - 29 % tolerance (acres)</th><th>30 - 49 % tolerance (acres)</th><th>50 - 79 % tolerance (acres)</th><th>≥ 80 % tolerance (acres)</th></tr>
<tr><td>White-headed Woodpecker (17,393 acres)</td><td>4,839</td><td>7,275</td><td>4,149</td><td>1,127</td></tr>
<tr><td colspan="5">There is no difference between alternatives because harvest within ponderosa pine/Douglas-fir only occurs within stand replacement areas. DecAid data was aquired from Table PPDF_S/L.sp-22.</td></tr>
</table>

Table 3.99. B&B Recovery Project Alternative Comparison of habitat for species that use montane mixed conifer small and medium structural stages. Only montane mixed conifer mixed mortality, underburned, and unburned acres are included.

<table>
<tr><th>Species</th><th>0 - 49 % tolerance (acres)</th><th>≥ 50% tolerance (acres)</th></tr>
<tr><td>American Marten (18,036 acres)</td><td>11,786</td><td>6,249</td></tr>
<tr><td>Pacific Fisher (18,036 acres)</td><td>9,233</td><td>8,803</td></tr>
<tr><td colspan="3">There are no treatments occurring within montane mixed conifer. DecAid data was aquired from Table MMC_S/L.sp-22.</td></tr>
</table>

3.11 Down Wood Habitat

Logs are an important component on the landscape. They provide organic and inorganic nutrients in soil development, contribute to water economy, provide microhabitats for invertebrates, plants, amphibians, and other small vertebrates, and provide structure for riparian associated species in streams and ponds. It has been shown that size, distribution, and orientation may be more important than tonnage or volume. Small logs provide escape cover or shelter for small species. It is still unknown what levels of down woody material are needed to provide quality habitat for associated species. (Bull et al. 1997). Tallmon and Mills (1994) have shown that red-backed voles, a primary prey species for the spotted owl, are highly associated with large down material in more advanced decay stages. Truffles, a dietary staple of the northern flying squirrel, have also been loosely associated with down material.

Too much down material may impede travel by big game and present a fire hazard. However, increased levels also provide cover for small invertebrates and may protect seedlings from browse and scorching. Orientation has also been shown to be important. Logs that lie along a contour are used more than those lying across contours. Larger sized logs are also used more and by more species than smaller logs. (Bull et al. 1997).

Affected Environment and Environmental Consequences

Existing Condition

Field reconnaissance has found that within stand replacement areas much of the pre-existing downed wood was consumed. However, within the fire perimeter a percentage of the existing down woody material are trees that have fallen since the fires and most are in Decay Classes 1 and 2. Some downed material was consumed within the mixed mortality and underburned areas as well, especially where fire intensity was greater. This consisted of smaller material (<12”dbh) and advanced decayed logs primarily. Larger pre-existing material is still present although logs are now case-hardened in many situations.

For green stands, down log averages per acre are characteristically higher within the mixed conifer wet and riparian PAGs and generally the lowest within the ponderosa pine PAGs. Down wood abundance on the Deschutes National Forest is highly variable due to many factors. The Deschutes National Forest lies on the eastside of the Cascades where there is a limited availability of water and nutrients as compared to the west side of the Cascades. This, combined with overcrowded stand conditions due to fire suppression, has led to tree mortality above historic levels especially within smaller size classes. In particular, plant associations groups that tend to be drier (i.e. ponderosa pine and mixed conifer dry) may recruit a higher level of down wood today than did historically.

Effects Common to All Alternatives including No Action

Green stands with a low proportion of damaged white fir will not be treated and down woody material levels will remain the same. Therefore, stands will continue to provide habitat for species that require live canopy along with down wood of various sizes and decay conditions (e.g., pileated woodpecker, American marten, northern flying squirrel, and red-backed vole).

A large percentage of the fire area will not be treated including all lodgepole pine habitats which occur within Fire Regime 4. This may result in increased fuel loadings when snags begin to litter the forest floor. Increased fuel loadings may put remaining habitat at risk from disturbance (see Fuels Report).

Currently, there is limited down woody material within the fire area, in particular stand replacement areas due to the consumption of most ground litter. Limited downed wood will continue for approximately 15 to 25 years until most snags begin to fall. At that point, a sharp increase in downed wood levels will occur with approximately 50% of the landscape having moderate to high levels of down wood cover. There will be a short term impact on species that forage on down woody material like black bears, and use by small mammals may be limited until that time. However, as snags fall and down wood levels increase along with the recovery of shrub and tree species, use by small mammals and insects (ants) will increase which will increase foraging opportunities for larger species (e.g., black bear, marten). Levels may be above the optimum levels for specific vegetation types as noted by Brown et al. (2003) in 30 years.

Effects Common to All Action Alternatives

Treatment will result in a decrease in down woody material levels, primarily material >16"dbh. This will result in a decrease in habitat for some species requiring large logs (e.g., pileated woodpecker, American marten, and black bear). However, without associated habitat components like live canopy and snags, species use may be limited until such time as these components are again present. Reducing down woody material levels will allow other species that utilize open habitats to be present (e.g., big game in relation to movement). In addition to treatments removing larger material, activity fuels created by the harvest will be cleaned up. This will not reduce levels any further but will result in a slight reduction in risk and provide for a mosaic of varying densities across the landscape.

Treated areas would result in the planting of desired tree species. This will eventually lead to larger material in the form of snags and down wood to be produced and will provide more stable, long-term habitat benefiting species that require larger material (e.g., pileated woodpecker, marten, fisher, and red-backed voles).

In addition to activity fuels treatments, supplemental fuels treatments are proposed for units where fuel levels exceed desired amounts. These would be prioritized for units occurring within defensible space zones, areas identified as fuel breaks, or units adjacent to existing spotted owl nesting, roosting, and foraging (NRF) habitat. Treatments would occur in units when overall fuel loadings exceed 40 tons per acre or where <3"dbh material exceeds 10 tons per acre. Treatment would aid in decreasing risk and would help in the reintroduction of fire which would help maintain desired stand composition. These treatments will impact smaller diameter material (<3"dbh) primarily and should have little impact on species who require down wood.

The snag retention strategies proposed all focus on the retention of larger material of which Douglas-fir and ponderosa pine are preferred. Douglas-fir and ponderosa pine can typically reach sizes preferred by most species utilizing large logs for denning or foraging and usually last longer on the landscape. The retention of these legacies can provide connectivity through time within a stand allowing species present pre-disturbance to exist in an area following a disturbance. Legacy wood can provide structural elements and complexity in stands that would otherwise require very long periods of time to develop (Hayes 2001 found in Rose et al. 2001).

Differences by alternative are slight. For Eastside Mixed Conifer, Alternative 2 levels mimic the No Action levels with a slight decrease (~5%). The other alternatives fall in between the No Action and Alternative 2 levels. Although there is a slight decrease, down woody material levels remain high throughout the watershed over time. There is basically no change in down woody material levels for the ponderosa pine/Douglas-fir habitat type. Most of this habitat type lies outside the fire perimeter and green stands highly influence the pattern of down woody material levels through time. Mortality from insects and competition from overstocked stands is driving most of the increase in these levels. And, most of this increase consists of smaller material (<10"dbh). No harvest will occur within the montane mixed conifer and lodgepole pine habitat types, therefore there is no change.

Comparison of Alternatives

Figures 3.31 through 3.32 compare down wood percent cover distribution by Alternative. Year 2006 is used to represent post-harvest conditions. There is no harvest within Montane Mixed Conifer Stands so alternatives are identical.

As seen in Figure 3.31, the fire consumed most of the downed wood and existing dead wood is still standing at Year 2006. The differences shown between alternatives are a result of the amount of harvest and removing the trees before they become downed wood. Figure 3.32 shows low down wood percent cover. Ponderosa pine/Douglas-fir sites are less productive than mixed conifer sites and typically do not produce high downed wood levels.

Figure 3.31. Upper Metolius Watershed Down Wood Percent Cover Distributions (6 Inches or Greater) for Eastside Mixed Conifer Stands.

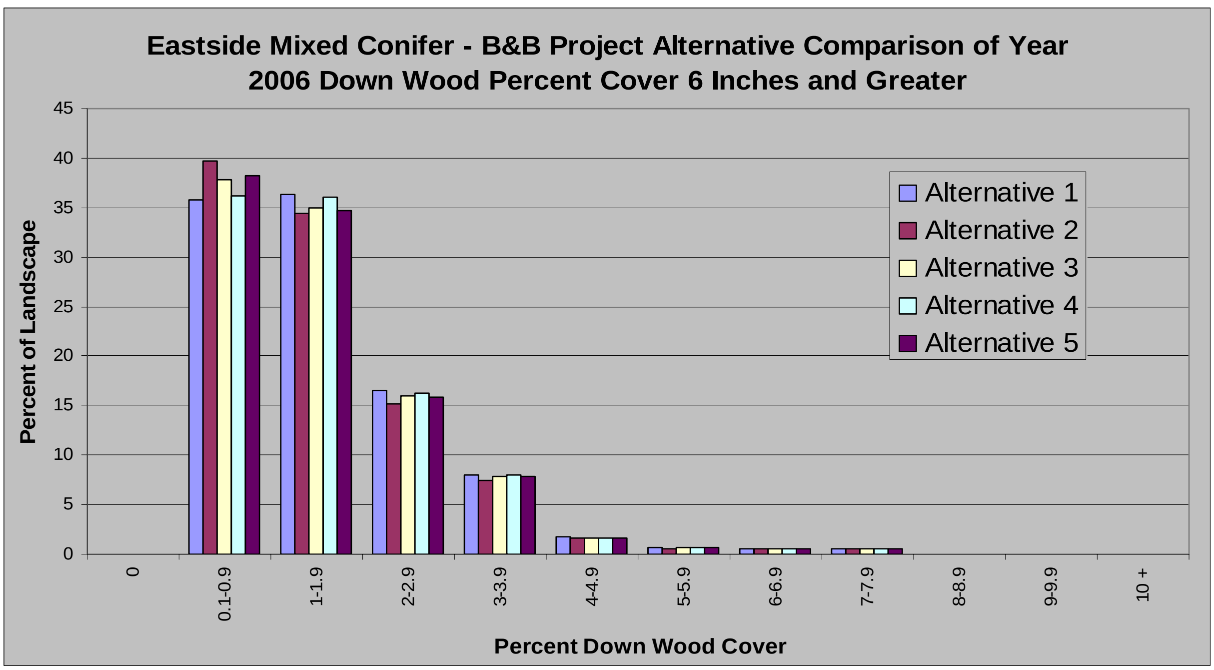
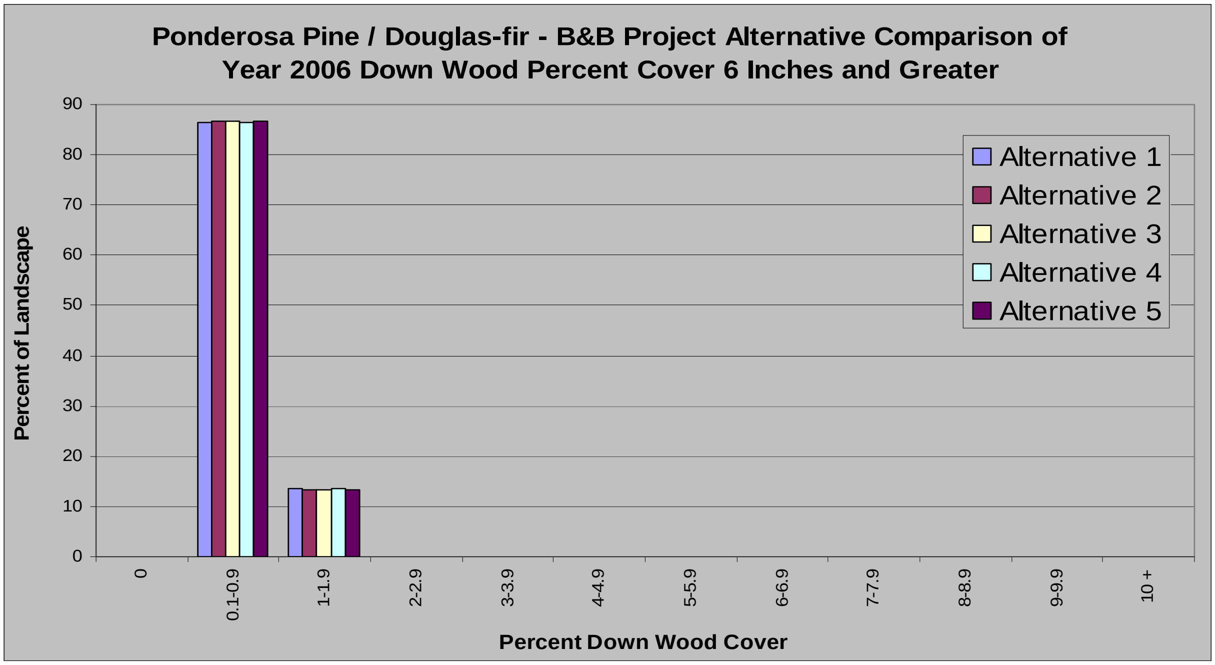


Figure 3.32. Upper Metolius Watershed Down Wood Percent Cover Distributions (6 Inches or Greater) for Ponderosa Pine Douglas-fir Stands.



Utilizing FVS-FFE model runs down wood percent cover dynamics overtime can be projected. Figures 3.32 through 3.35 show the comparison of alternatives using the 50% and greater tolerance level and 80% or greater tolerance level for small and medium trees by habitat type. The 50 and 80 percent tolerance levels are shown to illustrate the differences in down wood percent cover over time as some species have been shown to need high density pockets of down wood. The small and medium tree structural condition is used as it best represents the condition of the Upper Metolius Watershed.

Alternatives will have some short term effects on down wood percent cover although differences are minor. As snags begin to fall, down wood cover increases (Figures 3.32 and 3.33). A different pattern is shown for ponderosa pine/Douglas-fir habitat. Most of the ponderosa pine/Douglas-fir habitat type occurs outside the fire perimeter and green stands highly influence the pattern of down wood over time. Recruitment of down wood continues to increase until Year 2070 then levels out due to over-stocked stands and mortality from insects and competition. For the larger snags in the ponderosa pine/Douglas-fir habitat type, a bark beetle epidemic was modeled at year 2050 and an increase is shown after this time period (Figures 3.34 and 3.35).

Figure 3.32. Upper Metolius Watershed Down Wood Percent Cover (≥ 50% tolerance level) through time (6 Inches or Greater) for Eastside Mixed Conifer Stands. Tolerance Levels acquired from DecAid data (Figure EMC_ECB_S.inv-10).

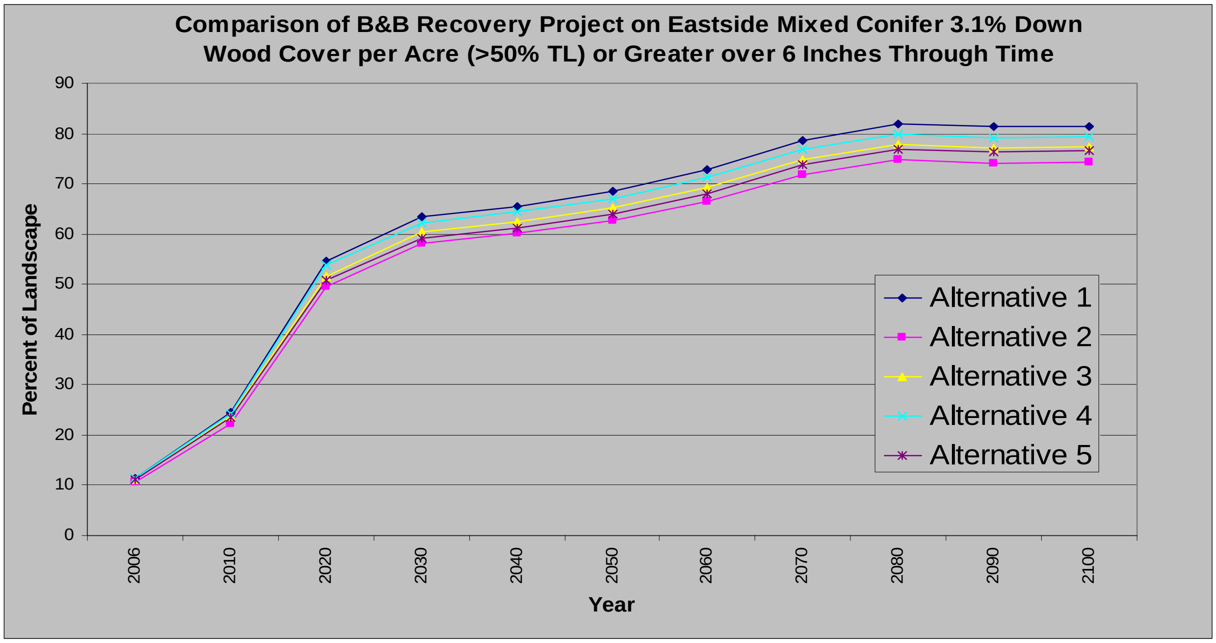


Figure 3.33. Upper Metolius Watershed Down Wood Percent Cover (≥ 80% tolerance level) through time (6 Inches or Greater) for Eastside Mixed Conifer Stands. Tolerance Levels acquired from DecAid (Figure EMC_ECB_S.inv-10).

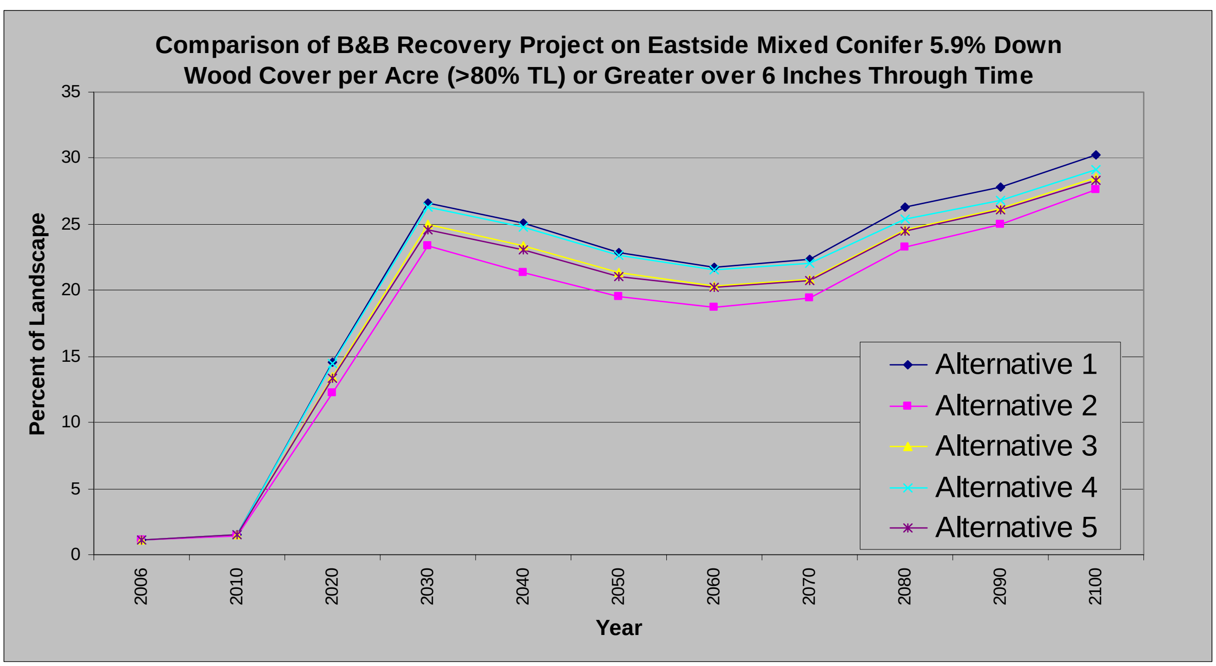


Figure 3.34. Upper Metolius Watershed Down Wood Percent Cover (≥ 50% tolerance level) through time (6 Inches or Greater) for Ponderosa Pine/Douglas-fir Stands. Tolerance Levels acquired from DecAid (Figure PPDF_S.inv-10).

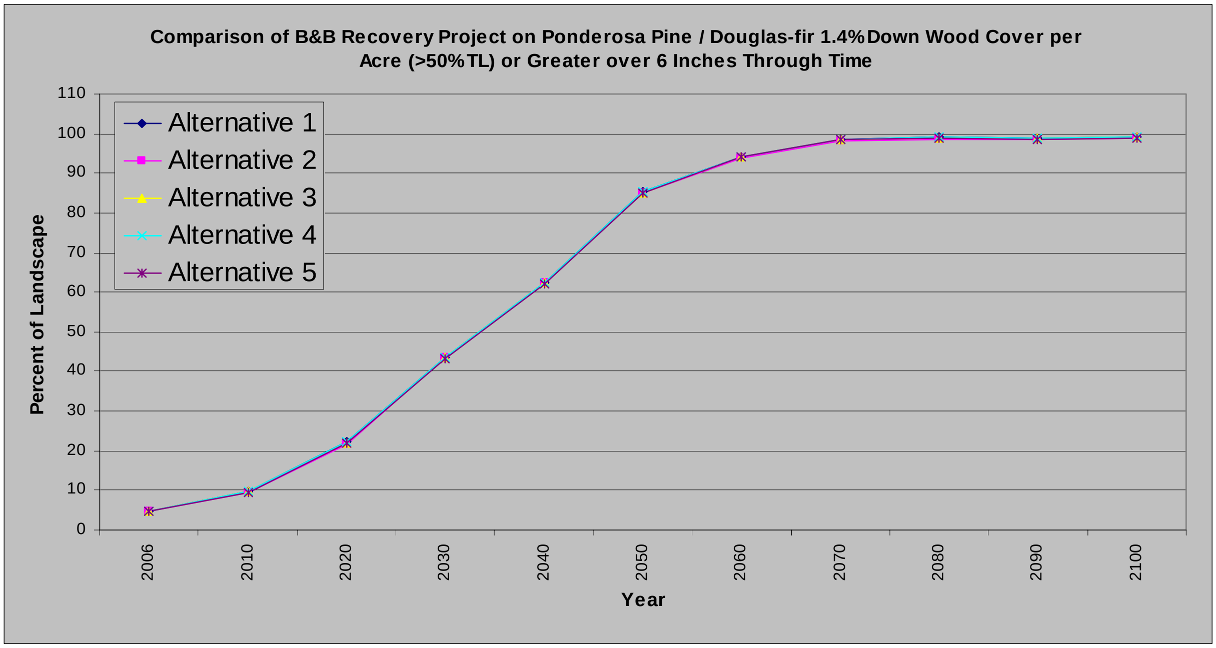
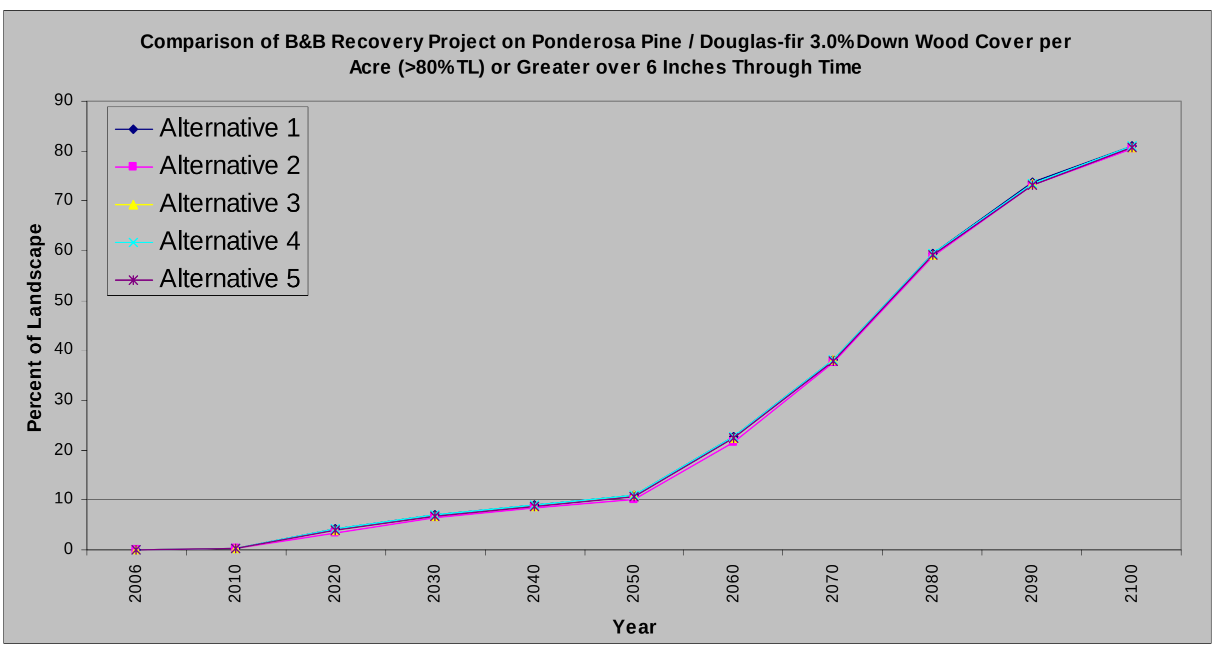


Figure 3.35. Upper Metolius Watershed Down Wood Percent Cover (≥ 80% tolerance level) through time (6 Inches or Greater) for Ponderosa Pine/Douglas-fir Stands. Tolerance Levels acquired from DecAid (Figure PPDF_S.inv-10).



Utilizing FVS-FFE model runs downed wood dynamics overtime can be projected. Figures 3.36 through 3.37 display estimated downed wood projections on the landscape over time. Small and medium tree inventory data from DecAID was used to compare watershed downed wood cover with unharvested inventory data to illustrate how the fire area will influence down wood cover into the future. Forested vegetation inventory data found in DecAID is used to represent the "natural condition".

At year 2006 in the Eastside Mixed Conifer type, Figure 3.36 shows most downed wood was consumed by the fire and most existing dead wood is still standing. By year 2030, a large proportion of small snags have fallen increasing downed wood levels. By year 2090, most of the watershed has a down wood percent cover. Again the ponderosa pine/Douglas-fir habitat type shows a different pattern. This again is influenced by the green stands within the watershed and the by the mortality from overstocked stands, competition, and insects in the absence of fire (Figures 3.37).

Figure 3.36. Upper Metolius Watershed Percent Down Wood Cover (6" or Greater) for Eastside Mixed Conifer over time. DecAid data for eastside mixed conifer from unharvested inventory plots (Figure EMC_ECB_S.inv-16).

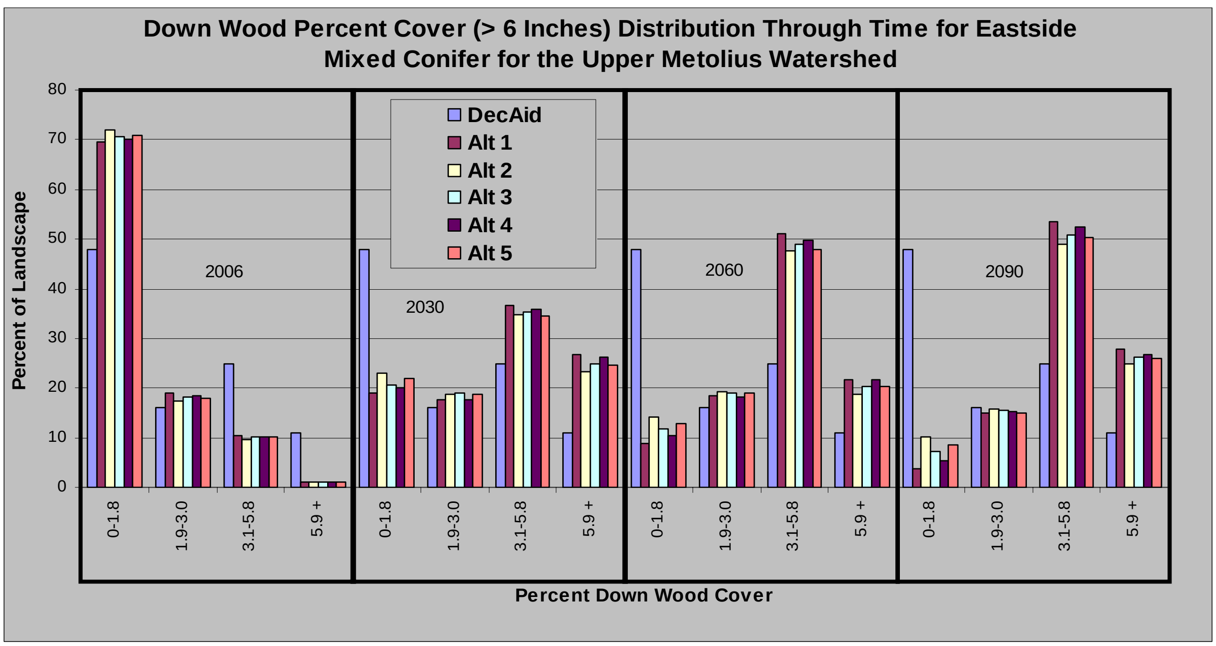
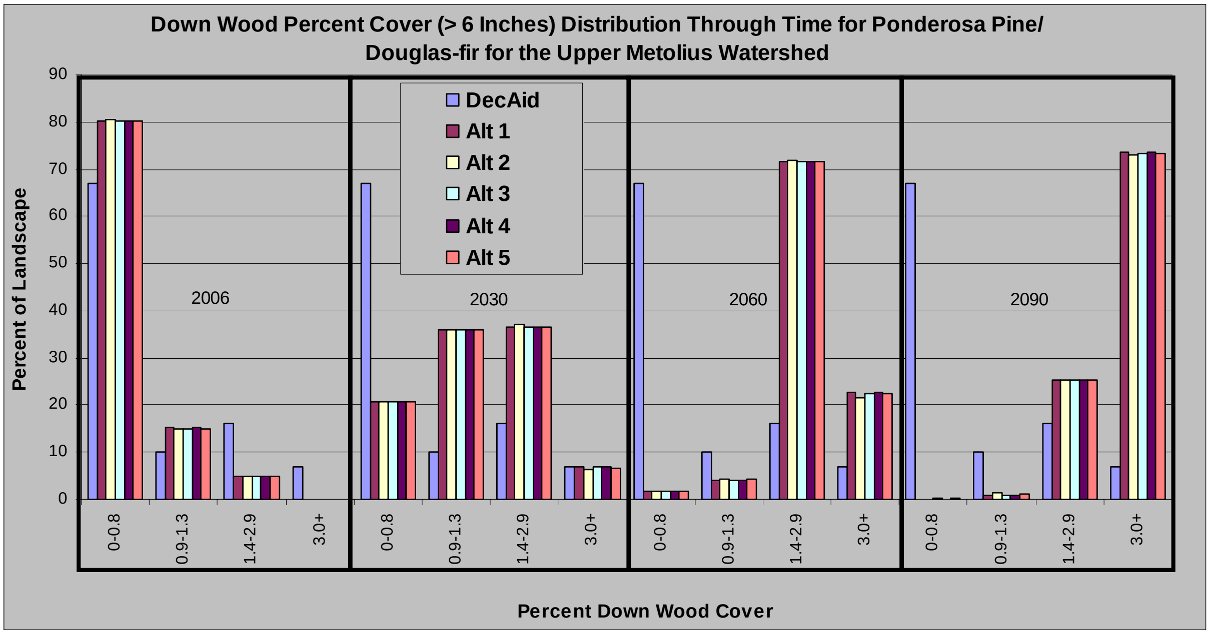


Figure 3.37. Upper Metolius Watershed Percent Down Wood Cover (6" or Greater) for Ponderosa Pine/Douglas-fir over time. DecAid data for eastside mixed conifer from unharvested inventory plots (Figure PPDF_S.inv-16).



Using Tables from the DecAID advisory tool and estimates of percent down wood cover, watershed acres of existing habitat were calculated. No information is available for downed wood in DecAID for post-fire environments and little literature exists for wildlife use of downed wood by wildlife species in post-fire environments.

Habitat exists for other species outside of stand replacement areas within the watershed. Mixed mortality, underburned, and unburned areas (47,025 acres) represent a different suite of species. Differences in alternatives reflected in Tables 3.100 and 3.101 are a result of the mixed mortality and white fir treatments.

Wildlife data found in DecAID for wildlife use of small and medium trees was used to determine acres of specific levels of downed wood (i.e. tolerance levels) required by each species.

Table 3.100. B&B Recovery Project Alternative Comparison of habitat for species that use down wood within eastside mixed conifer small and medium structural stages. Only eastside mixed conifer mixed mortality, underburned, and unburned acres are included.

Species	Alternative	0 - 29 % tolerance (acres)	30 - 49 % tolerance (acres)	50 - 79 % tolerance (acres)	≥ 80 % tolerance (acres)
Black-backed Woodpecker (47,025 acres)	1	46,097	928	0	0
	2	46,174	851	0	0
	3	46,105	920	0	0
	4	46,098	927	0	0
	5	46,115	910	0	0
Pileated Woodpecker (47,025 acres)	1	45,281	489	498	755
	2	45,373	476	498	678
	3	45,303	476	498	747
	4	45,296	476	498	754
	5	45,313	476	498	737
Three-toed Woodpecker (47,025 acres)	1	46,657	368	0	0
	2	46,657	368	0	0
	3	46,657	368	0	0
	4	46,657	368	0	0
	5	46,657	368	0	0
DecAid data was aquired from Table EMC_S/L.sp-24.					

Table 3.101. B&B Recovery Project Alternative Comparison of habitat for species that use montane mixed conifer small and medium structural stages. Only montane mixed conifer mixed mortality, underburned, and unburned acres are included.

Species	0 - 49 % tolerance (acres)		≥ 50% tolerance (acres)	
American Marten (18,036 acres)	17,773		261	
Pacific Fisher (18,036 acres)	17,237		798	
Species	**0 - 29 % tolerance (acres)**	**30 - 49 % tolerance (acres)**	**50 - 79 % tolerance (acres)**	**≥ 80 % tolerance (acres)**
Southern Red-Backed Vole (18,036 acres)	0	18,036	0	0
Three-toed Woodpecker (18,036) acres	17,330	704	0	0
There are no treatments occurring within montane mixed conifer. DecAid data was aquired from Table MMC_S/L.sp-24.				

3.12 Threatened or Endangered Wildlife Species

A Biological Evaluation has been prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3., FSM 2670-2671, FSM W.O. Amendments 2600-95-7, and the Endangered Species Act (ESA) of 1973. A Biological Assessment (BA) will be prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4 and the Endangered Species Act of 1973 (Subpart B: 402.12, Section 7 Consultation, as amended) on actions and programs authorized, funded, or carried out by the Forest Service to assess their potential for effect on threatened and endangered species and species proposed for federal listing (FSM 2670.1).

Those species thought to occur presently or historically on the Deschutes National Forest and analyzed in this document include the Canada Lynx (*Lynx Canadensis*), the northern bald eagle (*Haliaeetus leucocephalus*), and the northern spotted owl (*Strix occidentalis*). The Oregon spotted frog (*Rana pretiosa*) is also included because its ESA status is under review (Table 3.102 & 3.103).

Table 3.102. Threatened and Endangered Species Summary

Species	Status	Habitat	Presence
Canada Lynx	Federal Threatened	Subalpine fir with Lodgepole pine	No Habitat
Northern Bald Eagle	Federal Threatened, Management Indicator Species (MIS)	Lakeside with Large Trees	Documented
Northern Spotted Owl	Federal Threatened, MIS	Old Growth Mixed Conifer Forests	Documented
Oregon Spotted Frog	Federal Candidate, Regional Forester Sensitive	Stream, Marsh	No Habitat

Table 3.103. Summary of Conclusion of Effects, Threatened and Endangered Species, B&B Fire Recovery Project.

Species/Habitat	Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5
Canada Lynx	NE	NE	NE	NE	NE
Northern Bald Eagle	NLAA	NLAA	NLAA	NLAA	NLAA
Northern Spotted Owl	NLAA	NLAA	NLAA	NLAA	NLAA
Northern Spotted Owl Critical Habitat	NLAA	NLAA	NLAA	NLAA	NLAA
Oregon Spotted Frog	NE	NE	NE	NE	NE

Canada Lynx, Federal Threatened

The Canada lynx is a federally listed threatened species. The Forest Wildlife Biologists from the Deschutes and Ochoco National Forests, and Crooked River National Grasslands have made a determination based on the best available science, that neither the Canada lynx nor their habitat are currently present on these administrative units (USDA 2003b). There is only one verified Canada lynx record from the Deschutes National Forest collected near Lava Lake in 1916 and only 12 verified records in Oregon since 1897. Most of the verified lynx records in Oregon coincide with population peaks of lynx in Alaska and Canada. Self-maintaining lynx populations in Oregon have not existed historically, and lynx occurrence here is likely the result of dispersal from occupied areas with declining prey populations (Verts and Carraway 1998; McKelvey and Aubrey 2001). Surveys for lynx were conducted on the Deschutes National Forest in 1999, 2000, and 2001. There were no lynx detections confirmed from the survey efforts.

The Lynx Biology Team reported that all investigations into lynx habitat in the southern part of its range shows an association between lynx and lodgepole pine cover types within the subalpine fir series. The best scientific information available suggests that subalpine fir plant associations capable of supporting a minimum density of snowshoe hares (*Lepus americanus*) is a reasonable surrogate for describing lynx habitat conditions in order to support survival (primary vegetation to support survival and reproduction and comprise a Lynx Analysis Unit (LAU)). In addition, the Lynx Conservation Assessment and Strategy (Ruediger et al. 2000) identified the need for at least 10 square miles of primary vegetation to support lynx survival and reproduction and comprise a LAU. On the Deschutes National Forest, four subalpine fir plant associations (subalpine fir-Engleman spruce, alpine parkland sedge, alpine parkland woodrush, and alpine parkland sagebrush) could be considered primary vegetation that could contribute to lynx habitat. In total, about 3,650 acres of subalpine fir plant associations occur across the entire Forest and most of those (3,500 acres) are "parklands" which do not support snowshoe hare. Therefore, there is not an adequate amount of primary vegetation to identify any lynx habitat or a Lynx Analysis Unit on the Deschutes National Forest. For these reasons, implementation of the No Action or any Action Alternative proposed in the B&B Fire Recovery Project area would have **"No Effect"** on the Canada lynx or their habitat.

Bald Eagle, Federal Threatened, MIS

Existing Condition

The northern bald eagle is currently a federally listed threatened species in the state of Oregon. Essential habitat elements for the recovery and eventual delisting of the northern bald eagle are nest sites, communal night roosts, foraging areas, and perch sites. On the Deschutes National Forest, ponderosa pine and Douglas-fir trees averaging 32 inch+ dbh with live large, open limb structure are preferred for nesting. Nests consist of bulky stick platforms built in the super-canopy of such trees, or less frequently on cliffs. They are typically constructed within one mile of appropriate foraging habitat, which includes rivers and large lakes and reservoirs. Bald eagles are sit-and-wait predators, which predominantly capture prey from perches over water; ideal perches are large trees and snags within 330 ft. (100 m) of water (Anthony et al. 1995). Prey items include fish, waterfowl and other birds, small mammals, and carrion (Stalmaster 1987).

The Pacific Bald Eagle Recovery Plan (USFWS 1986) designated recovery zones for each state and the Deschutes National Forest is within the High Cascades Zone. The Recovery Plan population goal for the High Cascades is 33 territories and the Habitat Management goal is 47 territories. Surveys conducted in 2003 confirmed the presence of 61 occupied territories of 65 territories located in the High Cascades Zone (Isaacs and Anthony 2003). There is one territory within the B&B project area, Suttle Lake. In 2003, prior to the fire, the Suttle Lake territory was occupied with young. Surveys were conducted in 2004 and again the territory was occupied. However, the presence of young could not be determined but nesting was occurring. See Table 3.104 for the status by year for the Suttle Lake territory.

Table 3.104. Suttle Lake bald eagle nest territory and yearly status.

Territory Name	Year Located	Status 95	Status 96	Status 97	Status 98	Status 99	Status 00	Status 01	Status 02	Status 03	Status 04
Suttle Lake	1971	1	1	1	2	oF	oF	2	1	1d/n	O?

\# - Number of young fledged
oF – Site occupied, at least one adult and a nest observed during breeding season; no evidence of eggs or failure
/d – downy young
n – nest burned in wildfire
O? – occupied, outcome unknown; adult eagle(s)observed, but no nest observed or outcome not determined.

Bald Eagle Management Areas (BEMAs) were designated in the Deschutes National Forest Plan (USDA 1990a). The Suttle Lake territory lies within a BEMA that encompasses a large area primarily south of Suttle Lake. The entire BEMA (approximately 1,458 acres) lies within the project boundary. Management direction allows for timber harvest in catastrophic situations with efforts made to protect or create suitable eagle habitat (M3-7, page 4-94). It also allows for timber harvest and pre-commercial thinning to achieve habitat objectives (M3-4, 5, and 6, page 4-94).

Fire suppression over the years allowed white fir to come in below ponderosa pine and Douglas-fir trees. These overstocked stands suffered varying degrees of insects and disease. As a result, the BEMA experienced high mortality of larger ponderosa pine and Douglas-fir trees from insects and disease. Replacement trees consist of white fir, not ponderosa pine or Douglas-fir. Remaining large trees suffer from high levels of mistletoe within the BEMA, especially within the Douglas-fir trees. Management activities, primarily understory thinning, had been initiated to help maintain existing bald eagle habitat and promote future suitable habitat.

Post-fire

The Suttle Lake nest grove was burned over during the B&B fire of 2003 however the nest remained intact. The nest tree was also burned but still retained yellow needles during the breeding season (2004). The nest grove experienced stand replacement fire on 16 acres out of 20 (Table 3.105). Approximately 217 acres of 1,458 acres within the BEMA burned with stand replacement intensity. This includes the north and southwest sides of Suttle Lake and the isolated piece on the northwest side of Blue Lake. There is still potential habitat remaining on 1,214 acres of the mixed severity, underburned or unburned areas within the vicinity of Suttle Lake, primarily the road corridors along the 2070 and 2066 roads where recent treatment had occurred and near Dark and Scout Lakes. It may be unlikely that the birds will use these areas due to the high recreation use.

Table 3.105. Fire Intensity for the areas influencing the Suttle Lake bald eagle pair.

Fire Intensity	**Suttle Lake Bald Eagle Areas (ac)**	
	BEMA	**Nest Grove**
Stand Replacement	217	16
Mixed Severity	728	3.5
Underburned/Unburned	503	.5
Total	**1,458**	**20**

Due to the fast rate of spread, fire behavior, and lack of resources to implement, minimal fire suppression activities occurred within the BEMA. Suppression activities consisted of dozer line construction.

Evaluation Criteria

Large tree habitat for the bald eagle was lost during the B&B fire both within the Bald Eagle Management Area and around Suttle Lake in general. Development of large tree structure capable of supporting future bald eagle nesting, roosting and perching is important to achieve as quickly as possible. Evaluation criteria will consist of the timing of development of large ponderosa pine and Douglas-fir tree structure and the number of acres treated.

Environmental Consequences

Effects Common to All Alternatives Including No Action

Large green trees will remain within the BEMA, therefore retaining potential nest and roost trees.

Stand development varies by alternative by those acres planted and those acres not planted. Trees with a moderate to high likelihood of survival will not be harvested and stand development in these areas will not vary across alternatives. Due to their thick bark and tolerance to fire, ponderosa pine and Douglas-fir trees are most likely to survive. See the Forest Vegetation report for criteria in determining trees with a low probability of survival.

Where treatment does not occur across stand replacement burned areas, development of suitable habitat will be prolonged if reached at all. Brush fields will dominate in areas where there was little to no conifer seed source occurring after the fire. Where there was a conifer seed source, sampling has shown that the majority of regeneration (90%) is comprised of white fir. These white fir dominated stands will be short-lived (80-120 years on average), are vulnerable to increased levels of insects, disease, and wildfire activity. White fir is not a preferred nest tree species and may never produce large trees (>32"dbh with large limbs) needed for nesting. Therefore, it is unlikely that large dominant trees needed for nesting will develop due to the lack of adequate Douglas-fir and ponderosa pine seed sources. Fuel loadings in these once overstocked stands present a risk of future uncharacteristic wildfire. It is estimated to take in excess of 300-400 years to develop into large tree habitat where trees are established and 500+ years if shrubs are established (see Forest Vegetation Report).

Trees that pose a hazard to public safety on open roads and in recreation areas would continue to be monitored and felled when identified as an imminent hazard. Treatments proposed for the north side of Suttle Lake, developed recreation sites around Suttle Lake (campgrounds, day use areas, etc), Scout Lake, Dark Lake, Blue Lake and Round Lake have the potential to reduce the number of large snags which may serve as intermittent perch trees. At this time no known roost or perch trees have been identified for removal and roost and perch trees are abundant. Impacts from the removal of danger trees are considered minimal for the following areas:

- North side of Suttle Lake – area lies between Suttle Lake and Highway 20, a high disturbance area and use is unlikely.
- Dark and Scout Lakes – high use recreation sites, small in size, and no fisheries.

One of the primary concerns with removing hazards from the north side of Suttle Lake is removing the noise buffer for Highway 20 in relation to the nest. However, this buffer would be short-lived (snags will fall within 15-30 years) and the trade off is to provide for safety along the highway corridor.

Effects Common to All Action Alternatives

Harvest of 16"dbh or greater fire killed trees will reduce the number of potential roost and perch trees available and thus may alter roosting and foraging patterns. However, since proposed units within the BEMA occur on the uplands some distance from a shoreline, it is unlikely to alter perching and hunting patterns. See Table 3.106 for the proposed acres of treatment within the BEMA by alternative.

Table 3.106. Proposed treatment acres within the Suttle Lake BEMA/BECA for the B&B project.

Alternative	Proposed Treatment Acres in the BEMA
2	173
3	115
4	0
5	173

Planting regimes for open stand development would allow for the reintroduction of a more natural fire regime. Reforestation will focus on providing an appropriate mix of Douglas-fir and ponderosa pine trees at densities that would ultimately provide the large trees and snags needed for the development of suitable habitat conditions. Trees will be planted at 15 to 20 foot spacing to avoid the need to conduct a pre-commercial thinning. This will contribute to the development of open grown trees, quickly developing, large limbs, and wide crowns. The immediate goal and objective is to grow the big trees first and foremost. Modeling indicates that in approximately 75-100 years, the majority of trees would be greater than 21”dbh assuming an appropriate level of density control has occurred. However, the desired crown and limb development may take up to 200 years. Therefore, the development of suitable habitat is estimated to take 200-300 years for stand replacement areas and 50 to 100 years for mixed mortality and underburned areas depending on residual stand structure. Alternatives 2 and 5 will provide the greatest benefits as these alternatives replant the most acres and over the long term develop the most habitat for eagles.

The treatment of harvest created slash and fuels remaining post-harvest would vary with each alternative depending on the amount of harvest proposed. Activity fuels clean-up will occur within salvage unit boundaries to reduce fuel loads. Material less than 12”dbh would not be treated. Because material <12”dbh would remain in harvest units, the reintroduction of fire may be delayed until this material decomposes (estimated 40 years) (Bussey and Harmon). It could also increase the risk slightly to the new stand until this time. Within treatment units where total fuel loadings exceed 40 tons per acre or <3”dbh material exceeds 10 tons per acre, supplemental fuels treatments would occur to reduce potential risk to existing habitat and allow for the reintroduction of fire. Alternatives 2 and 5 result in the most acres treated in order to reduce risk to existing habitat.

Modeling included thinning in the year 2040. This activity (as modeled) would reduce the trees per acre to 60 and reduce overall canopy cover. Stands treated would be more stable, have desired stand composition, be able to produce more large trees per acre, and be able to continue to develop the large limb structure needed.

Proposed road decommissioning and inactivation varies by alternative. This activity would allow for reduced fragmentation over time as stands develop. It would also result in reduced disturbance potential. Table 3.107 outlines the proposed miles of road closures within the BEMA and BECA. The alternatives are similar with a slight increase in proposed miles for Alternative 5.

Table 3.107. Proposed Miles of Road Closures within the Suttle Lake BEMA and BECA for the B&B project.

Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Proposed Miles Reduced in BEMA	1.9	1.9	1.9	2.0
Proposed Miles Reduced in BECA	3.1	3.1	3.1	3.6
Proposed Miles Reduced within 0.25 miles of Suttle Lake nest	0.5	0.5	0.5	0.5
Proposed Miles Reduced within 0.5 miles of Suttle Lake nest	1.0	1.0	1.0	1.0

Riparian reserve treatments are not proposed with the exception of Round Lake and danger tree removal along roads. Harvest will occur within the riparian reserve around Round Lake to meet defensible space strategies outlined in the Fuels Strategy. This would equate to approximately 20 acres of treatment within the Round Lake riparian reserve meeting snag and down wood levels. Minimal impacts are expected due to the intermittent use by eagles at this location and the amount of remaining snags in the area.

Mitigation measures were developed to reduce or eliminate disturbance to nesting or roosting northern bald eagles with the implementation of any action alternative. Restrictions will be placed on activities near bald eagle nests between January 1 and August 31.

Cumulative Effects

Activities occurring within one mile of major lakes, rivers, or streams influence eagle habitat including recreation facilities, private lands, major roads, past harvest activities, and past wildfires.

Danger trees are routinely removed from recreation facilities (campgrounds, summer home tracts, etc.) and major travel routes. Continued loss of large snag habitat in and immediately adjacent to recreation facilities and major travel routes due to safety reasons limits available nesting and perching sites along suitable water bodies (e.g., Suttle Lake, Metolius River, Lake Billy Chinook). Most danger trees removed do not occur directly on the shoreline in most cases but do occur within the riparian reserve. Large snag habitat outside designated recreation areas is important to retain since most, if not all, large snag habitat will eventually be lost in the recreation sites over time. Because of the high level of use these areas receive, it is unlikely they would be utilized for nesting. Removal of snags would have no effect on nesting as bald eagles prefer green trees for nesting.

Several sections of private land occur near potential habitat. These sections are not managed for eagle habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term. For instance, private lands around Blue Lake were recently harvested after the B&B fire removing most existing large trees and snags. Other private lands occurring along the Metolius River and Lake Billy Chinook consist of small communities or resort facilities. Large tree development may be consistent with their goals and objectives but retention of large snag habitat is not for safety reasons.

Past harvest activities and wildfires (Eyerly, Link, and Cache Mountain) resulted in the removal of large trees and snags. This coupled with the loss of large snag habitat has reduced the available nesting, roosting, and perching habitat for eagles. However, recent vegetation management projects like the Metolius Basin Forest Vegetation Management project designed treatments along the Metolius River to facilitate the development of large tree structure and reduce the risk to existing large trees and snags. Some management activities primarily understory thinning within the BEMA and BECA had been completed (Coil Fiber timber sale) to help maintain existing bald eagle habitat and promote future suitable habitat for the Suttle Lake nest site. However, all treatments had not been accomplished prior to the fire, primarily around the nest tree due to seasonal restrictions for breeding.

Restoration projects on Brush Creek, Canyon Creek, and Jack Creek improved habitat for bull trout. In addition, many culverts were replaced under BAER to minimize impacts to important waterways. These projects have the potential to increase fish production, providing the bald eagle with a more abundant food source.

Overall, nesting, roosting, and perching habitat has declined but existing and potential habitat still remains outside of managed facilities and away from major travel routes. The quality of habitat has changed due to the wildfires and will continue to change inside and out of the fire areas. The future of eagle use in burned nesting territories on Suttle Lake and Lake Billy Chinook will be determined with continued monitoring.

Determination

The B&B fire area had higher than historical tree densities and fuel loadings. The fire burned with higher than historical intensities. As a result the BEMA suffered a higher loss of habitat than would have occurred under a more natural fire regime. Treatments are designed to lower fuel levels and allow for the reintroduction of fire. They would result in reduced risk to existing habitat, and provide for the development of habitat with the desired tree species composition. Mitigation measures would reduce or eliminate disturbance to nesting or roosting bald eagles with the implementation of any action alternative.

Proposed actions in Alternatives 2, 3, and 5 move portions of the stand replacement burned areas to desired habitat conditions sooner and acres treated to a more historic fire regime. Planting ponderosa pine and Douglas-fir would provide the preferred species for nesting. Reduction of fuels would allow for the use of fire to manage stands to develop dominant structures needed for nesting. In the long term, habitat more suitable for bald eagle nesting and foraging would develop in 200-300 years, approximately 100-200 years sooner than Alternatives 1 and 4. In the short term it is unknown how the eagles will continue to utilize the area. Therefore, there may be some short term impacts for long term benefits. Implementation of **Alternatives 2, 3, or 5 May Effect, but are not likely to Adversely Affect bald eagles.**

The 2004 survey showed eagles using the historic nest tree that was burned. However, this may only serve as short term habitat. Without planting ponderosa pine and Douglas-fir, the forest that would develop would be dominated by white fir, not the ponderosa pine or Douglas-fir they prefer for nesting. Without salvage, fire could not be reintroduced without destruction to existing large trees or regeneration. Fire could not be used to help maintain open understories that would aid in the development of large trees. This may result in an unusable nesting territory for a long time frame. Implementation of **Alternatives 1 and 4 May Effect and but are not likely to Adversely Affect bald eagles.**

Communication with U.S. Fish and Wildlife Service

All Project Design Criteria listed in the FY2003-2006 Programmatic Biological Assessment have been met and communication with U.S. Fish and Wildlife Service is not recommended.

<u>Northern Spotted Owl, Federal Threatened, MIS</u>

Existing Condition

In June 1990 the northern spotted owl was listed as threatened throughout its range. The FWS recently completed a five year review of the status of the owl. They concluded a change in the classification of the northern spotted owl was not warranted (USDI 2004). A report by Sustainable Ecosystems Institute (SEI) was prepared for the U.S. Fish and Wildlife Service to evaluate the scientific materials currently available on the northern spotted owl (Courtney et al. 2004). This report compared risks faced by the northern spotted owl in 2004 with those at the time of listing in 1990 under the Endangered Species Act. The SEI report incorporated the "Status and Trends in Demography of Northern Spotted Owls" report on northern spotted owl populations within the range of the Northwest Forest Plan. Some key results of the SEI report are:

- The report confirms and supports findings on habitat associations as known at the time of listing (1990): that spotted owls typically need some late-successional habitat and that other habitat components are also important in some parts of their range.
- The conservation needs of the northern spotted owl – late-successional forests and connectivity between them – have not substantially changed.
- The risks currently faced by the northern spotted owl are significant, comparable in magnitude to those faced by the species in 1990, and have the potential to increase.
- The best available data, although limited, suggest that timber harvest has decreased greatly since the time of listing and that a major cause of habitat loss on federal lands is fire.

- Major threats to northern spotted owls at this time include effects of past and current harvest, loss of habitat to fire, and barred owls.

Spotted owls are primarily inhabitants of old growth and mature forests. Suitable spotted owl habitat contains adequate quantities of dead and down woody material, decadent trees, a medium to high crown closure, multiple layers in the overstory, and trees at least 200 years old or greater than 32 inches dbh (USDA 1990b). Nesting, roosting, and foraging (NRF) habitat for the northern spotted owl on the Deschutes National Forest includes stands of mixed conifer, ponderosa pine with white fir understories, and mountain hemlock with subalpine fir. Suitable nest sites are generally in cavities in the boles of either dead or live trees. Platform nests may also be used (but more rarely), which include abandoned raptor nests, broken treetops, mistletoe brooms, and squirrel nests. Relatively heavy canopy habitat with a semi-open understory is essential for effective hunting and movement (USDA 2003a).

Habitat conditions that support good populations of northern flying squirrels (*Glaucomys sabrinus*), western red-backed voles (*Clethrionomys californicus*), and other nocturnal or crepuscular small mammals, birds, and insects are essential to supporting spotted owls. An analysis of local spotted owl pellets showed the primary prey species is the northern flying squirrel with red-backed vole, bushy-tailed woodrat (*Neotoma cinerea*), western pocket gopher (*Thomomys mazama*), Douglas squirrel (*Tamiasciurus hudsonicus*), snowshoe hare (*Lepus americanus*), voles (*Microtus* spp.), mice (*Peromyscus* spp.), and insects as secondary prey items.

The northern flying squirrel was found to be the most important prey species for the spotted owl in 16 of 17 studies analyzed for the SEI Report (Courtney et al. 2004). It was once thought to be old growth dependent but several studies have shown that densities were similar in both young and old forests, especially if old forest legacies (e.g. large decaying logs) and well-developed understories were present (Rosenberg and Anthony 1992, Carey 1995, Waters and Zabel 1995, Carey et al. 1997, Carey 2000, Carey et al. 2002, and Ransome and Sullivan 2003). Den sites have been documented in cavities in live and dead old growth trees, stick nests, moss nests, cavities in branches of fallen trees, decayed stumps, and suppressed young trees (Carey et al. 1997). Mychorrizal and epigeous fungi, in particular truffles, are an important food source for flying squirrels (Maser et al. 1985, Waters and Zabel 1995, Waters et al. 2000, Carey et al. 2002, Lehmkuhl et al. 2004, and Lehmkuhl et al. in draft, 2004) but where winter snow levels are deeper, as seen in eastside habitats more often, other foods become important like lichens (Thysell et al. 1997, Rosentreter et al. 1997, and Lehmkuhl et al. in draft, 2004).

While few studies exist for the southern red-backed vole (*C. gapperi*), a species found on the east slope of the Cascades, information does exist for the California or western red-backed vole (*C. californicus*). Patterns of abundance associated with stand age have been inconsistent. Some studies indicate voles are more highly associated with old growth or mature stands (Rosenberg et al. 1994) while others have found no difference of vole abundance between young and older forests, but stands selected were mostly naturally regenerated from wildfire (Aubry et al. 1991). The presence of down woody material seems to be important in some aspects. Tallmon and Mills (1994) found that 98% of recorded observations coincided with down logs even though only 7% of the area was covered with logs. In addition, this study reported that more decayed logs were selected for. This may have to do with increased moisture levels and the increased presence of mychorrizal fungi, a major food source. However, the presence of down woody material is not always an indicator of use. Mills (1995) found that even though down wood was present in adequate amounts, it did not predict the distribution of voles but the presence of hypogeous sporocarps, did predict distribution. Rosenberg et al. (1994) also found this species highly associated with deep organic soils, another predictor of fungi occurrence.

Bushy-tailed woodrats are also an important prey species but these species may have a patchy distribution due to specific habitat requirements. They typically inhabit boulder outcrops or talus slopes (Smith

1997). The number of suitable den sites may limit population density and appear to be climate dependent (Carey et al. 1999). Densities increase in stream-side areas associated with boulders and consistently occupy old, natural stands but are absent from young managed (35-80 years) stands (Carey et al. 1999).

Nesting, Roosting, and Foraging Habitat (NRF)
The entire project area lies within the range of the northern spotted owl and under management allocations of the Northwest Forest Plan (NWFP). Approximately 23,599 acres of the Metolius Late Successional Reserve (LSR) (RO245) are within the B&B fire perimeter as well as 9,437 acres of Critical Habitat Unit (CHU) OR-3 and 5,463 acres of Critical Habitat Unit OR-4.

Suitable NRF habitat has been declining or lost throughout the Sisters Ranger District including the project area due to mortality from insects, disease, and wildfire. Stands were "falling apart" in areas but still contained some live canopy, large snags, and down woody material. Surveys of former NRF habitat in project areas found insect and disease mortality had left many areas unsuitable as habitat. Although the decline was a continuous process over the last 10-20 years, documentation of habitat loss was completed with the Metolius and McCache project surveys and baseline NRF habitat changed in the Programmatic Biological Assessment (BA) (2003). See Table 3.108 for an accounting of NRF acres across the Sisters Ranger District.

Table 3.109. Documentation of NRF Baseline Changes in 2003.

Activity Name	Type	Acre Change
2001 Corrected NRF Baseline	SISTERS	58,371
McCache Project Surveys	Field Verification	197
Metolius Project Surveys	Field Verification	358
Metolius Project Surveys	Field Verification	(3,117)
McCache Project Surveys	Field Verification	(4,812)
Eyerly Wildfire	Wildfire	(1,377)
Cache Mountain Wildfire	Wildfire	(19)
New 2003 NRF Baseline (Sisters)	**TOTAL**	**49,601**

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Metolius Late Successional Reserves
The Metolius LSR is 75,840 acres and approximately 23,599 acres is within the project area. Prior to 2004 fire season this LSR had 15,943 acres of NRF habitat, of which 5,076 acres are within the project area. Decline in habitat has occurred with the LSR due to insects, disease, and wildfire. Table 3.109 displays NRF acres for the Metolius LSR.

Table 3.109. Accounting of NRF acres for the Metolius LSR.

Metolius Late-Successional Reserve	2000/2001	2002/2003	2003/2004
Total LSR Acres		75,840	
NRF Acres in LSR	20,330	15,943	11,824

The Northwest Forest Plan established a reserve network designed to protect late-successional forest species. The purpose of the Late Successional Reserves (LSR) is to provide distribution, quantity, and quality of late successional and old growth forest habitats sufficient to avoid foreclosure of future management options. The objective of LSRs is to "protect and enhance the condition of late-successional/old growth forest ecosystems, which serve as habitat for dependent or old growth associated species including the northern spotted owl." (USDA 1994a).

The Deschutes National Forest Late Successional Reserve Overview (USDA 1995b) recognized that late successional reserves east of the Cascade crest function differently as well as identifying the major risks to each. "Climatic conditions on the eastern flank of the Cascade Range are much drier then conditions west of the crest. These drier climatic conditions in combination with the exclusion of fire and past timber harvest activities have created over stocked and stressed stands that are and have been susceptible to large scale insect and disease epidemics, and catastrophic fires. Within Region 6, some of the Deschutes National Forest LSRs provide habitat for species which rely on late structured stands maintained by frequent, low intensity fire regimes. These "fire climax" late successional and old growth stands provide habitats and an array of late successional and old growth related species not usually associated with the "climatic climax" stands on the Deschutes Forest or Province. Because of this mix of "westside" and "eastside" vegetation types and conditions, management efforts should focus on maintaining the dynamic balance of all the vegetative series, to include both climatic climax and fire climax ecosystems. This will provide opportunities for ecosystem maintenance and restoration for existing and potential natural vegetation." (USDA 1995b).

As required by the NWFP, a Late Successional Reserve Assessment (LSRA) was completed to determine what management activities would be appropriate within the LSR. The LSRA was reviewed by the Regional Ecosystem Office (REO) and approved by letter August 8, 1996. The REO found the Metolius LSRA provided sufficient framework and context for future activities within the LSR.

Four vegetation trends were found for the LSRA. Given these trends and considering that almost 2/3 of the ponderosa pine and mixed conifer PAGs are considered dry types, there was concern over the occurrence of large-scale stand replacement events. They are as follows:

- Greatly increased stand densities are putting all sizes of trees at risk.
- Mortality of larger trees, insect and disease damage, and catastrophic fire are all increasing.
- Species composition has been shifting from early to late seral species.
- Stand structure has been shifting from larger tree sizes to smaller trees sizes, and from single or two canopy layers to multi-canopy layers.

The LSRA recognized the unbalanced nature of the vegetation within the LSR. Natural disturbance regimes have been altered by fire suppression and timber harvest. Historically, ponderosa pine plant associations had frequent low severity fires that would maintain open stands with grass and forbs in the understory. Mixed conifer plant associations would have a mix of low, moderate, and high intensity fires. Ponderosa pine plant associations have had fire regimes converted from frequent low severity fire regimes to a less frequent, moderate to high severity fire regime. Similarly, mixed conifer plant associations have changed from a complex fire regime of frequent low, moderate, and high intensity fires to one of less frequent, high intensity fires with a significant decrease in low and moderate intensity fires. High elevation and lodgepole pine plant associations were within the "natural" end of their fire cycle and stand replacement fires were expected.

The LSRA identified risk factors for the various management strategy areas (MSAs) and recommended treatments to reduce the risk of insect, disease, and fire. The LSRA included management options in which to reduce these risks and identified priority areas. However, it does not provide specific guidance for salvage other than those dealing with the mortality caused by the spruce budworm outbreak. The intent of the LSRA was to take a proactive approach before a wildfire could occur. Therefore, it was intended that treatments would have occurred to reduce the effect of a wildfire or forego this type of event all together.

Other sources have noted elevated risks of habitat loss to wildfire, insects, and disease for the east slope of the Cascades. The SEI Report (Courtney et al. 2004) lists a major cause of habitat loss on federal lands is fire. Fire was also mentioned as a major threat of habitat loss for the northern spotted owl at this time. Numerous locations throughout the document discuss that threats from catastrophic habitat loss on the east slope of the Cascade Range have increased (pages 6-4, 6-7, 6-8, 6-23, 6-24, 6-25, 6-26, 6-28, 6-32, 6-34, 8-14, 9-7, 9-8, 9-9, 9-12, 9-16, and 9-17). The trend of forest development will continue to increase the risk of habitat loss. Because years of fire suppression have occurred, there has been an increase in the accumulation of fuels, which makes these areas more susceptible to stand replacement fires, insects, and diseases. This significant threat will continue for some time. Managing the threat of habitat loss by wildfire should be a management priority.

Hessburg et al. (1994 in Courtney et al. 2004) concluded that a century of fire protection has promoted a steady shift away from open ponderosa pine and western larch forests toward denser late-seral fir forests. The harvesting of high valued seral overstory trees accelerated conversion to insect and pathogen susceptible late successional forests. Douglas-fir and grand fir (white fir) are highly susceptible to root pathogens, bark beetles, defoliators, and dwarf mistletoe. Lehmkuhl et al. (1994) documented forests in eastern Oregon and Washington became more dense in vertical and horizontal canopy structure as understory structure increased with regeneration of mostly shade-tolerant species. Along with these changes, the percentage of dead trees increased. These changes in the mixed conifer community resulted in habitat conducive to the spotted owl but have also resulted in a shift toward greater instability (Maffei and Tandy 2002). Much of this newly developed spotted owl habitat is relatively short-lived as habitat because replacement Douglas-fir and ponderosa pine nest trees are unlikely to develop given successional pathways. This was the case with most suitable habitat across the Sisters Ranger District.

In addition, the Draft Recovery Plan for the Northern Spotted Owl (USDI 1992) recognized the threats in the Eastern Cascades province:

- "Declining Habitat – a moderate threat. Habitat levels probably increased in historic times, as fire suppression allowed pine-dominated stands to develop a second canopy of mixed conifer." (page 148)
- "Vulnerability to Natural Disturbance" – The potential for large-scale loss of owl habitat from fire is higher here than for any other Oregon province, and is considered a severe threat. There is a low probability that DCAs in the province will avoid a stand replacing fire over a significant portion of the landscape during the next century. Loss of habitat is currently occurring as drought is creating forest health conditions which are expected to decrease the acreage of suitable habitat in the province." (page 149)

Biological goals and implementation guidelines were also outlined to aid in reducing risk:

- "The forest health concerns include the potential for significant loss of habitat on the Deschutes National Forest. DCAs in this area of catastrophic risk may require forest management activities beyond those recommended for most DCAs. These activities should focus on unsuitable habitat, but may occur in suitable habitat." (page 149)
- "INSECTS – Fire exclusion, coupled with natural mortality factors, gradually reduce the pine and larch components of mixed conifer stands…..the resulting multistoried stands of Douglas-fir and true fir create conditions for the build-up of defoliators. Douglas-fir tussock moth and western spruce budworm populations will increase with frequent outbreaks. …..Accumulations of heavy fuels within stands will make total fire protection very difficult." (Likely Outcome of a Total Protection Strategy during the Next Century, page 232-233).
- "There are no forest protection options to maintain owl habitat at its current level in the East Cascades sub-region. As noted, the current extensive habitat is likely a result of an historical anomaly: successful fire protection. The structure resulting from this anomaly is inherently unstable, subject to increased fire, wind, disease and insect damage. Any stand manipulation

which will significantly increase resistance to these disturbance factors apparently will result in decreased owl habitat.” (Forest Protection Guidelines, page 233)

- “Forest ecosystems are dynamic. They change with or without active management. ….A recommendation to implement a strategy that in fact reduces optimum owl habitat may seem a paradox. We believe that such implementation will in the long run better protect owl habitat than a short-sighted attempt to continue total protection. ….Active management of habitat in the East Cascades sub-region, through protection strategies designed to prevent large-scale catastrophic events, is the most rational management direction.” (Conclusions, page 234)

Therefore, there is a need to balance the management for the spotted owl with other habitat conditions on the landscape. Where development of suitable spotted owl habitat best fits the landscape, additional measures will be incorporated to ensure that components of habitat are being managed for (i.e. prey species habitat requirements, dispersal, large trees, etc.).

Critical Habitat Units
Critical Habitat Units (CHU) were established by the U. S. Fish and Wildlife Service because 1) spotted owl habitat is continually decreasing and becoming more fragmented, 2) the resultant increased threat of isolation of spotted owl populations, and 3) the exacerbation of poor habitat conditions for dispersing spotted owls.

The objectives for CHUs, developed by USFWS (1992b), are as follows:

1. Increase the amount of suitable habitat within home ranges of known spotted owls in the Southern Deschutes Area of Concern.
2. Maintain and improve dispersal habitat throughout the province, particularly across lower elevation passes along the crest of the Cascades.
3. Maintain all existing and future resident spotted owls within the southern Deschutes area until populations recover sufficiently to provide stable breeding units.

CHU OR-3 was designated to develop and maintain essential nesting, roosting, and foraging habitat and help support the dispersal of owls along the eastern slope of the Cascades. This 21,560 acre CHU is important for maintaining the eastern extent of the range within the Eastern Cascade province and for providing the north-south continuum of critical habitat along the east slope of the Cascades.

CHU OR-4 was designated to provide essential breeding, roosting, and foraging habitat and to assist the dispersal of spotted owls along the eastern extent of the Cascades. This 17,287 acre CHU provides an inter-provincial link with the Western Cascades and also helps maintain the north-south continuum of habitat along the eastern slope of the Cascades. See Table 3.110 for more information on CHUs in the project area.

Table 3.110. Accounting of NRF acres in Critical Habitat Units.

DNF Baseline CHU’s	Total Acres in CHU	Total Acres Overlap CHU with LSR	Total Acres NRF within CHU 2002/2003
OR-3	21,560	21,014	5,018
OR-4	17,287	14,688	2,272

Portions of these two CHUs occupy the B&B project area. CHU OR-3 is located in the northern section of the project area following the matrix/LSR boundary and CHU OR-4 is found in the area adjacent to the Mt. Jefferson wilderness in the First Creek drainage and along the western edge of the Suttle Lake area. Reductions in suitable NRF habitat have occurred since 1996 due primarily to insect and disease mortality and wildfire (Table 3.111).

Table 3.111. Spotted Owl NRF Habitat by Allocation Prior to the B&B Fire.

Allocation	Acres within the B&B Fire Recovery Project Area	NRF Acres Prior to the B&B Fire	Percent of Acres within B&B Fire Project Area that are NRF (pre-fire)
Late Successional Reserve	23,599	5,076	22%
Matrix	16,304	2,841	17%
Administratively Withdrawn	1,032	153	15%
Private Land	1,208	0	0
Critical Habitat Unit OR-3*	9,437	1,934	20%
Critical Habitat Unit OR-4*	5,463	1,044	19%
Total	**42,143**	**8,070**	**19%**

* - Not additive acres. Much of the CHUs overlap other allocations listed.

Dispersal Habitat

Dispersal habitat was defined by the Interagency Scientific Committee (USDA 1990b) as stands with an average dbh of 11 inches and a 40% canopy cover. Those conditions are not biologically possible in all eastside plant association groups. The Deschutes National Forest conveyed a Science Team of experts on local conditions to determine plausible definitions of dispersal habitat. The team developed a process by which local biological knowledge of sites would be used to describe dispersal habitat (USDA 1996b). The following criteria have been used to define dispersal habitat on the Sisters Ranger District for various projects (Table 3.112):

Table 3.112. Dispersal Habitat Definitions.

Plant Association Group	Stand Criteria Average dbh, Percent Canopy Cover
Mixed Conifer Wet	11” dbh, 40% CC
Mixed Conifer Dry	11” dbh, 30% CC
Ponderosa Pine	11” dbh, 30% CC
Lodgepole Pine	7” dbh, 30% CC
Mountain Hemlock	7” dbh, 30% CC

Dispersal habitat was generally available throughout the area. Even though there were high levels of mortality across the project area, some live canopy still remained as well as dense patches of advanced regeneration to provide for dispersal. Miller et al. (1997) found dispersing owls favored old growth structure for dispersal, but utilized many types of forest. Use of open sapling stands during dispersal decreased the probability of mortality, where use of clearcuts increased the probability of mortality. Miller et al. tied the increase of survival in sapling stands to availability of prey. The SEI report (Courtney et al. 2004) noted that owls did not disperse across large unforested valleys but did disperse between areas through forested foothills.

Prior to the fires adequate north/south connectivity existed along the east slope of the Cascades even with the increased mortality levels. It was marginal in some areas like the Santiam Corridor project area around Suttle Lake but the wilderness provided an additional avenue for movement north and south.

Home Ranges

Seventeen known spotted owl home ranges lie partially or totally within the B&B project area (11 pairs totally within, 6 pairs partially within). See Table 3.113 for a listing of the pairs and their reproductive history. Surveys conducted according to the R-6 protocol (1993) have occurred throughout the project area since 1995. However, the project area was not surveyed in its entirety but rather focused on specific planning areas. The B&B project area was surveyed in the spring of 2004 and will be surveyed again in

2005. All suitable habitat in addition to historic activity centers, regardless of their burn severity, were surveyed to determine post-fire occupancy and use.

Declining habitat has an effect on spotted owl reproduction and ultimately occupancy (SEI 8-14). Wildfires and defoliation has reduced the number of occupied territories. Few sites were occupied at the time of the B&B fire. In consultation with FWS a "take" situation exists where there is less than 40% NRF habitat within a 1.2 mile home range, or 50% of 0.7 mile center because of the tenuous nature of an owl's existence at those habitat levels. By 2001 all home ranges had deteriorated below the threshold due to defoliation by insects, disease, and wildfire. Current occupancy is probably due to site tenacity.

Table 3.113. Spotted owl pair survey and reproductive history for the B&B Fire Recovery Project area.

Owl Pair	Pre-fire NRF within 1.2 mi/% (of 2,955 ac)	Pre-fire NRF within 0.7 mi /% (of 980 ac)	Status 96	Status 97	Status 98	Status 99	Status 00	Status 01	Status 02	Status 03	Status 04
Abbot/Cabot	577 20%	195 20%	P-1	NA	NA	NA	Unk	Unk	NA	Unk	NA
Cabot*	-	-	-	-	-	-	--	-	-	-	-
Brush Creek	362 12%	275 28%	NA	NA	Unk	NA	Unk	Unk	Unk	Unk	NA
Jefferson Cr	855 29%	484 49%	Unk	P-1	Unk	Unk	Unk	Unk	Unk	Unk	Unk
First Creek	569 19%	297 30%	P-1	NA	Unk	NA	Unk	S	NA	NA	NA
Key West	538 18%	180 18%	NA	Unk	Unk	Unk	Unk	NA	Unk	Unk	NA
Cache Mt. West	684 23%	372 38%	R/2	P	R/2	Unk	Unk	S	NA	Unk	NA
Cache Mt. East	115 4%	47 5%	NA	Unk	Unk	NA	Unk	Unk	unk	Unk	NA
Davis Creek	834 28%	295 30%	Unk	NA	Unk	NA	Unk	NA	NA	Unk	NA
Canyon Cr	698 24%	340 35%	R/0	P	NA	NA	NA	S	NA	Unk	P-1
Bear Valley	404 14%	175 18%	P	P-1	P-1	Unk	S	Unk	S	Unk	NA
Santiam Pass	584 20%	296 30%	R/1	NA	NA	NA	Unk	Unk	Unk	Unk	NA
Spring Cr	378 13%	73 7%	P	P-1	P-1	NA	Unk	Unk	NA	NA	NA
Suttle	744 25%	155 16%	NA	P-1	P-1	NA	Unk	NA	NA	Unk	NA
Suttle 96	855 29%	329 34%	R/2	NA	Unk	NA	Unk	NA	NA	Unk	P-1
Suttle South	345 12%	160 16%	P+1	P	R-0	NA	R/2	S	NA	NA	NA

Owl Pair	Pre-fire NRF within 1.2 mi/% (of 2,955 ac)	Pre-fire NRF within 0.7 mi /% (of 980 ac)	Status 96	Status 97	Status 98	Status 99	Status 00	Status 01	Status 02	Status 03	Status 04
Upper Canyon	346 12%	100 10%	R/1	NA	Unk	Unk	Unk	Unk	NA	Unk	NA

*Cabot pair is thought to be same pair as Abbot/Cabot.
S = Single bird R/# = Pair, # of young P = Pair site, occupied
NA = surveyed, not active P-1 = Pair site occupied, 1 bird located Unk = Unknown site status

Declining trends in owl populations is range wide. Additional information can be obtained from the SEI report located at www.sei.org. Key results from the demographic study include:

- The analysis suggests that the range-wide northern spotted owl population declined at about 3.7 percent per year during the years 1985 to 2003.
- The rate of population decline for the eight monitoring areas under the Effectiveness Monitoring Plan was 2.4 percent per year.
- Oregon declined by 2.8 percent per year, California by 2.2 percent per year and unexpectedly Washington declined by 7.3 percent per year.

In light of the rapid loss of NRF habitat, as well as recent reports and findings, a strategy for the short and long-term recovery, protection, and/or development of spotted owl habitat was developed for the Metolius Watershed Update (USDA 2004b). The objective of this strategy is to maintain or accelerate large tree development to provide for suitable spotted owl habitat (NRF) on the landscape into the future and to reduce the outcomes of events such as those that occurred in the 1990's and 2000's (i.e. uncharacteristic insect and disease outbreaks and wildfires). There are both spatial and temporal considerations to the strategy. It outlines the methodology for identifying areas within the Metolius Watershed which are appropriate to manage for higher stand densities that are typical of spotted owl suitable habitat (i.e. NRF). Although the B&B Fire Recovery project's purpose and need is the recovery of wood products, management actions of alternatives were designed to be compatible with objectives associated with this strategy.

Snags and Down Wood

Due to the spruce budworm outbreak of the 1990's, abundant snag levels occurred throughout the project area. Documents, including several guiding documents, recommend retaining snags of specific diameters or diameters greater than 20 inches, or recommend limitations on amount of area salvaged.

Recovery Plan for the Northern Spotted Owl – Draft (1992 p.113-114). "Snags from the original stand may be an important component of flying squirrel habitat as forests develop after fire. Although there is some uncertainty concerning the optimum density of snags to be provided for squirrels, management to provide maximum benefit likely for this prey species is an appropriate strategy for DCAs (designated conservation areas). Therefore, snags larger than 20-inch dbh will be retained."

At that time it was believed that the flying squirrel was old growth dependent, and a secondary cavity nester, dependent on snags for denning. Rosenberg and Anthony (1992) and others (Carey 1995, Waters and Zabel 1995, Carey et al. 1997, Carey 2000, Carey et al. 2002, and Ransome and Sullivan 2003) found similar densities of flying squirrels in young second growth and old growth forests in western Oregon. They concluded that flying squirrels may be habitat generalists and not an old growth dependent species. Because they nest in a variety of structures, cavities in small snags, witches' brooms, moss and stick nests, nesting habitat may not limit their abundance. They suggested factors such as food availability, predation and competition with other species limit the abundance of the flying squirrel. Carey et al. (1997) specifically studied dens of the northern flying squirrel. They found the majority of dens were in live trees. They recommend management for northern flying squirrels include leaving large fallen trees and large dbh tall stumps, and retain large green trees with platform branching, multiple tops and/or cavities. While retaining snags in burned areas is important to provide options for the flying squirrel, retaining all snags is not. Developing closed canopy stands to provide habitat may be more important following a fire.

The recovery plan recognized that retaining all 20 inch and greater snags may not be appropriate everywhere. "This guideline may need to be refined for application in some physiographic provinces. However, retention of all stems larger than 20-inch dbh is likely to provide the highest probability of long-term retention of snags throughout the owl's range. In all areas, however, the primary focus should be on long-term planning."

The recovery plan did not refine the guidelines for physiographic provinces, set standards on how the refinement may be done, or was even finalized. The Northwest Forest Plan however did adopt many of the recommendations of the recovery plan. The FWS was heavily involved in the development of the standards and guidelines for the NWFP.

The Northwest Forest Plan (Final Supplemental Environmental Impact Statement, Appendix G) looked at the relationship of the SEIS to the goals and objectives of the draft recovery plan and the development of the alternatives for the SEIS. "The alternatives for consideration in this SEIS were developed using these (Final Draft Recovery Plan) strategic and biological principles as a basis. This basis was appropriate because the northern spotted owl population and habitat conditions had not changed significantly since the Final Draft Recovery Plan was developed.

Post-fire

The Link and B&B fires burned 23,599 acres of the Metolius LSR, 16,304 acres of Matrix, and 1,032 acres of Administratively Withdrawn within the project area. Stand replacement (>75% mortality) and mixed mortality (25-75%) fire intensity resulted in approximately 16,205 acres (69%) of LSR, 8,448 acres (52%) of Matrix, and 370 acres (36%) of Administratively Withdrawn being burned at high to moderate burn intensity. The remaining burned area consisted of underburns where fire intensities were not as great primarily as a result of back burning operations. The fires without suppression efforts burned and/or modified approximately 12,035 acres of NRF. Suppression efforts resulted in the burning and/or modification of approximately 858 acres of NRF.

The Link fire started July 5, 2003 near Cache Lake. The fire burned in heavy fuels on the north side of Cache Mountain for the first couple of days. Active fire behavior continued with torching and long range spotting for the next several days. Several burn-out operations were completed to slow the forward progress of the fire. On July 10th, the fire reached the top of Cache Mountain and winds carried it downslope towards the east. On July 11th the fire reached Little Cache Mountain where it continued to burn around both Cache and Little Cache Mountains to the south and east where in was eventually contained. Only 540 acres of the Link fire are included within the project boundary, most of which burned stand replacement (455 acres). Within the 540 acres occurring in the B&B project area, 40 acres of NRF were lost as a result of the fire. Suppression activities consisted of primarily burn out operations along major roads and some dozerline construction.

The Bear Butte and Booth fires (joined to make the B&B fire) started on August 19, 2003, both located in the Mt. Jefferson Wilderness at opposite ends. A wind driven fire in the first three days resulted in high intensity stand replacement fire over much of the area. On the fourth day, a low pressure system brought wetting rain, lower temperatures, and decreased relative humidities allowing suppression crews to begin burnout operations along main roads to help stop the spread into the Metolius Basin area. These suppression tactics occurred for the next several days while the fire spread onto the Willamette National Forest. Then on September 2nd, the fire became very active again resulting in a plume dominated fire. Suppression efforts were attempted by implementing a large burnout operation in the Cabot Creek drainage while dozer line was constructed east of Road 12. Moderate and high burn intensities resulted in the direct loss of nesting, roosting, foraging, and dispersal habitat in the north portion of the district primarily from Sugar Pine Ridge to Roaring Creek and in the southern portion of the fire from the First Creek drainage to south of Suttle Lake.

During both fires, contact was made with local U.S. Fish and Wildlife personnel and emergency consultation was initiated. Minimization measures were drafted to reduce effects if possible. These included the following:

- Avoid aggressive suppression tactics within owl nest groves (no bucket drops or dozer line through nest groves.
- Avoid flights over T&E nests (5 spotted owl activity centers identified in potential flight path).
- Minimize loss of old growth habitat.

Across the project area, areas with low intensity burns were generally underburned with varying degrees of individual tree or patch torching. These areas still retain some characteristics of habitat and are some of the few remaining green patches in the fire areas. These areas contain the last patches of suitable NRF habitat in the project area. These are small in size and isolated patches potentially usable for dispersal, but not sufficient in size to support a single owl. Even though many stands look green, many of these remaining areas are comprised of white fir, a species that does not tolerate fire and while green at this point, are most likely to die soon or are already dead. Sampling has occurred in many of these stands and results have found about 95-100% mortality in white fir trees with any scorch at all. Therefore, habitat loss may be greater than originally estimated.

Habitat loss due to construction and rehabilitation of firelines and safety zones was minimal in most cases. However, in one instance, a backfire spotted across the line into an existing nest stand and fire engulfed the nest tree. Suppression efforts led to the felling of a known nest tree and several other large trees in the core area in order to halt the fire front. Drop points and staging areas did not remove any habitat as existing road junctions or wide areas in roads were used.

Table 3.114 displays the baseline NRF acres, NRF acres lost as a result of both the B&B and Link fires, and NRF acres lost as a result of suppression efforts for the entire B&B and Link fire areas while Table 3.115 displays this information for just the B&B project area.

Table 3.114. Baseline Acres of NRF, Loss of NRF from B&B and Link Fires, and Loss of NRF from Suppression Efforts for the entire Link and B&B fire areas.

Fire Only		**Intensity**			**Suppression Only**		**Intensity**		
Allocation	**NRF Acres Lost**	**Stand Replace.**	**Mixed**	**Under-burned**	**Allocation**	**NRF Acres Lost**	**Stand Replace.**	**Mixed**	**Under-burned**
CHU OR-3	1,623	1,190	234	198	**CHU OR-3**	236	98	1	137
CHU OR-4	1,862	1,600	185	77	**CHU OR-4**	0	0	0	0
Total	**3,485**	**2,790**	**419**	**276**	**Total**	**236**	**98**	**1**	**137**
LSR	5,124	2,931	1,026	1,167	**LSR**	407	78	5	324
Matrix	2,030	674	410	946	**Matrix**	451	31	184	236
AWD	179	65	73	40	**AWD**	0	0	0	0
CWD	4,703	3,169	911	622	**CWD**	0	0	0	0
Total	**12,035**	**6,840**	**2,420**	**2,775**	**Total**	**858**	**109**	**189**	**560**

The B&B project area includes those lands within the B&B fire perimeter that are on the Deschutes National Forest outside the Mt. Jefferson and Mt. Washington wilderness areas and private lands.

Table 3.115. Baseline Acres of NRF, Loss of NRF from B&B and Link Fires, and Loss of NRF from Suppression Efforts for the Link and B&B fire areas within the B&B Fire Recovery project area.

Fire Only		**Intensity**			**Suppression Only**		**Intensity**		
Allocation	**NRF Acres Lost**	**Stand Replace.**	**Mixed**	**Under-burned**	**Allocation**	**NRF Acres Lost**	**Stand Replace.**	**Mixed**	**Under-burned**
CHU OR-3	1,617	1,186	233	198	**CHU OR-3**	236	98	1	137
CHU OR-4	1,022	887	126	9	**CHU OR-4**	0	0	0	0
Total	**2,639**	**2,074**	**359**	**207**	**Total**	**236**	**98**	**1**	**137**
LSR	4,294	2,247	972	1,075	**LSR**	406	78	5	323
Matrix	2,023	674	404	945	**Matrix**	451	31	184	236
AWD	151	38	73	40	**AWD**	0	0	0	0
CWD	0	0	0	0	**CWD**	0	0	0	0
Total	**6,468**	**2,959**	**1,450**	**2,059**	**Total**	**857**	**109**	**189**	**559**

There was significant loss of suitable NRF habitat due to the fires. Approximately 91% of the existing NRF was lost in the project area as a whole, 92% within the LSR, and 97% of the NRF within the CHUs. Table 3.116 displays NRF acres before and after the fires.

Table 3.116. Spotted owl NRF habitat by allocation before and after the Link and B&B fires.

Allocation	Acres within the B&B Fire Recovery Project Area	NRF Acres Prior to the B&B/Link Fires	NRF Acres After the B&B/Link Fires
Late-Successional Reserve	23,599	5,076	376
Matrix	16,304	2,841	367
Administratively Withdrawn	1,032	153	2
Private Land	1,208	0	0
Critical Habitat Unit OR-3*	9,437	1,934	81
Critical Habitat Unit OR-4*	5,463	1,044	22
Total	**42,143**	**8,070**	**745**

*Not additive acres. CHUs overlap other allocations listed.

Metolius Late Successional Reserve

The B&B and Link fires altered 31% (23,600 acres) of the Metolius LSR. Approximately 56% of the B&B Fire Recovery project area is within the Metolius LSR. Suitable habitat was reduced by 4,700 acres within the project area. Approximately 1% of the LSR is NRF, occurring in pockets and patches of remaining green stands.

Critical Habitat Units

Suitable habitat was reduced (4% remaining) in CHU OR-3 within the project area. This CHU had little suitable habitat overall to begin with (23%). Two large fires have occurred in this CHU in the last 5 years (Eyerly and B&B). CHU OR-4 has less than 1% suitable habitat remaining within the project area, affecting its ability to provide essential breeding, roosting, and foraging habitat. The B&B, Link, Cache Mountain, and Cache Creek fires have all occurred in this CHU since 1996. It is unlikely that these CHUs currently function as intended due to the extent of habitat loss.

Dispersal Habitat

Dispersal habitat is also very limited. Much of the fire area is unsuitable for dispersal at this time due to the amount of stand replacement. Dispersal habitat is limited to a linear strip along Green Ridge which is outside the project area. Remaining green areas are primarily comprised of MCD and PP PAGs which are dominated by ponderosa pine. These areas do not provide the best quality dispersal habitat due to the more open nature of these stands.

Since the fires of 2002 and 2003, north/south connectivity has been reduced due to high burn intensity. Large areas of the watershed experienced stand replacement. Much of the wilderness was also included within the fire perimeter reducing the potential for movement in this area as well. Few options exist for connectivity within the project area. Green Ridge, although outside the project area, may provide the only north/south corridor available at this time.

Home Ranges

Suppression activities occurred within ¼ mile of the Canyon Creek, Suttle South, Davis Creek, Suttle, Cache East, and Jefferson Creek territories. It is believed most territories were not occupied. Surveys over the previous two years (2002 and 2001) had only revealed single birds detected at the Canyon Creek and Suttle South sites. Habitat loss was most severe for the Canyon Creek (50%) and Davis Creek (10%) territories. Approximately 347 acres of NRF in the Canyon Creek home range and 84 acres of NRF in the Davis Creek home range were lost from suppression efforts. In addition, suppression activities resulted in the loss of the known nest tree for the Canyon Creek site (Table 3.117).

Table 3.117. Home Range NRF Baseline, Loss from Fire, and Loss from Suppression Efforts.

Home Range	Acres of Pre-fire NRF (1.2)*	% of Home Range (2955 ac)	NRF Acres Lost from Fires	NRF Acres Lost from Suppression Efforts	Acres of Post-fire NRF (1.2)	Resulting % of Home Range in NRF
Abbot/Cabot	577	20%	564	7	6	0%
Brush Creek	362	12%	358	0	4	0%
Jefferson Cr.	855	29%	693	0	162	5%
First Creek	569	19%	585	0	0	0%
Key West	538	18%	497	0	41	1%
Cache Mtn. West	684	23%	538	0	146	5%
Cache Mtn. East	115	4%	114	4	0	0%
Davis Creek	834	28%	296	84	454	15%
Canyon Creek	698	24%	144	347	206	7%
Bear Valley	404	14%	383	0	21	1%
Santiam Pass	584	20%	580	0	3	0%
Spring Creek	378	13%	347	0	31	1%
Suttle	744	25%	717	1	26	1%
Suttle 96	855	29%	630	51	173	6%
Suttle South	345	12%	250	20	75	3%
Upper Canyon Creek	346	12%	302	0	44	1%

*Acres of NRF have been updated from the 2004 BA Update.

It is unlikely that any of the seventeen known home ranges would be occupied or reoccupied anytime soon with the exception of perhaps the Canyon Creek and Davis Creek sites. However, this is also not very likely due to the loss of the nest tree for Canyon Creek and the amount of pre-fire mortality for the Davis Creek site. Most home ranges contained marginal habitat prior to the fire due to the spruce budworm mortality and most home ranges had not been occupied for several years. While there is evidence that spotted owls are able to withstand the short-term effects of fire occurring at low to moderate severities (0-70% canopy kill) without displacement, those in high severity (71-100% canopy kill) were displaced to the nearest available habitat, if they survived the fire (Bond et al. 2002).

Evaluation Criteria

An approach to address the maintenance and development of spotted owl habitat in light of recent events was developed for the watershed (Metolius Watershed Update). It identifies areas most suitable for the management of those habitats by incorporating appropriate plant associations, soil types, and fire regimes. Implementation of the NRF strategy would result in the retention of NRF habitat that is more sustainable over the long term and develop a north/south framework of spotted owl habitat along the east slope of the Cascades.

As mentioned earlier, the approach includes both spatial and temporal aspects. A variety of stand conditions exist at this time and different goals and objectives are associated with each type and will be addressed by the B&B project. The B&B project is not focused on fulfilling the strategy but opportunities exist to implement treatments now in order to meet some of those goals and objectives.

There will be no harvest within identified suitable habitat. However, there is risk of further loss of habitat. Fuel levels will increase as snags begin to fall putting remaining stands risk. Risk reduction is needed to maintain existing habitat.

Some stands have experienced moderate levels of mortality which may result in higher fuel loadings as time goes by putting the remaining desired habitat components (i.e. medium-sized Douglas-fir and ponderosa pine) at risk. In addition, stand composition is such that long-term sustainable habitat may not be achieved due to the amount of white fir present. Re-establishment of desired stand composition in addition to the retention of existing habitat components is needed to achieve suitable habitat conditions sooner.

Connectivity between existing suitable habitat, home ranges, and LSRs was lost. Development of dispersal habitat is important for the re-establishment of occupancy in the desired habitat areas.

Mature or old growth coniferous forests with complex structure including multiple canopy layers, large green trees and snags, heavy canopy habitat, and coarse woody debris on the forest floor developed with years of fire suppression. The older overstory, however, developed under a different fire regime. Re-establishment of stands that can be managed with fire early in the stand development, interspersed with denser habitat, is needed to adequately provide for spotted owls in the future.

Spotted owl prey species are both diverse in the habitats they utilize as well as in their dietary requirements. Therefore, management for a diverse array of habitat components and stand conditions may be necessary for healthy prey populations in order to support spotted owls. While there is no data to suggest owls or their primary prey benefit from very high densities of snags (Forsman pers. comm. from Davis EIS), management of snags is important for future potential nest sites for spotted owls and nesting habitat, and as a food source for its major prey species, the northern flying squirrel (*Glaucomys sabrinus*). Both utilize large diameter (18-33"dbh) snags (Buchanan et al. 1995, Carey et al. 1997) for nesting and resting. There are no specific snag densities recommended for these species as they also take advantage of green trees with advanced decay that have cavities produced by woodpeckers, or breakage of large limbs and tops. Down wood and snags provide major food sources for the flying squirrel whose diet consists largely of fungi, and lichens, as well as catkins, nuts, buds, fruits, insects, tree sap, roosting birds, eggs and flesh of other vertebrates (Verts and Carraway 1998). Red-backed voles (*Clethrionomys californicus*), a secondary prey species, are also associated with down wood and also rely on fungi and lichens. Lacking specific snag and down wood density recommendations for these species, use of unharvested plot data obtained from DecAID will be used in addition to peer reviewed literature for various wildlife species dependent on dead wood habitat. DecAID is a web-based advisory tool to help managers evaluate effects of forest conditions and existing or proposed management activities on organisms that use snags and down wood. It is a summary, systhesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgement and experience. It utilizes information from vegetation plots taken across the state for a given habitat type. Because plots cover a broader area than the project area, it may not accurately depict historic levels for the B&B fire area. When used DecAID allows for a comparison between alternatives. See the snag and down wood section for the goals of snag and down wood retention. Mixed conifer habitat is the focus for spotted owls as it can support higher tree densities than ponderosa pine/Douglas-fir. The Forest Vegetation Simulator with the Fire and Fuels Extension was used for modeling snag fall down rates, tree growth, and snag recruitment.

The following evaluation criteria will be used to evaluate the effects of planned activities:

1. **NRF Habitat**: Acres of suitable habitat developed over time (modeled out to 100 years).
2. **Risk**: Acres of landscape where risk reduction has occurred.
3. **Dispersal**: Acres of landscape reaching minimum dispersal habitat requirements (MCW – 11"dbh and 40% canopy cover; MCD/PP – 11"dbh and 30% canopy cover; LPP – 7"dbh and 30% canopy cover) within 100 years.

In addition, snag and down wood levels will be discussed as they relate to spotted owl habitat. However, a more in depth discussion on snags and down wood can be found in that section.

Analysis Process
Vegetation conditions, pre and post-fire, were determined using stand exam data, photo interpretation, satellite imagery, and the Most-Similar-Neighbor (MSN) Imputation program within the Integrated Forest Resource Management System (INFORMS) program. This data was then entered into the Forest Vegetation Simulator with the Fire and Fuels Extension (FVS-FFE). This suite of forest growth simulation models stand development over time as well as fuel dynamics, potential fire behavior and snag fall down rates. For a complete description of the INFORMS and FVS-FFE processes, see the Forested Vegetation Section.

These models were run to determine habitat over 100 years at 10 year intervals. The outputs include tree composition, size and canopy cover. This was used to determine the development of suitable habitat and dispersal habitat. Snag levels and diameters are another output of the models. The retention and fall down rates for snags are based on data for different species and size classes. Out-year results are not based on any individual snag, but for an area, as influences such as position on the slope and microscopic conditions are not modeled.

Environmental Consequences

Effects Common to All Alternatives Including No Action

No harvest of existing nesting, roosting, and foraging (NRF) habitat (approx. 745 acres) will occur in order to protect the remaining habitat for the spotted owl. These patches of habitat are small and isolated and may not be large enough to support a pair of spotted owls at this time.

Stand development varies by alternative by those acres planted and those acres not planted. Trees with a moderate to high likelihood of survival will not be harvested and stand development in these areas will not vary across alternatives.

Where treatment does not occur across stand replacement burned areas, development of dispersal and suitable habitat will be prolonged if reached at all. Brush fields will dominate in areas where there was little to no conifer seed source occurring after the fire. Where there was a conifer seed source, sampling has shown that the majority of regeneration (90%) is comprised of white fir. These white fir dominated stands will be short-lived (80-120 years on average), are vulnerable to increased levels of insects, disease, and wildfire activity, and may never produce large trees (>32”dbh with large limb structure) needed for nesting. In addition, tree densities of resulting stands may be patchy not providing canopy cover needed. Therefore, it is unlikely that NRF habitat will develop due to the lack of adequate Douglas-fir and ponderosa pine seed sources and the risk of future disturbances. It is estimated to take in excess of 300-400 years to develop into NRF habitat where trees are established and 500+ years if shrubs are established. Modeling has shown that no NRF habitat would develop in stand replacement areas within the first 100 years for all alternatives.

Mixed severity and underburned areas are estimated to reach dispersal and suitable habitat conditions sooner (100 to 200 years) than stand replacement areas. Further decline is expected in white fir dominated stands. These stands will continue to experience mortality where fire impacted them at all due to the thin bark of white fir and its intolerance to fire damage. This added mortality will increase fuel levels and put existing habitat at risk to loss.

NRF habitat will only develop in the central portion of the project area where stands have been underburned or in some stands that experienced mixed mortality in the next 100 years. Treatment is not proposed in most of these stands allowing natural processes to occur (i.e. regeneration). Most developing NRF stands will have a large percentage of the stand composition comprised of white fir occurring at high densities. Overstocking puts desired existing habitat components at risk (large Douglas-fir and ponderosa pine trees). Since these components have been greatly reduced within the project area and development of additional large trees will not occur for several decades, retention and protection of those components is important in order to facilitate the recovery of owl populations in the project area.

LSR/CHU

Both the LSR and Critical Habitat Units show similar trends in suitable habitat development within the first 100 years. Suitable NRF habitat reaches a high around year 2060 but then decreases. This is due to the development of white fir dominated stands and the susceptibility of these stands to increased mortality from insects and disease as seen in the project area prior to the fire. By not maintaining the suitable habitat that has developed, these CHUs will not function as intended. This trend is similar across all alternatives (Table 3.118).

Table 3.118. Suitable NRF habitat developed in the LSR and CHUs for the B&B project area for the No Action Alternative.

Year	Area	NRF Acres Developed for No Action Alternative
	Critical Habitat Unit OR-3	
2060		1,055
2100		256
	Critical Habitat Unit OR-4	
2060		785
2100		350
	Metolius LSR	
2060		4,997
2100		1,794

Dispersal

Connectivity would remain limited primarily to routes outside the project area for the first 100 years. Dispersal habitat in stand replacement areas will not be widespread for some time. Most dispersal habitat developed occurs within the mixed and underburned areas (central portion of the project area primarily) with minimal development in stand replacement areas. The lack of dispersal habitat and connectivity across the project area may limit use by spotted owls especially in areas that experienced stand replacement burns until conditions improve.

Dispersal habitat however shows a different trend. Habitat development shows a steady increase until year 2040 and between years 2040 and 2050, dispersal habitat acres almost double and then again increases steadily. At this time (2050), many stands are reaching the size and canopy cover requirements needed for dispersal habitat. However, stands are comprised of primarily white fir with little Douglas-fir and ponderosa pine (Table 3.119).

Table 3.119. Dispersal habitat developed in the LSR and CHUs for the B&B project area for the No Action Alternative.

Year	Area	NRF Acres Developed for No Action Alternative
	Critical Habitat Unit OR-3	
2060		3,804
2100		4,986
	Critical Habitat Unit OR-4	
2060		1,754
2100		3,074
	Metolius LSR	
2060		12,416
2100		15,688

Trees that pose a hazard to public safety on open roads and in recreation areas would continue to be monitored and felled when identified as an imminent hazard. These typically occur outside suitable habitat or areas managed for the development of suitable habitat. However, where danger trees are identified in suitable habitat, trees will be felled and left to provide additional downed wood. Danger trees within NRF habitat should be rare since these stands are still green. Removal of hazards outside of NRF habitat will reduce snag and down wood levels, however this will be minor in scope and will be contained to the road prism and area immediately adjacent. Adequate snag and downed wood levels will still remain across the project area. The amount of treatment varies by alternative.

Effects Common to All Action Alternatives

Planting regimes for open stand development would provide for the reintroduction of a more natural fire regime. Reforestation will focus on providing an appropriate mix of Douglas-fir and ponderosa pine trees at densities that will ultimately provide the 8+ large trees per acre, snags, and down wood needed for the development of suitable NRF habitat conditions. Trees will be planted at 15 to 20 foot spacing to avoid the need to conduct a pre-commercial thinning. This will contribute to the development of open grown trees, quickly developing, large limbs, and wide crowns. The immediate goal and objective is to grow the big trees first and foremost. It is estimated that in approximately 75-100 years, the majority of trees would be greater than 21"dbh assuming an appropriate level of density control has occurred. However, the desired crown development may take up to 200 years. Therefore, the development of NRF habitat is estimated to take 200-300 years for stand replacement areas and 50 to 100 years for mixed mortality and underburned areas depending on residual stand structure. Those areas most important for the development of habitat were identified in the NRF strategy and the degree to which this project assists in the development of habitat varies by alternative. See Table 3.120 for acres proposed in the NRF strategy areas by alternative.

Table 3.120. Proposed treatment acres in the NRF strategy area for the B&B project area.

Proposed Treatment	Alternative 2 Acres	Alternative 3 Acres	Alternative 4 Acres	Alternative 5 Acres
HSV-M	59	59	59	59
HSV-M-WF	458	343	355	448
HSV-SR	981	562	336	486
HSV-UB-WF	103	102	102	103
SFP-M	16	0	0	16
SFP-SR	50	0	29	50
TOTAL	**1,668**	**1,066**	**882**	**1,163**

As Table 3.120 indicates, Alternative 2 results in the most acres treated in the NRF strategy areas resulting in more suitable habitat developed over time than the other alternatives. It also reduces risk across more acres, providing more protection to the remaining habitat from uncharacteristic wildfire.

Modeling included commercial thinning in year 2040. This activity (as modeled) would reduce the trees per acre to 60 and reduce overall canopy cover. Therefore, some stands almost meeting criteria for NRF or dispersal habitat may be delayed until a later time. However, stands treated would be more stable, have desired stand composition, be able to produce more large trees per acre, and be able to develop the large limb structure needed.

The removal of harvest created slash and fuels remaining post-harvest would be treated with each alternative. The amount and method would vary by alternative depending on the amount of harvest proposed. Activity fuels clean-up would occur within salvage unit boundaries to reduce fuel loads. Material less than 12"dbh will not be treated. Because material <12"dbh would remain in harvest units, it may not allow for the reintroduction of fire until this material decomposes (estimated 40 years). It would also increase the risk slightly to the new stand until this material decomposes. However, supplemental fuels treatments are also proposed within treatment units when total fuel loadings exceed 40 tons per acre or <3"dbh material exceeds 10 tons per acre, reducing potential risk. These activities will alter down woody material levels and distributions which may affect prey species. However, project design and mitigation measures for retaining large pieces of down wood would provide for varying densities of prey at the same time stands develop conditions preferred by these species (tree densities, canopy cover, size of structures, etc.).

Road decommissioning and inactivation is proposed and will vary by alternative. This activity will allow for reduced fragmentation over time as stands develop. It will also result in reduced disturbance potential.

Riparian reserve treatments are not proposed with the exception of Round Lake and danger tree removal along roads. Harvest will occur within the riparian reserve around Round Lake to meet defensible space strategies outlined in the Fuels Strategy. This will equate to approximately 20 acres of treatment within the riparian reserve around Round Lake meeting snag and down wood levels. High densities of down wood will occur in most riparian reserves benefiting prey species like the red-backed vole over time.

To ensure spotted owls are no longer utilizing the project area or are protected if they are, surveys following the Region 6 survey protocol (3 visits for two seasons) will be completed throughout the project area. Known activity centers within stand replacement areas will also be surveyed regardless of burn intensity. Any burned stands found to have nesting owls will be dropped or deferred from salvage until the area is no longer utilized by owls. Harvest activities within ¼ mile or close proximity to known spotted owl activity centers may disrupt nesting activity. Harvest operations would be restricted during the nesting period (March 1 through September 30). Harvest is proposed within ¼ mile of one known spotted owl activity center (Canyon Creek) still considered potentially viable for all alternatives and units occurring within this zone will be restricted.

Alternative 1 – No Action
Direct and Indirect Effects

NRF Habitat
This alternative allows for processes to follow natural succession. There would no removal of wood other than danger trees, no planting of desired tree species, or fuels reduction. Suitable NRF habitat reaches a high around year 2060 but then decreases. This is due to the development of white fir dominated stands

and the susceptibility of these stands to increased mortality from insects and disease as seen in the project area prior to the fire. Large portions of the project area would be white fir with scattered patches of ponderosa pine and Douglas-fir. Existing habitat would be at risk due to high fuel loadings (Table 3.121).

Table 3.121. Acres of habitat development over time for the B&B project area (No Treatment).

Habitat Developed within 100 Years (Year 2100)	Land Allocation (Acres)				
	LSR	**Matrix**	**AWD**	**CHU OR-3***	**CHU OR-4***
Suitable NRF Habitat	1,794	3,083	208	256	350
Dispersal Habitat	15,688	11,177	691	4,986	3,074

*- Acres are not additive.

NRF habitat would be comprised primarily of white fir and in a state of decline, with little to no development of ponderosa pine and Douglas-fir forests across the landscape. It is unknown if spotted owls would use and/or be productive in this type of habitat.

Dispersal

Dispersal habitat would not develop in stand replacement areas until approximately year 2050. Dispersal habitat would be patchy. It is not possible to determine whether the pattern of dispersal habitat would be adequate to provide sufficient connections to LSRs and CHUs to the north and south. Approximately 89% of the dispersal habitat developed by 2050 is located in mixed and underburned areas (Table 3.122).
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Table 3.122. Dispersal habitat developed over time for the B&B project area (No Treatment).

Year	LSR (acres)	Matrix (acres)	AWD (acres)	Total Acres
2006	3,051	1,997	96	**5,144**
2010	1,653	1,339	96	**3,088**
2020	1,567	965	115	**2,647**
2030	2,190	1,994	162	**4,346**
2040	4,260	3,451	244	**7,955**
2050	10,191	8,091	445	**18,727**
2060	12,416	9,455	559	**22,430**
2070	13,707	10,663	660	**25,030**
2080	14,604	10,955	676	**26,235**
2090	15,092	11,237	691	**27,020**
2100	15,688	11,177	691	**27,556**

Risk

There would be no risk reduction with fuels treatments with this alternative. The trade off would be in available snag habitat over the short term. Initially, snag habitat would be abundant throughout the watershed with 23% of the mixed conifer habitat type exceeding 60 snags per acre ≥10"dbh and 7% exceeding 18 snags per acre ≥20"dbh. These densities would provide habitat for a number of secondary species such as red-backed voles, but canopy cover would be insufficient for the flying squirrel inside the project area. Outside the project area and in green stands within the project area, canopy cover would be sufficient in most mixed conifer wet stands to provide for the flying squirrel. Modeling predicts at year 2040 standing snag levels have dropped and densities range from 0 to 12 snags per acre ≥20"dbh. Snag levels do not mimic distributions as displayed in DecAID from unharvested CVS plots where there is a broader distribution of snag densities. Snag recruitment inside the project area will not occur for approximately 50 years in stand replacement areas and then will consist primarily of smaller (<10"dbh) snags at that time (Table 3.123 & 3.124).

Table 3.123. Snag Habitat Over Time, Mixed Conifer, **>10”**dbh, No Treatment.

Data from DecAID	**EMC_S Unharvested plot data**	**Post Treatment Year 2006**	**Year 2040**	**Year 2100**
Snag density/ac	>10”dbh, % of area	>10”dbh, % of area	>10”dbh, % of area	>10”dbh, % of area
0	15	0	1	0
0-6	25	10	58	40
6-12	17	7	28	11
12-18	18	10	9	10
18-24	9	11	3	5
24-30	6	9	1	5
30-36	4	9	1	6
36-42	2	7	0	9
42-48	1	5	0	8
48-54	1	4	0	3
54-60	1	3	0	2
60+	2	23	0	1
	101*	100	100	100

* - Exact percentages not gained due to rounding.

Table 3.124. Snag Habitat Over Time, Mixed Conifer, **>20”**dbh, No Treatment

Data from DecAID	**EMC_S Unharvested plot data**	**Post Treatment Year 2006**	**Year 2040**	**Year 2100**
Snag density/ac	>20”dbh, % of area	>20”dbh, % of area	>20”dbh, % of area	>20”dbh, % of area
0	31	6	3	2
0-2	18	21	46	47
2-4	17	18	31	22
4-6	13	11	14	15
6-8	7	12	5	8
8-10	6	9	1	4
10-12	3	5	0	2
12-14	1	4	0	1
14-16	2	2	0	0
16-18	1	4	0	0
18+	1	7	0	0
	100	100	100*	100

* - Exact percentages not gained due to rounding.

Approximately 2% of the project area within LSR would meet or exceed LSRA recommendations for down wood habitat of 25 to 35 tons per acre (2.29 – 4.77% down wood cover) in 2006 representing post-harvest. It would be abundant and potentially persistent until fire returns to the area. Fuel loadings for the project area would steadily increase until around 2030 to 2060 which indicates when most snags would be on the ground. After this time period, down wood levels decrease slightly as down wood begins to decompose. However, these are still above optimum levels recommended by Brown et al. (2003) for cool Douglas-fir types (10 to 30 tons per acre). These heavy fuel loads would result in stand replacement fire if a fire were to start (Table 3.125).

Table 3.125. Down wood levels over time, MCW in LSR, for the B&B Project Area, No Action.

Tons per Acre	Percent of Late-Successional Reserve			
	2006	2030	2060	2100
<25	97	51	50	41
25-35	2	24	25	29
>35	0	25	25	30

Alternative 2

This alternative would treat approximately 6,802 acres (~16% of project area), including 1,668 acres in the NRF strategy area. Ground based yarding would be the primary harvest system (5,847 acres) while helicopter yarding is proposed for 955 acres. Salvage would treat dead and dying trees in matrix and dead only in LSR 16"dbh or greater. A small percentage of the total acres are designated for the removal of special forest products which would target smaller diameter trees. In addition, approximately 6,802 acres would be reforested, danger trees would be treated along 146 miles of road and 20 acres of high public use areas, fuels would be reduced on 6,802 acres, and about 71 miles of road would be decommissioned or inactivated (Table 3.126).

Table 3.126. Proposed treatment acres by land allocation for Alternative 2.

Land Allocation	Alternative 2 Proposed Treatment Acres
Late Successional Reserve	4,960
Matrix	1,725
Administratively Withdrawn	117
Critical Habitat Unit OR-3*	2,271
Critical Habitat Unit OR-4*	1,518
Total	**6,802**

* - Acres are not additive but included in the above totals.

Alternative 2 will use a landscape approach to snag retention by retaining 2 of the most likely to persist snags per acre in all units in addition to 15% retention clumps in units greater than 40 acres. This would result in a mosaic of low density areas in a landscape of high density snags. The 2 most likely to persist snags will most likely be Douglas-fir or ponderosa pine since they remain standing the longest and consist of the larger size classes. In addition, for units that have the potential to become NRF habitat within the next 100 years and are within 2 miles of existing NRF, one additional snag >20"dbh per acre will be retained along with 15% retention in units 20 acres or greater.

Harvest would include approximately 419 acres of white fir dominated stands in the LSR that experienced mixed mortality or were underburned. Only white fir trees less than 28"dbh would be removed after snag and downed wood levels are met. No ponderosa pine or Douglas-fir would be taken in these units.

Direct and Indirect Effects

NRF Habitat

Salvage reduces dead tree levels on 6,802 acres. Planting in 6,802 acres where there was treatment ensures reforestation of preferred tree species (ponderosa pine and Douglas-fir).

Treatment of white fir dominated stands would facilitate the reforestation of desired tree species and accelerate the development of NRF habitat. Removal of excess material in stands with existing habitat components will help reduce risk of loss as well. With little NRF habitat remaining in the project area and the long time frame needed to develop suitable habitat over much of the area, these remnant habitat components (larger desired tree species) are important to retain since these areas have the potential to develop into habitat at a faster rate than those that have experienced stand replacement (Table 3.127).

Table 3.127. Acres of habitat development over time for the B&B project area (Alternative 2).

Habitat Developed within 100 Years (Year 2100)	Land Allocation (Acres)				
	LSR	Matrix	AWD	CHU OR-3*	CHU OR-4*
Suitable NRF Habitat	1,725	3,066	208	254	336
Dispersal Habitat	16,496	11,189	644	5,599	3,218

* - acres are not additive.

NRF habitat at this time (100 years) is primarily those areas that were underburned, treated or not treated. White fir was removed in treatment units and Douglas-fir and ponderosa pine dominate these stands. Although this alternative has less NRF developed than Alternative 1 the composition of the stands are more stable. Additionally, 6,802 acres of ponderosa pine and Douglas-fir forests will be usable as foraging with 1,668 acres specifically managed for NRF habitat. The matrix would provide the bulk of the habitat for spotted owls at this time.

Dispersal

Dispersal habitat increases through the years similar to the No Action. A minor lag time develops when compared to Alternative 1 at year 2020. This is a reflection of the thinning modeled. Growth from the thinned trees accelerates and by 2100 dispersal habitat in this alternative exceeds the No Action (Table 3.128).

Table 3.128. Dispersal habitat developed over time for the B&B project area (Alternative 2).

Year	LSR (acres)	Matrix (acres)	AWD (acres)	Total Acres
2005	3,051	1,997	96	**5,144**
2010	1,530	1,281	96	**2,907**
2020	1,511	947	114	**2,572**
2030	2,175	1,967	156	**4,298**
2040	4,251	3,440	238	**7,929**
2050	9,451	7,657	413	**17,521**
2060	11,539	9,207	512	**21,258**
2070	12,804	10,424	613	**23,841**
2080	14,042	10,796	640	**25,478**
2090	15,235	11,215	655	**27,105**
2100	16,496	11,189	644	**28,329**

Risk

The 5,394 acres of fuels strategy treatment areas includes 2,700 acres of defensible space for existing NRF (324 acres) and potential future NRF (2,376 acres) Fuels treatments and salvage would result in 3,596 acres where fuel loading does not exceed 10-35 tons per acre (DEIS 3-228,3-233).

The change in fuel loading over time is discussed in the Fire and Fuels section. The trade off with risk reduction is a reduction in snags and down wood across the landscape. Optimal levels for wildlife range from 5-20 tons per acre on dry forest types and 10-30 tons per acre on other forest types (Brown et al. 2003). These levels include both standing and down.

The landscape approach to snag retention will result in the 2 most likely to persist snags per acre, most likely Douglas-fir or ponderosa pine. These species have been found to have longer standing times

(Everett et al. 1999) and are usually the largest snags available. Although these species remain standing for a longer time, they probably will not persist until stands become habitat (Dahms 1949, Keen 1929, Parks et al. 1999, and Everett et al. 1999). They may be present as downed wood however, providing habitat for prey species like the northern flying squirrel and red-backed vole.

In addition, units within 2 miles of existing NRF and have the ability to become NRF within 100 years will retain one additional snag per acre. Spotted owls, where their main prey species is the northern flying squirrel, have larger home ranges (Carey et al. 1992). Since sampling of pellets has shown the flying squirrel as the main prey species here, an expanded buffer zone was prescribed for units meeting these criteria (from 1.2 miles to 2 miles). This will provide for prey habitat within and adjacent to existing and reasonably foreseeable habitat by providing increased downed wood levels while still maintaining the ability to reforest and reintroduce fire.

Although treatment units will have decreased levels of dead wood structure, there are untreated patches within (15% retention) and between units that will provide high density levels of snags and downed wood. Due to the juxtaposition of treatment units and untreated patches, a diversity of habitat conditions will be provided.

Initially, snag habitat would be abundant throughout the watershed with 21% of the mixed conifer habitat type exceeding 60 snags per acre ≥10"dbh and 6% exceeding 18 snags per acre ≥20"dbh. Levels identified are very similar as the No Action alternative. These densities would provide habitat for a number of secondary species such as red-backed voles, but canopy cover would be insufficient for the flying squirrel inside the project area. Outside the project area and in green stands within the project area, canopy cover would be sufficient in most mixed conifer wet stands to provide for the flying squirrel. Modeling predicts at year 2040 standing snag levels have dropped and densities range from 0 to 10 snags per acre ≥20"dbh. Snag levels do not mimic distributions as displayed in DecAID from unharvested CVS plots where there is a broader distribution of snag densities. Snag recruitment inside the project area will not occur for approximately 50 years in stand replacement areas and then will consist primarily of smaller (<10"dbh) snags (Table 3.129 & 3.130).

Table 3.129. Snag Habitat Over Time, Mixed Conifer, **≥10"**dbh, Alternative 2.

Data from DecAID	**EMC_S Unharvested plot data**	**Post Treatment Year 2006**	**Year 2040**	**Year 2100**
Snag density/ac	≥10"dbh, % of area	≥10"dbh, % of area	≥10"dbh, % of area	≥10"dbh, % of area
0	15	0	1	39
0-6	25	11	60	12
6-12	17	8	27	10
12-18	18	11	9	5
18-24	9	11	3	5
24-30	6	9	1	6
30-36	4	9	1	8
36-42	2	7	0	8
42-48	1	5	0	3
48-54	1	4	0	2
54-60	1	3	0	1
60+	2	21	0	0
	101*	100	100	100

* - Exact percentages not gained due to rounding.

Table 3.130. Snag Habitat Over Time, Mixed Conifer, **≥20”**dbh, Alternative 2.

Data from DecAID	**EMC_S Unharvested plot data**	**Post Treatment Year 2006**	**Year 2040**	**Year 2100**
Snag density/ac	≥20”dbh, % of area	≥20”dbh, % of area	≥20”dbh, % of area	≥20”dbh, % of area
0	31	6	3	2
0-2	18	22	49	47
2-4	17	20	29	22
4-6	13	11	13	15
6-8	7	11	5	8
8-10	6	9	1	4
10-12	3	5	0	2
12-14	1	4	0	1
14-16	2	2	0	0
16-18	1	4	0	0
18+	1	6	0	0
	100	100	100	100

* - Exact percentages not gained due to rounding.

Approximately 2% of the project area within LSR would meet or exceed LSRA recommendations for down wood habitat of 25 to 35 tons per acre (2.29 – 4.77% down wood cover) in 2006 representing post-harvest. It would be abundant and potentially persistent until fire returns to the area. Fuel loadings for the project area would steadily increase until around 2030 to 2060 which indicates when most snags would be on the ground. After this time period, down wood levels decrease slightly as down wood begins to decompose. However, these are still above optimum levels recommended by Brown et al. (2003) for cool Douglas-fir types (10 to 30 tons per acre). These heavy fuel loads would result in stand replacement fire if a fire were to start. Alternative 2 results in the greatest reduction in risk (Table 3.131).

Table 3.131. Down wood levels over time, MCW in LSR, for the B&B Project Area, Alternative 2.

Tons per Acre	**Percent of Late-Successional Reserve**			
	2006	**2030**	**2060**	**2100**
<25	98	58	56	47
25-35	2	21	23	26
>35	0	22	21	27

Alternative 3

This alternative would treat approximately 3,762 acres (~9% of project area). Ground based yarding is the only harvest system prescribed for all 3,762 acres. Salvage would treat dead and dying trees in matrix and dead only in LSR 16”dbh or greater. In addition, approximately 3,762 acres would be reforested, danger trees would be treated along 121 miles of road and 20 acres of high public use areas, fuels would be reduced on 3,762 acres, and about 71 miles of road would be decommissioned or inactivated (Table 3.132).

Table 3.132. Proposed treatment acres by land allocation for Alternative 3.

Land Allocation	**Alternative 3 Proposed Treatment Acres**
Late Successional Reserve	2,002
Matrix	1,643
Administratively Withdrawn	117
Critical Habitat Unit OR-3*	1,099
Critical Habitat Unit OR-4*	592
Total	**3,762**

* - Acres are not additive but included in the above totals.

Alternative 3 will leave snags according to the Metolius LSRA for units within the LSR and DecAID habitat type levels will be applied to matrix units on a per acre basis (averaged across the unit). This will result in a mosaic of low density areas scattered between high density clumps and untreated areas.

Direct and Indirect Effects
NRF Habitat
Salvage reduces dead tree levels on 3,762 acres. Planting in 3,762 acres where there was treatment ensures reforestation of preferred tree species (ponderosa pine and Douglas-fir).

Treatment of white fir dominated stands would facilitate the reforestation of desired tree species and accelerate the development of NRF habitat. Removal of excess material in stands with existing habitat components will help reduce risk of loss as well. With little NRF habitat remaining in the project area and the long time frame needed to develop suitable habitat over much of the area, these remnant habitat components (larger desired tree species) are important to retain since these areas have the potential to develop into habitat at a faster rate than those that have experienced stand replacement (table 3.133).

Table 3.133. Acres of habitat development over time (Alternative 3).

Habitat Developed within 100 Years	Land Allocation (Acres)				
	LSR	Matrix	AWD	CHU OR-3*	CHU OR-4*
Suitable NRF Habitat	1,768	3,074	208	254	349
Dispersal Habitat	16,028	11,206	691	5,222	3,116

* - acres are not additive.

NRF habitat at this time (100 years) is primarily those areas that were underburned, treated or not treated. White fir was removed in treatment units and Douglas-fir and ponderosa pine dominate these stands. Although this alternative has less NRF developed than Alternative 1 the composition of the stands are more stable. Additionally, 3,762 acres of ponderosa pine and Douglas-fir forests will be usable as foraging with 1,066 acres specifically managed for NRF habitat. The matrix would provide the bulk of the habitat for spotted owls at this time.

Dispersal
Dispersal habitat increases through the years similar to the No Action. A minor lag time develops when compared to Alternative 1 at year 2020. This is a reflection of the thinning modeled. Growth from the thinned trees accelerates and by 2100 and dispersal habitat in this alternative exceeds the No Action slightly but is less than Alternative 2 (Table 3.134).

Table 3.134. Dispersal habitat developed over time (Alternative 3).

Year	LSR (acres)	Matrix (acres)	AWD (acres)	Total Acres
2005	3,051	1,997	96	**5,144**
2010	1,632	1,284	96	**3,012**
2020	1,546	947	115	**2,608**
2030	2,175	1,967	162	**4,304**
2040	4,236	3,439	244	**7,919**
2050	9,862	7,668	445	**17,975**
2060	11,988	9,230	559	**21,777**
2070	13,228	10,442	660	**24,330**
2080	14,264	10,805	676	**25,745**
2090	15,059	11,221	691	**26,971**
2100	16,028	11,206	691	**27,925**

Risk
The 1,149 acres of fuels strategy treatment areas includes 1,588 acres of defensible space for existing NRF (178 acres) and potential future NRF (1,410 acres) Fuels treatments and salvage result in 2,078 acres where fuel loading does not exceed 10-35 tons per acre (IGOT THese NUMBER FROM DEIS 3-228,3-233).

Initially, snag habitat would be abundant throughout the watershed with 22% of the mixed conifer habitat type exceeding 60 snags per acre ≥10"dbh and 7% exceeding 18 snags per acre ≥20"dbh. Levels identified are very similar as the No Action alternative. These densities would provide habitat for a number of secondary species such as red-backed voles, but canopy cover would be insufficient for the flying squirrel inside the project area. Outside the project area and in green stands within the project area, canopy cover would be sufficient in most mixed conifer wet stands to provide for the flying squirrel. Modeling predicts at year 2040 standing snag levels have dropped and densities range from 0 to 10 snags per acre ≥20"dbh. Snag levels do not mimic distributions as displayed in DecAID from unharvested CVS plots where there is a broader distribution of snag densities. Snag recruitment inside the project area will not occur for approximately 50 years in stand replacement areas and then will consist primarily of smaller (<10"dbh) snags (Table 3.135 & 3.136).

Table 3.135. Snag Habitat Over Time, Mixed Conifer, **≥10"**dbh, Alternative 3.

Data from DecAID	**EMC_S Unharvested plot data**	**Post Treatment Year 2006**	**Year 2040**	**Year 2100**
Snag density/ac	≥10"dbh, % of area	≥10"dbh, % of area	≥10"dbh, % of area	≥10"dbh, % of area
0	15	0	1	0
0-6	25	11	59	39
6-12	17	8	27	12
12-18	18	10	9	10
18-24	9	11	3	5
24-30	6	10	1	5
30-36	4	9	1	6
36-42	2	7	0	8
42-48	1	5	0	8
48-54	1	4	0	3
54-60	1	4	0	2
60+	2	22	0	1
	101*	100	100	100

* - Exact percentages not gained due to rounding.

Table 3.136. Snag Habitat Over Time, Mixed Conifer, **≥20"**dbh, Alternative 3.

Data from DecAID	**EMC_S Unharvested plot data**	**Post Treatment Year 2006**	**Year 2040**	**Year 2100**
Snag density/ac	≥20"dbh, % of area	≥20"dbh, % of area	≥20"dbh, % of area	≥20"dbh, % of area
0	31	6	3	2
0-2	18	21	47	47
2-4	17	18	30	22
4-6	13	12	13	15
6-8	7	12	5	8
8-10	6	9	1	4
10-12	3	5	0	2

12-14	1	4	0	1
14-16	2	2	0	0
16-18	1	4	0	0
18+	1	7	0	0
	100	100	100	100

* - Exact percentages not gained due to rounding.

Approximately 2% of the project area within LSR would meet or exceed LSRA recommendations for down wood habitat of 25 to 35 tons per acre (2.29 – 4.77% down wood cover) in 2006 representing post-harvest. It would be abundant and potentially persistent until fire returns to the area. Fuel loadings for the project area would steadily increase until around 2030 to 2060 which indicates when most snags would be on the ground. After this time period, down wood levels decrease slightly as down wood begins to decompose. However, these are still above optimum levels recommended by Brown et al. (2003) for cool Douglas-fir types (10 to 30 tons per acre). These heavy fuel loads would result in stand replacement fire if a fire were to start. Alternative 3 results in some reduction of risk (Table 3.137).

Table 3.137. Down wood levels over time, MCW in LSR, for the B&B Project Area, Alternative 3.

Tons per Acre	**Percent of Late-Successional Reserve**			
	2006	**2030**	**2060**	**2100**
<25	97	54	52	44
25-35	2	22	24	27
>35	0	24	23	29

Alternative 4

This alternative would treat approximately 1,725 acres (~4% of project area). Ground based yarding is the only harvest system prescribed for all 1,725 acres. Salvage would treat dead and dying trees 16”dbh or greater in matrix only. A small percentage of the total acres are designated for the removal of special forest products which would target smaller diameter trees. In addition, approximately 1,725 acres would be reforested, danger trees would be treated along 54 miles of road and 20 acres of high public use areas, fuels would be reduced on 1,725 acres, and about 71 miles of road would be decommissioned or inactivated (Table 3.138).

Table 3.138. Proposed treatment acres by land allocation for Alternative 4.

Land Allocation	**Alternative 4 Proposed Treatment Acres**
Late Successional Reserve	0
Matrix	1,725
Administratively Withdrawn	0
Critical Habitat Unit OR-3*	28
Critical Habitat Unit OR-4*	68
Total	**1,725**

* - Acres are not additive but included in the above totals.

Alternative 4 will use the same landscape approach to snag retention as in Alternative 2 except that only matrix lands will be included. This will include the retention of the 2 most likely to persist snags per acre in all units in addition to 15% retention clumps in units greater than 40 acres. This would result in a mosaic of low density areas in a landscape of high density snags. The 2 most likely to persist snags will most likely be Douglas-fir or ponderosa pine since they remain standing the longest and consist of the larger size classes. In addition, for units that have the potential to become NRF habitat within the next

100 years and are within 2 miles of existing NRF, one additional snag >20"dbh per acre will be retained along with 15% retention in units 20 acres or greater.

Treatment is limited to matrix allocations for this alternative. Goals and objectives outlined in the Metolius Late Successional Reserve will not be obtained with the implementation of this alternative.

Direct and Indirect Effects

NRF Habitat
Salvage reduces dead tree levels on 1,725 acres. Planting in 1,725 acres where there was treatment ensures reforestation of preferred tree species (ponderosa pine and Douglas-fir).

Treatment of white fir dominated stands would facilitate the reforestation of desired tree species and accelerate the development of NRF habitat. Removal of excess material in stands with existing habitat components will help reduce risk of loss as well. With little NRF habitat remaining in the project area and the long time frame needed to develop suitable habitat over much of the area, these remnant habitat components (larger desired tree species) are important to retain since these areas have the potential to develop into habitat at a faster rate than those that have experienced stand replacement (Table 3.139).

Table 3.139. Acres of habitat development over time for the B&B project area (Alternative 4).

Habitat Developed within 100 Years (Year 2100)	Land Allocation (Acres)				
	LSR	**Matrix**	**AWD**	**CHU OR-3***	**CHU OR-4***
Suitable NRF Habitat	1,783	3,066	208	256	350
Dispersal Habitat	15,688	11,189	691	4,986	3,066

* - acres are not additive.

NRF habitat at this time (100 years) is primarily those areas that were underburned, treated or not treated. White fir was removed in treatment units and Douglas-fir and ponderosa pine dominate these stands. Although this alternative has less NRF developed than Alternative 1 the composition of the stands are more stable. Additionally, 1,725 acres of ponderosa pine and Douglas-fir forests will be usable as foraging with 882 acres specifically managed for NRF habitat. The matrix would provide the bulk of the habitat for spotted owls at this time.

Dispersal
Dispersal habitat increases through the years similar to the No Action. A minor lag time develops when compared to Alternative 1 at year 2020. This is a reflection of the thinning modeled. Growth from the thinned trees accelerates and by 2100 and acres of dispersal habitat developed in this alternative is virtually the same as the No Action (Table 3.140).

Table 3.140. Dispersal habitat developed over time for the B&B project area (Alternative 4).

Year	LSR (acres)	Matrix (acres)	AWD (acres)	Total Acres
2006	3,051	1,997	96	**5,144**
2010	1,653	1,281	96	**3,030**
2020	1,567	947	115	**2,629**
2030	2,190	1,967	162	**4,319**
2040	4,260	3,440	244	**7,944**
2050	10,191	7,657	445	**18,293**
2060	12,416	9,207	559	**22,182**
2070	13,707	10,424	660	**24,791**
2080	14,604	10,796	676	**26,076**
2090	15,092	11,215	691	**26,998**
2100	15,688	11,189	691	**27,568**

Risk
The 58 acres of fuels strategy treatment areas includes 1,740 acres of defensible space for existing NRF (152 acres) and potential future NRF (1,086 acres) Fuels treatments and salvage result in 1,404 acres where fuel loading does not exceed 10-35 tons per acre.

The landscape approach to snag retention will result in the 2 most likely to persist snags per acre, most likely Douglas-fir or ponderosa pine. These species have been found to have longer standing times (Everett et al. 1999) and are usually the largest snags available. Although these species remain standing for a longer time, they probably will not persist until stands become habitat (Dahms 1949, Keen 1929, Parks et al. 1999, and Everett et al. 1999). They may be present as downed wood however, providing habitat for prey species like the northern flying squirrel and red-backed vole.

In addition, units within 2 miles of existing NRF and have the ability to become NRF within 100 years will retain one additional snag per acre. Spotted owls, where their main prey species is the northern flying squirrel, have larger home ranges (Carey et al. 1992). Since sampling of pellets has shown the flying squirrel as the main prey species here, an expanded buffer zone was prescribed for units meeting these criteria (from 1.2 miles to 2 miles). This will provide for prey habitat within and adjacent to existing and reasonably foreseeable habitat by providing increased downed wood levels while still maintaining the ability to reforest and reintroduce fire.

Although treatment units will have decreased levels of dead wood structure, there are untreated patches within (15% retention) and between units that will provide high density levels of snags and downed wood. Due to the juxtaposition of treatment units and untreated patches, a diversity of habitat conditions will be provided.

Initially, snag habitat would be abundant throughout the watershed with 23% of the mixed conifer habitat type exceeding 60 snags per acre ≥10”dbh and 7% exceeding 18 snags per acre ≥20”dbh. Levels identified are the same as the No Action alternative. These densities would provide habitat for a number of secondary species such as red-backed voles, but canopy cover would be insufficient for the flying squirrel inside the project area. Outside the project area and in green stands within the project area, canopy cover would be sufficient in most mixed conifer wet stands to provide for the flying squirrel. Modeling predicts at year 2040 standing snag levels have dropped and densities range from 0 to 10 snags per acre ≥20”dbh. Snag levels do not mimic distributions as displayed in DecAID from unharvested CVS plots where there is a broader distribution of snag densities. Snag recruitment inside the project area will not occur for approximately 50 years in stand replacement areas and then will consist primarily of smaller (<10”dbh) snags (Table 3.141 & 3.142).

Table 3.141. Snag Habitat Over Time, Mixed Conifer, **≥10”**dbh, Alternative 4.

Data from DecAID	EMC_S Unharvested plot data	Post Treatment Year 2006	Year 2040	Year 2100
Snag density/ac	≥10”dbh, % of area	≥10”dbh, % of area	≥10”dbh, % of area	≥10”dbh, % of area
0	15	0	1	0
0-6	25	11	58	40
6-12	17	8	28	12
12-18	18	10	9	10
18-24	9	11	3	5
24-30	6	9	1	5
30-36	4	9	1	6

36-42	2	7	0	8
42-48	1	5	0	8
48-54	1	4	0	3
54-60	1	3	0	2
60+	2	23	0	1
	101*	100	100	100

* - Exact percentages not gained due to rounding.

Table 3.142. Snag Habitat Over Time, Mixed Conifer, **>20"**dbh, Alternative 4.

Data from DecAID	**EMC_S Unharvested plot data**	**Post Treatment Year 2006**	**Year 2040**	**Year 2100**
Snag density/ac	≥20"dbh, % of area	≥20"dbh, % of area	≥20"dbh, % of area	≥20"dbh, % of area
0	31	6	3	2
0-2	18	21	46	47
2-4	17	18	30	22
4-6	13	11	14	15
6-8	7	11	5	8
8-10	6	9	1	4
10-12	3	5	0	2
12-14	1	4	0	1
14-16	2	2	0	0
16-18	1	4	0	0
18+	1	7	0	0
	100	100	100	100

* - Exact percentages not gained due to rounding.

Approximately 2% of the project area within LSR would meet or exceed LSRA recommendations for down wood habitat of 25 to 35 tons per acre (2.29 – 4.77% down wood cover) in 2006 representing post-harvest. It would be abundant and potentially persistent until fire returns to the area. Fuel loadings for the project area would steadily increase until around 2030 to 2060 which indicates when most snags would be on the ground. After this time period, down wood levels decrease slightly as down wood begins to decompose. However, these are still above optimum levels recommended by Brown et al. (2003) for cool Douglas-fir types (10 to 30 tons per acre). These heavy fuel loads would result in stand replacement fire if a fire were to start. Alternative 4 results in little reduction in risk where the landscape is similar to the No Action alternative (Table 3.143).

Table 3.143. Down wood levels over time, MCW in LSR, for the B&B Project Area, Alternative 4.

Tons per Acre	**Percent of Late-Successional Reserve**			
	2006	**2030**	**2060**	**2100**
<25	97	51	50	41
25-35	2	24	25	29
>35	0	25	25	30

Alternative 5

This alternative would treat approximately 4,633 acres (~11% of project area). Ground based yarding is the only harvest system prescribed for all 4,633 acres. Salvage would treat dead and dying trees in matrix and dead only in LSR 16"dbh or greater. A small percentage of the total acres are designated for the removal of special forest products which would target smaller diameter trees. In addition, approximately 4,633 acres would be reforested, danger trees would be treated along 122 miles of road and 20 acres of high public use areas, fuels would be reduced on 4,633 acres, and about 77 miles of road would be decommissioned or inactivated (table 3.144).

Table 3.144. Proposed treatment acres by land allocation for Alternative 5.

Land Allocation	Alternative 5 Proposed Treatment Acres
Late Successional Reserve	1,694
Matrix	2,822
Administratively Withdrawn	117
Critical Habitat Unit OR-3*	1,157
Critical Habitat Unit OR-4*	707
Total	**4,633**

* - Acres are not additive but included in the above totals.

The same landscape approach to snag retention used in Alternatives 2 and 4 will apply to matrix lands for Alternative 5. However, for units occurring within the LSR, all Douglas-fir and ponderosa pine snags >20"dbh or greater will be retained.

Harvest would include approximately 419 acres of white fir dominated stands in the LSR that experienced mixed mortality or were underburned. Only white fir trees less than 28"dbh would be removed after snag and downed wood levels are met. No ponderosa pine or Douglas-fir would be taken in these units.

Direct and Indirect Effects

NRF Habitat

Salvage reduces dead tree levels on 4,633 acres. Planting in 4,633 acres where there was treatment ensures reforestation of preferred tree species (ponderosa pine and Douglas-fir).

Treatment of white fir dominated stands would facilitate the reforestation of desired tree species and accelerate the development of NRF habitat. Removal of excess material in stands with existing habitat components will help reduce risk of loss as well. With little NRF habitat remaining in the project area and the long time frame needed to develop suitable habitat over much of the area, these remnant habitat components (larger desired tree species) are important to retain since these areas have the potential to develop into habitat at a faster rate than those that have experienced stand replacement (Table 3.145).

Table 3.145. Acres of habitat development over time for the B&B project area (Alternative 5).

Habitat Developed within 100 Years (Year 2100)	Land Allocation (Acres)				
	LSR	Matrix	AWD	CHU OR-3*	CHU OR-4*
Suitable NRF Habitat	1,622	3,074	188	254	336
Dispersal Habitat	17,736	11,186	668	5,231	3,096

* - acres are not additive.

NRF habitat at this time (100 years) is primarily those areas that were underburned, treated or not treated. White fir was removed in treatment units and Douglas-fir and ponderosa pine dominate these stands. Although this alternative has less NRF developed than Alternative 1 the composition of the stands are more stable. Additionally, 4,633 acres of ponderosa pine and Douglas-fir forests will be usable as foraging with 1,163 acres specifically managed for NRF habitat. The matrix would provide the bulk of the habitat for spotted owls at this time.

Dispersal

Dispersal habitat increases through the years similar to the No Action. A minor lag time develops when compared to Alternative 1 at year 2020. This is a reflection of the thinning modeled. Growth from the thinned trees accelerates and by 2100 and dispersal habitat in this alternative is similar to Alternative 3, slightly more than the No Action but is less than Alternative 2 (Table 3.146).

Table 3.146. Dispersal habitat developed over time for the B&B project area (Alternative 5).

Year	LSR (acres)	Matrix (acres)	AWD (acres)	Total Acres
2006	3,051	1,997	96	**5,144**
2010	1,521	1,281	96	**2,898**
2020	1,524	947	115	**2,586**
2030	2,164	1,967	162	**4,293**
2040	4,232	3,440	244	**7,916**
2050	9,804	7,657	445	**17,906**
2060	11,928	9,207	559	**21,694**
2070	13,206	10,424	660	**24,290**
2080	14,330	10,796	676	**25,802**
2090	15,165	11,215	691	**27,071**
2100	16,043	11,189	691	**27,923**

Risk

The 1,602 acres of fuels strategy treatment areas includes 1,901 acres of defensible space for existing NRF (257 acres) and potential future NRF (1,644 acres) Fuels treatments and salvage result in 2,584 acres where fuel loading does not exceed 10-35 tons per acre.

The landscape approach to snag retention will result in the 2 most likely to persist snags per acre, most likely Douglas-fir or ponderosa pine. These species have been found to have longer standing times (Everett et al. 1999) and are usually the largest snags available. Although these species remain standing for a longer time, they probably will not persist until stands become habitat (Dahms 1949, Keen 1929, Parks et al. 1999, and Everett et al. 1999). They may be present as downed wood however, providing habitat for prey species like the northern flying squirrel and red-backed vole.

In addition, units within 2 miles of existing NRF and have the ability to become NRF within 100 years will retain one additional snag per acre. Spotted owls, where their main prey species is the northern flying squirrel, have larger home ranges (Carey et al. 1992). Since sampling of pellets has shown the flying squirrel as the main prey species here, an expanded buffer zone was prescribed for units meeting these criteria (from 1.2 miles to 2 miles). This will provide for prey habitat within and adjacent to existing and reasonably foreseeable habitat by providing increased downed wood levels while still maintaining the ability to reforest and reintroduce fire.

Although treatment units will have decreased levels of dead wood structure, there are untreated patches within (15% retention) and between units that will provide high density levels of snags and downed wood. Due to the juxtaposition of treatment units and untreated patches, a diversity of habitat conditions will be provided.

Initially, snag habitat would be abundant throughout the watershed with 21% of the mixed conifer habitat type exceeding 60 snags per acre ≥10"dbh and 7% exceeding 18 snags per acre ≥20"dbh. Levels identified are very similar as the No Action alternative. These densities would provide habitat for a number of secondary species such as red-backed voles, but canopy cover would be insufficient for the flying squirrel inside the project area. Outside the project area and in green stands within the project area, canopy cover would be sufficient in most mixed conifer wet stands to provide for the flying squirrel.

Modeling predicts at year 2040 standing snag levels have dropped and densities range from 0 to 10 snags per acre ≥20"dbh. Snag levels do not mimic distributions as displayed in DecAID from unharvested CVS plots where there is a broader distribution of snag densities. Snag recruitment inside the project area will not occur for approximately 50 years in stand replacement areas and then will consist primarily of smaller (<10"dbh) snags (Table 3.147 & 3.148).

Table 3.147. Snag Habitat Over Time, Mixed Conifer, ≥10"dbh, Alternative 5.

Data from DecAID	**EMC_S Unharvested plot data**	**Post Treatment Year 2006**	**Year 2040**	**Year 2100**
Snag density/ac	≥10"dbh, % of area	≥10"dbh, % of area	≥10"dbh, % of area	≥10"dbh, % of area
0	15	0	1	0
0-6	25	11	59	39
6-12	17	8	27	12
12-18	18	11	9	10
18-24	9	11	3	5
24-30	6	10	1	5
30-36	4	9	1	6
36-42	2	7	0	8
42-48	1	5	0	8
48-54	1	4	0	3
54-60	1	3	0	2
60+	2	21	0	1
	101*	100	100	100

* - Exact percentages not gained due to rounding.

Table 3.148. Snag Habitat Over Time, Mixed Conifer, **≥20"**dbh, Alternative 5.

Data from DecAID	**EMC_S Unharvested plot data**	**Post Treatment Year 2006**	**Year 2040**	**Year 2100**
Snag density/ac	≥20"dbh, % of area	≥20"dbh, % of area	≥20"dbh, % of area	≥20"dbh, % of area
0	31	6	3	2
0-2	18	21	48	47
2-4	17	19	29	22
4-6	13	12	13	15
6-8	7	11	5	8
8-10	6	9	1	4
10-12	3	5	0	2
12-14	1	4	0	1
14-16	2	2	0	0
16-18	1	4	0	0
18+	1	7	0	0
	100	100	100	100

* - Exact percentages not gained due to rounding.

Approximately 2% of the project area within LSR would meet or exceed LSRA recommendations for down wood habitat of 25 to 35 tons per acre (2.29 – 4.77% down wood cover) in 2006 representing post-harvest. It would be abundant and potentially persistent until fire returns to the area. Fuel loadings for the project area would steadily increase until around 2030 to 2060 which indicates when most snags would be on the ground. After this time period, down wood levels decrease slightly as down wood begins to decompose. However, these are still above optimum levels recommended by Brown et al. (2003) for cool Douglas-fir types (10 to 30 tons per acre). These heavy fuel loads would result in stand replacement fire if a fire were to start. Alternative 5 results in a reduction in risk but is slightly less than Alternative 2 (Table 3.149).

Table 3.149. Down wood levels over time, MCW in LSR, for the B&B Project Area, Alternative 5.

Tons per Acre	Percent of Late-Successional Reserve			
	2006	2030	2060	2100
<25	97	56	54	45
25-35	2	21	23	27
>35	0	23	23	28

The B&B and Link fires reduced nesting, roosting, and foraging habitat within the project area by approximately 7355 acres, and suppression efforts account for 857 of those acres. Reduction of habitat by construction and rehabilitation of firelines, safety zones, etc. was minimal and included in the total acres of suppression habitat loss. Nesting, roosting, and foraging habitat would still be provided on approximately 745 acres within the project area (Table 3.150).

Table 3.150 NRF by NWFP Allocation

NWFP Allocation	Pre-fire NRF	NRF Lost in the B&B and Link Fires	Post-Fire NRF	Degraded NRF*
LSR	5,076	4,700	376	0
Matrix	2,841	2,474	367	0
AWD	153	151	2	0
Total	**8,070**	**7,355**	**745**	**0**
CHU OR-3	1,934	1,853	81	0
CHU OR-4	1,044	1,022	22	0
Total	**2,978**	**2,875**	**103**	**0**

*NRF in all burn intensities were considered lost due to the severe underburning, loss of understory and mortality to white fir.

The majority of nest sites on the Sisters RD are located within the mixed conifer PAGs. These PAGs experienced moderate to heavy mortality with the insect outbreak of the early 1990's with impacts occurring a few years later. This event probably had the greatest influence on spotted owl habitat across the district due to the reduction of canopy cover, loss of multi-storied stands, and mortality of large Douglas-fir and ponderosa pine prior to the fires. These open stands are considered unsuitable nesting habitat for spotted owlsn .

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 13,431 acres of NRF was lost as a result of these events. The recent fires negated many of the impacts resulting from past management projects.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact spotted owl habitat since suitable NRF habitat was avoided or impacts from the fire had already happened. In addition, two vegetation management projects have been planned (McCache and Metolius Basin Forest Management Project). No NRf habitat was proposed to be treated in either planning area. Measures were incorporated to retain suitable nesting habitat for each project area as well as enhance habitat conditions. Overall, treatments proposed will improve spotted owl habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances.

Fires and timber harvest have reduced owl habitat across the forest. In the past four years, NRF on the Forest has been reduced by timber harvest (approximately 10,000 acres) or wildfires (1,400 acres prior to the 2003 season). Appendix A from the programmatic Biological Assessment was updated January 2004 to reflect the changes in NRF habitat due to the large fires on the Sisters and Crescent Ranger Districts (USFS 2004). The following table includes losses of habitat by the Davis fire on the Crescent Ranger District and B&B and Link fires and the amount of habitat impacted by this project (Table 3.151).

Table 3.151. Changes in Spotted Owl Baseline Habitat

Ranger District	2003 Baseline (App B)	NRF Lost	January 2004 Baseline (App B)	Acres of NRF Habitat Lost by the B&B Project
Crescent	34,008	5,154	**28,854**	
Sisters	51,936	11,560	**40,286**	0
Bend-Ft. Rock	24,791	0	**24,791**	
Forest Total	110,735	16,714	**93,931**	

Implementation of the B&B project will have no further cumulative effects to spotted owls.

Comparison of Alternatives

The No Action alternative results in more NRF acres developed within 100 years as opposed to the Action Alternatives. NRF developed under the No Action Alternative will have a different stand composition as to those treated. White fir will be a primary species. And where it may grow faster than Douglas-fir and ponderosa pine, it does not possess other characteristics needed for long term suitable spotted owl habitat. Crown development is not as full as Douglas-fir and ponderosa pine, tree boles are narrower, especially near the top, limb structure does not attain the large size needed, and trees are not as long-lived. Therefore, habitat developed will only be short term.

NRF habitat developed under the Action Alternatives will result in Douglas-fir and ponderosa pine as the primary species. Assuming adequate density control and allowing Douglas-fir and ponderosa pine trees to grow in more open conditions will help in accelerating growth and the development of desired characteristics (large full crowns, large boles and limbs, and longer-lived). This will result in more long term habitat.

There is very little difference between the amount of suitable habitat developed between alternatives when comparing it to the larger landscape. However, treatment will help in protecting existing habitat as well as developing desired suitable habitat sooner by planting desired tree species and reducing fuel loadings. Alternative 2 is the preferred alternative for spotted owls as it results in more suitable habitat across the project area in the long term (Table 3.152 & 3.153).

Table 3.152. Comparison of Alternatives for the development of suitable NRF for the B&B project area.

NRF Habitat Developed within 100 Years						
Allocation	**Existing Acres**	**No Action Acres**	**Alternative 2 Acres**	**Alternative 3 Acres**	**Alternative 4 Acres**	**Alternative 5 Acres**
LSR	376	1,794	1,725	1,768	1,794	1,731
Matrix	367	3,083	3,066	3,074	3,066	3,066
AWD	2	208	208	208	208	208

Total	**745**	**5,085**	**4,999**	**5,050**	**5,068**	**5,005**
CHU OR-3	81	256	254	254	256	254
CHU OR-4	22	350	336	349	350	336
Total	**103**	**606**	**590**	**603**	**606**	**590**

Table 3.153. Comparison of Alternatives for the development of dispersal habitat for the B&B project area.

Dispersal Habitat Developed within 100 Years					
Allocation	**No Action Acres**	**Alternative 2 Acres**	**Alternative 3 Acres**	**Alternative 4 Acres**	**Alternative 5 Acres**
LSR	15,668	16,496	16,028	15,688	16,043
Matrix	11,177	11,189	11,206	11,189	11,189
AWD	691	644	691	691	691
Total	**27,536**	**28,329**	**27,925**	**27,568**	**27,923**
CHU OR-3	4,986	5,599	5,222	4,986	5,231
CHU OR-4	3,074	3,218	3,116	3,066	3,096
Total	**8,060**	**8,817**	**8,338**	**8,052**	**8,327**

Fire suppression, insects, and disease led in increased stand densities and fuel loadings. This resulted in conditions on the landscape suitable for spotted owl occupation where historicially may not have been present. NRF habitat was at risk to loss. As a result the B&B fire burned with higher than historical intensities. The loss of habitat was more than would have occurred under a more natural fire regime. Treatments are designed to lower fuel levels and allow for the reintroduction of fire. They would result in reduced risk to existing habitat, and provide for the development of habitat with the desired tree species composition. Mitigation measures would reduce or eliminate disturbance to nesting spotted owls with the implementation of any action alternative.

Proposed actions in the Action Alternatives move portions of the stand replacement burned areas to desired habitat conditions sooner and acres treated to a more historic fire regime. Planting ponderosa pine and Douglas-fir would provide the preferred species for nesting. Reduction of fuels would allow for the use of fire to manage stands to develop dominant structures needed for nesting. In the long term, habitat more suitable for spotted owl nesting would develop in 200-300 years, approximately 100-200 years sooner than Alternative 1. In the short term it is unknown if and how spotted owls will continue to utilize the area. Implementation of **Alternatives 2, 3, 4, or 5 May Effect, but are not likely to Adversely Affect spotted owls.**

NRF and dispersal habitat is developed under the No Action Alternative. However, this habitat is not as desired as habitat developed under the Action Alternatives due to stand composition and habitat longevity. Without planting ponderosa pine and Douglas-fir the forest that would develop would be dominated by white fir, not the ponderosa pine or Douglas-fir they prefer for nesting or shrubs if conifer seed is absent. Without salvage, fire could not be reintroduced without destruction to existing large trees or regeneration. Fire could not be used to help maintain open understories that would aid in the development of large tree structure. Implementation of **Alternative 1 May Effect and is not likely to Adversely Affect spotted owls.**

Critical Habitat Units OR-3 and OR-4

Critical Habitat Units were developed by USFWS as a network of habitat to support continued persistence of the northern spotted owl. CHUs were established prior to the signing of the Northwest Forest Plan and the designation of LSRs. As with LSRs maintenance of habitat within CHUs is important. Salvage and associated treatments will occur within the CHU. No NRF habitat is being treated and activities are focused within stand replacement stands primarily. Planting desired tree species for the development of long term habitat and fuels treatments to help maintain existing habitat as well as facilitate the development of habitat will result in beneficial effects with some short term impacts. Implementation of **Alternatives 2, 3, 4, and 5 May Effect but is not likely to Adversely Affect northern spotted owl critical habitat.**

Implementation of **Alternative 1 will have No Effect** on northern spotted owl critical habitat.

Communication with U.S. Fish and Wildlife Service

All Project Design Criteria listed in the FY2003-2006 Programmatic Biological Assessment have been met. Communication with U.S. Fish and Wildlife Service is not recommended.

<u>Oregon Spotted Frog, Federal Candidate and Region 6 Sensitive</u>

Existing Condition

The Oregon spotted frog (*Rana pretiosa*) is currently listed as a candidate species by USFWS. Spotted frogs have a historic distribution that covers a small part of western North America, from southern British Columbia to northeastern California, and from the west side of the Willamette Valley to the east side of the Oregon Klamath basin. They have been extirpated in much of their range by introduction of the bullfrog (*Rana catesbeiana*), and habitat alteration and loss through intensified agriculture, grazing, and urbanization (USGS 2003).

Oregon spotted frogs are marsh specialists tied to permanent water in marsh type habitats with lots of floating vegetation and good hiding areas. Oviposition usually occurs between mid-February and mid-April, depending on temperature. Egg masses are typically deposited communally, attached to vegetation in shallow water (Hayes et al. 1997). Often found in the flooded upland adjacent to permanent water, the diet of spotted frogs consist mainly of insect material including moths, water striders, hoverflies, grasshoppers, spiders, beetles, and caddisflies.

Minimal potential habitat occurs on the Sisters Ranger District primarily outside the project area. Water temperatures are generally too cold and emergent wetland vegetation is absent except in isolated areas. There are no occurrences of spotted frogs on the district. Pre-fire surveys along Jack and First Creeks yielded Cascades frogs but no spotted frogs were found (district files).

Almost all (99%) riparian areas within the project area burned to some degree many of which experienced stand replacement. Fire resulted in the consumption of most of the non-woody vegetation. However, this will be a short term impact. Water bodies may see an increase in water levels due to the loss of other vegetation. This may be both beneficial and negative as more wet areas may be present and some existing sites may be too deep for this species.

Environmental Consequences

All Alternatives
Direct, Indirect, and Cumulative Impacts

Due to the lack of suitable habitat (permanent marsh habitat) within the project area and no activities proposed in riparian reserves except for isolated occurrences, there would be **No Effect** to the Oregon spotted frog with the implementation of any alternative.

Regional Forester's Sensitive Species

Species classified as sensitive by the Forest Service are to be considered through the National Environmental Policy Act process by conducting biological evaluations (BE) to determine potential effects of all programs and activities on these species (FSM 2670.32). The BE is a documented review of Forest Service activities in sufficient detail to determine how a proposed action may affect sensitive wildlife species, and to comply with the requirements of the Endangered Species Act.

The Forest Service Region 6 Sensitive Animal List (USDA 2000) and the Update to the Regional Forester's Sensitive Species List (USDA 2004c) were reviewed for species that may be present on the Deschutes National Forest. After a review of records, habitat requirements, and existing habitat components, it was determined that the following sensitive animal species have habitat or are known to occur in the project area and will be included in this analysis (Table 3.154):

Pacific Fisher	(*Martes pennanti*)
California Wolverine	(*Gulo gulo leuteus*)
Bufflehead	(*Bucephela albeola*)
Horned Grebe	(*Podiceps auritus*)
Crater Lake Tightcoil	(*Pristiloma arcticum crateris*)

Table 3.154. Sensitive Species Summary.

Species	Status	Habitat	Presence
Bufflehead (*Bucephala albeola*)	Regional Forester Sensitive	Lakes, Snags	Sighting
Harlequin Duck (*Histrionicus histrionicus*)	Regional Forester Sensitive	Rapid Streams, Large Trees	No habitat
Horned Grebe (*Podiceps auritus*)	Regional Forester Sensitive	Lake	Unknown
Red-necked Grebe (*Podiceps gisegena*)	Regional Forester Sensitive	Lake	No habitat
Tricolored Blackbird (*Agelaius tricolor*)	Regional Forester Sensitive	Lakeside, Bullrush	No habitat
Yellow Rail (*Coturnicops noveboracensis*)	Regional Forester Sensitive	Marsh	No habitat
Western Sage Grouse (*Centrocercus urophasianus phaeios*)	Regional Forester Sensitive	Sagebrush Flats	No habitat
American Peregrine Falcon (*Falco peregrinus anatum*)	Regional Forester Sensitive, MIS	Riparian, Cliffs	No habitat
Pacific Fisher (*Martes pennanti*)	Regional Forester Sensitive	Mixed, Complex	Unknown
Pygmy Rabbit (*Brachylagus idahoensis*)	Regional Forester Sensitive	Sagebrush Flats	No habitat
California Wolverine (*Gulo gulo*)	Regional Forester Sensitive, MIS	Mix, High Elevation	Unknown
Crater Lake Tightcoil (*Pristiloma arcticum crateris*)	Regional Forester Sensitive	Riparian, Perennially Wet	Sightings

After a review of records, habitat requirements, and existing habitat components, it was also determined that the remaining sensitive species do not occur and have no habitat in the project area and will not be included in any further analysis: harlequin duck (*Histrionicus histrionicus*), red-necked grebe (*Podiceps gisegena*), tricolored blackbird (*Agelaius tricolor*), yellow rail (*Coturnicops noveboracensis*), western sage grouse (*Centrocercus urophasianus phaeios*), American peregrine falcon (*Falco peregrinus anatum*), and pygmy rabbit (*Brachylagus idahoensis*).

Harlequin ducks winter in rough coastal waters, especially along rocky shores or reefs; summering non-breeders also occur in this habitat. Harlequins also nest along fast-moving rivers and mountain streams on rocks or banks. (NatureServe 2004). On the Sisters Ranger District, the Metolius River, and Jefferson, Candle and Squaw Creeks may provide the best potential suitable breeding habitat. Habitat for the harlequin duck does not occur within the project area. Implementation of any of the alternatives would have **no impact** on harlequin ducks.

Red-necked grebes winter along seacoasts, bays, and estuaries. However, in migration they can be found on lakes, ponds, and rivers. Nests are usually found on lakes, marshes, ponds, or calm rivers in areas with some vegetative cover favoring those that are shallow and have good fish populations. Nests are constructed on mounds of vegetation, floating or sitting in shallow water. (NatureServe 2004). Nesting habitat does not occur on the Sisters Ranger District, however many larger lakes could be used during migration (i.e. Suttle Lake). Implementation of any of the alternatives would have **no impact** on red-necked grebes.

Tri-colored blackbird breeding takes place in freshwater marshes of cattails, tules, bulrushes, and sedges. In migration and winter they are found in open cultivated lands and pastures. (NatureServe 2004). Nesting habitat does not occur on the Sisters Ranger District due to the lack of cattails, tules, etc. in large quantities. Implementation of any of the alternatives would have **no impact** on tri-colored blackbirds.

Yellow rail breeding takes place in emergent wetlands, grass or sedge and wet meadows in freshwater situations. From information gathered over the last six years, nesting habitat of the yellow rail in Oregon has been described as marshes or wet meadows which have an abundance of thin-leaved sedges, a layer of senescent vegetation to conceal their nests, and an average water depth of 7 cm (Popper 2001). This specific habitat type does not occur within the project area. Implementation of any of the alternatives would have **no impact** on yellow rails.

Western sage grouse are found in foothills, plains, and mountain slopes where sagebrush is present and the habitat contains a mixture of sagebrush, meadows, and aspen in close proximity. Winter habitat (palatable sagebrush) is probably the most limited seasonal habitat in some areas (NatureServe 2004). This habitat type does not occur within the project area. Implementation of any of the alternatives would have **no impact** on western sage grouse.

American peregrine falcons often nest on ledges or holes on the face of rocky cliffs or crags. They are commonly situated on ledges of vertical cliffs, commonly with a sheltering overhang. This habitat type does not occur within the project area. Implementation of any of the alternatives would have **no impact** on peregrine falcons.

Pygmy rabbits typically occur in dense stands of big sagebrush growing in deep loose soils (NatureServe 2004). This habitat type does not occur within the project area. Implementation of any of the alternatives would have **no impact** on pygmy rabbits (Table 3.155).

Table 3.155. Summary of Conclusion of Effects, Region 6 Sensitive Species

Species	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Horned Grebe	NI	NI	NI	NI	NI
Red-necked Grebe	NI	NI	NI	NI	NI
Bufflehead	NI	MIIH	NI	NI	MIIH
Harlequin Duck	NI	NI	NI	NI	NI
American Peregrine Falcon	NI	NI	NI	NI	NI
Western Sage Grouse	NI	NI	NI	NI	NI
Yellow Rail	NI	NI	NI	NI	NI
Tri-colored Blackbird	NI	NI	NI	NI	NI
California Wolverine	NI	NI	NI	NI	NI
Pacific Fisher	NI	NI	NI	NI	NI
Pygmy Rabbit	NI	NI	NI	NI	NI
Crater Lake Tightcoil	NI	NI	NI	NI	NI

NI = No Impact
MIIH = May impact individuals or habitat, but will not likely contribute a trend toward federal listing or loss of viability to the population or species
BI = Beneficial Impact

Horned Grebe, Region 6 Sensitive

Existing Condition

Horned grebes utilize marshes, ponds, lakes, and occasionally occur along sluggish streams for breeding. They nest among tall vegetation in shallow water on small and large lakes and ponds (approximately ¼ acre or larger), in calm waters of marshes, along rivers and streams. The highest breeding densities occur in pothole marshes of aspen woodlands. Outside the breeding season, horned grebes are found on bays, estuaries and seacoasts, and in migration commonly in inland freshwater habitats, especially lakes and rivers (NatureServe 2004).

There are no known sightings of horned grebes on the Sisters Ranger District. There is potential habitat in one small area of the project area. Three small ponds occur in the First Creek drainage along the 1210-300 road. Surveys were not conducted for this species.

This area experienced stand replacement fire and most trees were killed. Consumption of most the vegetation surrounding the ponds occurred during the fire however, recovery is expected.

Environmental Consequences

All Alternatives
Direct, Indirect, and Cumulative Impacts

There will be no alteration of habitat with the implementation of any alternative. Harvest is not prescribed for riparian reserves except for isolated occurrences and there are no units within ¼ mile of suitable habitat.

Determination
There will be **No Impact** to the horned grebe with the implementation of any alternative. There are no activities proposed that would impact habitat or cause disturbance.

Bufflehead, Region 6 Sensitive

Existing Condition
Buffleheads utilize lakes, ponds, rivers, and seacoasts. The birds nest in natural cavities or abandoned northern flicker holes in mixed coniferous-deciduous woodlands near lakes and ponds. Females often nest in the same site in successive years (NatureServe 2004). This duck eats both animal and plant material. However, during the breeding season, aquatic insects and larvae are the most important item in their diet. They also eat seeds of pondweeds and bulrushes (Csuti et al. 1997). Buffleheads winter on sheltered bays and estuaries as well as freshwater situations (NatureServe 2004). Bufflehead population numbers are generally low in Oregon and a shortage of natural cavities has brought attention to the breeding segment of the population (Csuti et al. 1997).

No surveys have been conducted for this species. Buffleheads have been documented at Wizard Falls fish hatchery, Suttle Lake, Scout Lake, and the Meadow Lakes area (district files). Potential habitat exists around wilderness lakes, small water bodies in the Meadow Lakes area, Suttle Lake, Round Lake, and streams with open slack water.

The fires have led to an influx of snag habitat. However, many of these snags are fire-hardened and may not be usable for some time by secondary cavity users. This may lead to more competition for remaining suitable snag habitat by a variety of species. After 15-30 years, much of the existing snag habitat will begin to fall and there will be a long lag time before suitable habitat is established. It is also unknown how the fires impacted small water bodies. The composition of plant and animal matter may have changed due to an increase in temperatures, sediment delivery, etc. This is yet to be determined.

Environmental Consequences

All Alternatives
Direct and Indirect Impacts

Action Alternatives would remove some snags around Round Lake to provide for a defensible space and reduce risk to the Christian Camp and surrounding area potentially decreasing available nest sites. However, this would be minor in scope (20 acres). Abundant snag habitat would remain around small water bodies with the implementation of any alternative. However, at this time, conditions needed for nesting don't exist due to the fire-hardened trees. Buffleheads are secondary cavity excavators, depending on primary cavity excavators for cavity formation. Snags will become more suitable over time as insects and decay agents spread throughout. Because the time it takes snags to reach conditions favorable to primary cavity excavators and then secondary cavity excavators, potential nest sites may not be as plentiful during the first several years, but should increase followed by a decrease as snags begin to fall. A long lag time will exist in stand replacement areas when minimal snag habitat is available until snags of sufficient size are again being recruited (>100 years).

Cumulative Impacts
Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to buffleheads. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (riparian reserves adjacent to perennial water bodies) is being used as the scale for analysis for the bufflehead. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. All these fires have reduced snag habitat within riparian reserves to some degree further reducing potential bufflehead habitat. Approximately 5,100 acres (19%) of 27,300 acres were within stand replacement areas resulting in non-suitable habitat.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales however did not impact bufflehead habitat since suitable habitat was avoided.
In addition, one vegetation management project may occur within suitable great blue heron habitat (Metolius Basin Forest Management Project). Measures were incorporated to enhance habitat conditions. Overall, treatments proposed will improve bufflehead habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances.

Hazard/danger tree activities are usually concentrated along roads and high use areas like campgrounds, many of which are associated with water bodies. It is highly unlikely that buffleheads would choose to nest in these locations; however there is continued removal of danger trees for safety reasons and continued expansion of recreation use into undeveloped areas reducing potential nesting areas due to disturbance primarily.

Recreation use for the area indicates increasing trends. Increased recreation pressure around and adjacent to water bodies may further decrease habitat suitability. It may also lead to increased disturbance potential around water bodies including wilderness lakes and ponds. For example, the Meadow Lakes area has been experiencing these issues.

Bufflehead populations are expected to decline slightly across the district due to the loss of nesting habitat especially within riparian reserves. Bufflehead populations would not begin to recover until the establishment of forested habitats. This may take several decades. Cumulatively, this project will minor impacts (<1%) to buffleheads because snag habitat within riparian reserves is not being impacted within suitable habitat.

Determination
While there would be an abundance of snags in all alternatives, not every snag will be retained potentially reducing nesting opportunities for individual buffleheads, especially around Round Lake. Implementation of the **Action Alternatives may impact individuals but will not likely contribute to a trend toward federal listing**.

Pacific Fisher, Region 6 Sensitive

Existing Condition
Fisher populations are considered to be extremely low in Oregon, Washington, and parts of the Rocky Mountains. They occur in landscapes dominated by late-successional and mature forests. Fishers have been found to use riparian areas disproportionately to what exists. On the Westside of the Cascades, fishers tend to be associated with low to mid-elevational forests dominated by late-successional and old growth Douglas-fir and western hemlock. However, on the eastside of the Cascades, they occur at higher elevations in association with true firs and mixed conifer forests. They tend to prefer areas with high canopy closure and late-successional forests with relatively low snow accumulations. Critical features of fisher habitat include physical structure of the forest and prey associated with forest structure. Structure includes vertical and horizontal complexity created by a diversity of tree sizes and shapes, light gaps, down woody material, and layers of overhead cover. Major prey species include small to medium sized mammals, birds, and carrion. Porcupine are the best known prey species but fisher will also prey on snowshoe hare, squirrels, mice and shrews. (Powell and Zielinski 1994)

Large forest openings, open hardwood forests, and recent clearcuts were found to be infrequently used by fishers in the West (Ruggerio et. al 1994). Fishers have shown an aversion to open areas and this has affected local distributions and can limit population expansion and colonization of unoccupied areas (Coulter 1966, Earle 1978). However, Kelly (1977) found that fishers tended to use recently harvested areas when brush and saplings provided some low overhead cover but these areas were avoided during the winter.

There are only two known populations of fisher in Oregon, one on the Rogue River National Forest and the other in southwestern Oregon along the Oregon-California border. Potential habitat exists in the center of the project area outside stand replacement areas and high elevation stands within wilderness that did not burn.

Surveys were conducted in the winters of 1997/1998 (Dec. through March) and 1999 (Febr. through April) according to the protocol outlined in Ruggerio et al. (1994). These consisted of Trailmaster baited camera set-ups located along the wilderness boundary. Four of nine stations were located within or directly adjacent to the project area (Table 3.156). Marten were the only carnivore species detected.

Table 3.156. Carnivore Bait Station Results.

Year	Station Location	Results
1997/1998	T.11S, R.8E, Section 36	Marten
1997/1998	T.12S, R.8E, Section 33	Marten
1997/1998	T.13S, R.8E, Section 16	Marten
1999	T.13S, R.8E, Section 4	Marten

Environmental Consequences

Alternative 1 – No Action
Direct and Indirect Impacts

High densities of snags and downed wood would occur throughout the project area. All snags and downed wood would be retained. However, these areas may be avoided until a dense overhead canopy is established (approximately 50 years).

Implementation of the No Action Alternative would result in the prolonged development of habitat across the entire project area. Planting of desired tree species would not occur. Stands dominated by white fir and brush species may never produce the vertical and horizontal structure needed for denning. Habitat is not expected for at least 300-400 years.

Action Alternatives
Direct and Indirect Impacts

Harvest would occur primarily in stand replacement stands which would be avoided until dense overhead canopy has developed (approximately 50 years). Habitat would be developed sooner due to planting of desired tree species. Alternative 2 will result in the most habitat developed while Alternative 4 will result in the least.

White fir dominated stands will be treated in Alternatives 2 and 5 decreasing downed wood levels. However, treatment will also decrease the risk to existing green trees from loss to either insects and disease or wildfire.

Varying densities of snags will be retained by alternative; the largest material will remain. Alternative 2 removes the most snags however, changes in overall snag numbers are minimal.

Indirectly, road closures can aid in the establishment of trees, and potential fisher habitat, more quickly. Road closures can help reduce fragmentation over time and the need for additional danger tree removal. Alternative 5 closes more roads than the other action alternatives (77 miles compared to 71 miles).

Cumulative Impacts

Much of the watershed has now experienced stand replacement wildfire and large tracts of late-successional forests have been impacted by recent insect and disease events reducing habitat quality due to more open stand conditions. More open stand conditions also result in greater snow accumulations, which may result in lowered habitat quality over large areas. Snow accumulations tend to be fairly deep in this area (4-5’ deep on average in areas). Therefore, increases in fragmentation may delay expansion of fisher occupation in the watershed until such time as higher density stands become frequent on the landscape. The loss of large structure across the landscape from disturbance events (wildfire, insects, and disease) may also lead to reduced survivorship of fishers until conditions are restored.

Determination
Fishers are not known to utilize the area. They would avoid the high intensity burned areas of the fire. All alternatives leave legacy down wood and snags in the riparian reserves as well as in varying densities

in the uplands. Planting by the action alternatives would provide habitat sooner than the no action alternative. Implementation of Alternative 2 would be beneficial for fisher habitat in the long-term. In the short term, implementation of any alternative would have **No Impact** on the fisher.

California Wolverine, Region 6 Sensitive, MIS

Existing Condition

Wilderness or remote country where human activity is limited appears essential to the maintenance of viable wolverine populations. Habitat use is probably dictated largely by food availability; wolverines are primarily scavengers, but also depend on a variety of prey items. High elevation alpine wilderness areas appear to be preferred in summer, which tends to effectively separate wolverines and humans. In winter, they tend to den in the ground under snow or in rocky ledges or talus slopes (Ingram 1973; Banci 1994). However, Copeland (1996) found they tended to prefer montane coniferous forest habitats during the winter. Wolverines make little use of young, thick timber and clear-cuts (Hornocker and Hash 1981). Wolverines were documented using burn areas in Idaho (Copeland 1996) from immediately after the fire to up to several years after the event. These seemed to be associated with following ungulate herds.

Magoun and Copeland (1998) described two types of dens: natal and maternal. Natal dens are used during parturition and occur more commonly in subalpine cirque basins associated with boulder talus slopes. Maternal dens are used subsequent to natal dens and before weaning and consist of a complex of dens associated with boulders or fallen trees. Magoun and Copeland (1998) believe that a critical feature of wolverine denning habitat is the dependability of deep snow to persist through the denning period (Febr. – May at least 1 m deep). Deep snow offers thermoregulatory advantages to kits. Boulders and fallen trees are incorporated into dens if available and covered with deep snow. These provide the needed subnivean cavities. Dens without boulders or trees are found at higher elevations in drifted hard-packed snow. There is only one area that has potential to provide denning habitat within the project area. The cirque basin associated with Bear Valley Creek could be considered habitat albeit marginal due to the lack of abundant boulder talus slopes. The Mt. Jefferson and Mt. Washington wilderness areas have the greatest potential for providing denning habitat scattered along the Cascade crest. It is assumed that wolverines may travel through and or forage infrequently at lower elevations on the district and utilize higher elevations most of its needs.

Wolverines appear to be extremely wide-ranging and unaffected by geographic barriers such as mountain ranges, rivers, reservoirs, highways, or valleys. For these reasons, Hornocker and Hash (1981) concluded that wolverine populations should be treated as regional rather than local. However, Edelman and Copeland (1999) suggest that wolverine populations move along corridors of mountainous habitats and that features such as the Columbia River Gorge and shrub-steppe habitats serve as barriers to dispersal. They also conclude that sightings occurring across the arid mountains of Central Oregon may suggest a movement corridor from the Cascade Mountains to the Wallowa Mountains.

Several historic sightings have been documented in and around the project area. One sighting occurred near Suttle Lake, while the remainder of sightings occurred within the Mt. Jefferson and Mt. Washington wilderness areas. The project area is fragmented with open road densities averaging 3.99 miles/sq. mile. Areas within the project area comprised of low elevation ponderosa pine forests and areas that receive heavy recreation use may not be suitable for wolverine use.

Two aerial flights were conducted of the Three Sisters, Mt. Washington, and Mt. Jefferson wilderness areas and adjacent roadless areas during the winter/spring of 1998 and 1999 by an interagency group consisting of several National Forests, ODFW, and PNW. Nothing was detected during the two flights. Baited camera systems were placed near the wilderness boundary from 1997 through 1999 to try and detect wolverine presence. Wolverines were not detected using this method. No other surveys have been conducted for this species.

Environmental Consequences

All Alternatives
Direct and Indirect Impacts

Harvest of fire killed trees would not alter the use of the area by wolverine. Prey availability would not be reduced by activities nor would they inhibit the wolverine's ability to travel across the landscape. Proposed activities would not take place within or adjacent to potential denning habitat.

Plantings proposed in the action alternatives would increase habitat for various prey species, especially small mammals, potentially increasing the prey base for predators such as the wolverine.

Fuel treatments in the action alternatives would reduce down woody material levels allowing for more big game use. Heavy fuel densities have been shown to impede big game travel (Lyon and Jensen 1980). Studies have shown the importance of large mammal carrion to wolverine and the availability of large mammals underlies the distribution, survival, and reproductive success of wolverines (Ruggerio et al. 1994). This may increase potential foraging opportunities for wolverine, especially within snow-free periods.

Beneficial impacts should result from road closures proposed in the action alternatives which will result in less disturbance potential and less fragmentation on the landscape in the long term. Major travel routes by humans will not change however. During peak use times, these may function as barriers to dispersal. Alternative 5 results in a small increase in the number of miles of road closed over the other action alternatives. However, this is not a significant increase.

Cumulative Impacts

Cumulatively, these alternatives should not cause a trend toward Federal listing. To better analyze cumulative effects, an area running north and south from the Cascade crest approximately 5-8 miles wide will be analyzed for the Sisters Ranger District.

Past harvest activities had been concentrated along the east slope of the Cascades, primarily in the highest mortality areas. Most of these areas are now included in one of the large fire areas e.g., Cache Creek, Cache Mountain, Eyerly, Link or B&B). In addition, three other project areas outside the burned area have been proposed or have not yet been implemented (Metolius Basin, McCache and South Trout). Conditions exist in these areas with heavy mortality and increased risk of loss of habitat. Trade-offs are being addressed to reduce risk of further loss by reducing fuel loadings while decreasing stand densities. Therefore, a large area running almost the entire length of the district has received harvest and fuels treatments to reduce risk or are included in a recent burned area. These actions have reduced overhead cover potentially impacting dispersal from wilderness areas. However, forage potential for big game may have increased, allowing more foraging opportunities for wolverines.

Along with increased harvest activities adjacent to wilderness areas, both summer and winter recreation use seems to be increasing with more powerful snow machines, more use of wilderness areas, and increasing OHV use.

Several projects have proposed road closures including McCache, Metolius Basin, Black Crater Road Closures, and several fisheries projects. These, along with those proposed for the B&B project, will aid in reducing overall road densities and lessen fragmentation over time.

Determination

Wolverines are thought to be infrequent visitors to the project area. Activities proposed in any of the action alternatives would not alter prey availability or use of the area by wolverine. Implementation of any of the alternatives would have **No Impact** the wolverine.

Crater Lake Tightcoil, Region 6 Sensitive

Existing Condition

The Crater Lake Tightcoil is a former Survey and Manage species that has been given Sensitive Species status on the Deschutes National Forest and is included on the Region 6 Sensitive Species list.

"The Crater Lake Tightcoil may be found in perennially wet situations in mature conifer forests, among rushes, mosses and other surface vegetation or under rocks and woody debris within 10 m. of open water in wetlands, springs, seeps and riparian areas, generally in areas which remain under snow for long periods during the winter. Riparian habitats in the Eastern Oregon Cascades may be limited to the extent of permanent surface moisture, which is often less than 10 m. from open water" (Duncan et al. 2003).

Threats to the species include activities that compact soils, reduce litter and/or vegetative cover, or impact potential food sources (i.e. livestock grazing, heavy equipment use, ORV's, and camping on occupied habitats). Fluctuations from removal of ground vegetation on ground temperature and humidity may be less extreme at higher elevations and on wetter sites, but no studies have been conducted to evaluate such a theory. These snails appear to occur on wetter sites than general forest conditions, so activities that would lower the water table or reduce soil moisture would degrade habitat (Burke et al. 1999).

Intense fire that burns through the litter and duff layers is devastating to most gastropods, and even light burns during seasons when these animals are active can be expected to have more serious impacts than burns during their dormant periods. Snowmobiling or skiing would impact these snails if snow, over their occupied habitats, is compacted losing its insulative properties and allowing the litter or ground to freeze (Burke et al. 1999).

Surveys were conducted to protocol using Version 2.0 from the fall of 1998 through the fall of 2002 (Furnish et al. 1997). These surveys occurred both in and outside of riparian areas since little was known about the species. The new survey protocol (Version 3.0) was introduced in February of 2003, and subsequent survey efforts were modified to meet requirements of the new protocol. Version 3.0 states that surveys are required only in perennial wet areas (Duncan et al. 2003). See Table 54 for more information regarding surveys within the B&B project area.

Most *Pristiloma* on the district have been located along perennial streams within 15 feet of the water's edge. Several streams within the B&B project area did not contain suitable habitat for mollusk species prior to the fire due to the intermittent nature of the streams, lack of riparian vegetation, and low moisture content (portions of First Creek and stretches along Abbot Creek for example). Remaining unburned riparian areas vary but most have a narrow band of riparian vegetation, averaging 10-30' wide. These are the only areas with potential habitat left within the project area (Table 3.157).

Table 3.157. Mollusk survey results for the B&B Fire Recovery project area.

Project	Year	Fall/Spring	Acres Surveyed	Known Sites
Bugs	1998	Fall	550 acres	No
Bugs	1999	Spring	550 acres	No
Beetle	1999	Both	35 ac – 70 ac total	No
Suttle Lake	1999	Both	20 ac – 40 ac total	No
Springtail	1999	Fall (2 surveys)	179 ac – 358 total	No
Lower Jack	1999	Fall	117 acres	No
First Creek Cottonwood	2002	Both	43 ac – 86 ac total	Yes
Bull Trout Rest. (Phase 1)	2003	Spring	41 acres	Yes
Bull Trout Rest. (Phase 2)	2003	Fall	37 acres	Yes
Total Acres			**1849 acres**	

Post-fire
There are approximately 7,603 acres of riparian habitat within the B&B project area which includes the full riparian buffer of 150-300’ area on either side of the stream. There are 1,739 acres of perennial streams within the project area which would equate to an approximation of potential habitat for the Crater Lake tightcoil. Approximately 1,728 acres received some type of burn through them. Therefore approximately 99% of the potential habitat has been impacted. Very few acres remain unimpacted by fire to aid in re-populating the project area over time.

The following table outlines the number of known sites by project area and the number of those impacted by fire. It is assumed that if fire went through an area, that site was lost (Table 3.158).

Table 3.158. Known mollusk sites by project area and number impacted by fires for the B&B Fire Recovery project area.

Project Area	Number of Known Sites	Known Sites Impacted	Fire
First Creek Cottonwood	2	2	B&B
Bull Trout (Phase 1)	11	5	B&B
Bull Trout (Phase 2)	2	1	B&B
Total	**15**	**8**	

Environmental Consequences

All Alternatives
Direct, Indirect, and Cumulative Effects

Action Alternatives would remove some snags around Round Lake to provide for a defensible space and reduce risk to the Christian Camp and surrounding area. This would be minor in scope (20 acres). All snag felling and/or removal will occur within burned areas which are not considered suitable habitat therefore there will be alteration of habitat.

Determination
There will be **No Impact** to the Crater Lake Tightcoil with the implementation of any alternative. There are no activities proposed that would impact habitat or cause disturbance.

Survey and Manage Species

In 1994, the Northwest Forest Plan developed a system of reserves, the Aquatic Conservation Strategy, and various standards and guidelines for the protection of old growth related species. Mitigation measures were included for species that were rare, or thought to be rare due to a lack of available information. These species collectively known as Survey and Manage species were included in standards and guidelines under Survey and Manage, Protection Buffers, and Protect Sites from Grazing. An amendment in 2001 amended the survey and manage standards and guidelines and a second amendment in 2004 removed or modified the survey and manage requirements including eligible species for inclusion on the Regional Forester's List of Sensitive Species. The B&B Fire Recovery project is completed under the new 2004 guidance. This project is consistent with the guidance in the 2004 ROD to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines.

Terrestrial species thought to occur on the Deschutes National Forest included the Crater Lake Tightcoil (*Pristiloma arcticum crateris*) and the Great Gray Owl (*Strix nebulosa*). The Crater Lake tightcoil was included in a group of eight mollusk species where equivalent-effort pre-disturbance surveys were required even though it was considered a Category B species (species are considered rare, where pre-disturbance surveys are not practical) based on direction in the 2001 Record of Decision. In the subsequent 2002 Annual Species Review Memorandum (USDA and USDI 2003), the Crater Lake Tightcoil was changed from a Category B to a Category A species, where species are considered rare and pre-disturbance surveys are considered practical. The great gray owl was a Category C species which were species considered uncommon and where pre-disturbance surveys are practical. The status of the great gray owl has not changed during subsequent reviews. The Crater Lake Tighcoil was included in the Sensitive Species update while the great gray owl was not but is still considered a management indicator species in the Deschutes LRMP.

3.13 Management Indicator and Other Species of Concern

The Deschutes National Forest Land and Resource Management Plan (LRMP) (USDA 1990a) identified a group of wildlife species as management indicator species (MIS). These species were selected because they represent other species with similar habitat requirements. Management indicator species can be used to assess the impacts of management activities for a wide range of wildlife species with similar habitat needs (FSM 2620.5). Those management indicator species selected for the Deschutes National Forest include the bald eagle, northern spotted owl, golden eagle, red-tail hawk, osprey, northern goshawk, Cooper's hawk, sharp-shinned hawk, great gray owl, great blue heron, woodpeckers (cavity nesters), peregrine falcon, California wolverine, elk, mule deer, American marten, Townsend's big-eared bat, and waterfowl. All but the following have been covered in previous sections and will be discussed below: golden eagle, red-tail hawk, osprey, northern goshawk, Cooper's hawk, sharp-shinned hawk, great gray owl, great blue heron, elk, mule deer, American marten, and waterfowl(Table 3.159).

In addition to the above mentioned MIS species there have been a number of wildlife species deemed "species of concern" either through the Northwest Forest Plan (e.g. bats; pg C-43) or through other directives (e.g., neotropical migrants, see Birds of Conservation Concern section Table 6, pg. 14).

Table 3.159. Management Indicator Species Summary (covered in this section).

Species	Habitat	Presence
Northern Goshawk (*Accipiter gentiles*)	Mature and old-growth forests; especially high canopy closure and large trees	Known historical nesting Surveys planned 2005
Coopers Hawk (*Accipiter cooperi*)	Similar to goshawk, can also use mature forests with high canopy closure/tree density	Presence but no known nesting
Sharp-shinned Hawk (*Accipiter striatus*)	Similar to goshawk in addition to young, dense, even-aged stands	Presence but no known nesting
Great Gray Owl (*Strix nebulosa*)	Mature and old growth forests associated with openings and meadows	Known nesting Surveys planned 2005
Great Blue Heron (*Ardea herodias*)	Riparian edge habitats including lakes, streams, marshes and estuaries	Presence but no known nesting
Golden Eagle (*Aquila chrysaetos*)	Large open areas with cliffs and rock outcrops	No presence/No habitat
Waterfowl*	Lakes, ponds, streams	Presence of a variety of species
Red-tailed Hawk (*Buteo jamaicensis*)	Large snags, open country interspersed with forests	Nesting suspected
Osprey (*Pandion haliaetus*)	Large snags associated with fish bearing water bodies	Known nesting
Neotropical Migrants*	Various habitats	Presence of a variety of species
Bats*	Forested areas, riparian	Most bat species found within and nearby
American Marten (*Martes americana*)	Mixed Conifer or High Elevation late successional forests with abundant down woody material	Known presence
Elk (*Cervus elephas*)	Mixed habitats	Known presence
Mule Deer (*Odocoileus hemionus*)	Mixed habitats	Known presence

Snags and Down Wood Associated Species and Habitat*	Snags and down woody material	Associated with cavity nesters, bats, and marten

* - See Appendix 1 for a listing of species and scientific names for these categories.

Northern Goshawk

Existing Condition

The goshawk is considered a management indicator species in the Deschutes Land and Resource Management Plan. It is not a species specifically mentioned within the Northwest Forest Plan (NWFP). Standards and guidelines for late-successional habitat found within the NWFP would incorporate habitat for the goshawk.

This species is associated with mature and late-successional forests. All mature and late-successional habitats are considered potential nesting habitat and earlier forested seral stages are considered potential foraging habitat. Moist mixed conifer and moist ponderosa pine late-successional areas are preferred habitats, although forest structure appears to be the more limiting factor to goshawk habitat rather than stand composition (i.e. tree species). Preferred nest stands have a minimum of 40% canopy closure; and the nest sites within these stands have >60% canopy closure (Reynolds et al. 1991).

In the B & B planning area there are four known nest sites. Each of these sites was impacted by the fire to varying degrees (from underburned to a stand replacement burn). The nests were last known active in the 1990's. Each site was checked in 2004 and only one was active. In the 2005 field season, surveys will be conducted to determine occupancy of these sites. The nest site inside a stand-replacement burned area is assumed destroyed and unlikely to be occupied for several decades.

Over 12,000 acres of potential goshawk nesting habitat (as defined as stands with small to medium/large structure trees, average tree diameter at breast height [dbh] 9-21 in. or more) was lost in the project area due to the fire (see Table 3.160). This was estimated to be nearly 30% of the available nesting habitat before the fire. Similarly, approximately 31% of the potential foraging and fledging habitat was lost in the project area. Over the entire watershed, approximately 18-22% of the potential goshawk habitat was lost due to the B&B fire.

Table 3.160. Potential goshawk habitat pre-fire and post-fire.*

	Foraging (acres)		**Nesting (acres)**		**Fledging (acres)**	
Pre-fire						
Project Area	27,831		15,439		21,248	
Watershed	83,112		49,223		65,152	
Post-fire		**% change**		**% change**		**% change**
Project Area	16,577	-27%	2,980	-30%	8,151	-31%
Watershed	59,391	-18%	23,010	-20%	36,954	-22%

*Potential fledgling habitat is defined as small to medium/large structural stages (avg. stand dbh = 9-21+") and a minimum of 30% canopy cover; Potential nesting habitat is defined as small to medium/large structural stages (avg.

stand dbh = 9-21"+) and a minimum of 40% canopy cover; Potential foraging habitat defined as small to large structural stages (avg stand dbh = 9-21"+).

Evaluation Criteria
Nesting habitat for the northern goshawk has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. The amount of potential nesting habitat as described above impacted by salvage activities.
2. The number of acres planted for the establishment of future potential nesting habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
No known goshawk habitat will be impacted with the implementation of this alternative.

It is anticipated that it will take at least 300-400 years before nesting habitat develops in the stand-replacement burned areas largely due to the lack of remaining seed source. Some suitable nesting habitat may develop in the mixed mortality areas within 100-200 years. For the most part, foraging habitat still exists in some of the mixed mortality and underburned areas (a maximum estimate of 50% of the project area). In stand replacement areas and parts of the mixed mortality burns, the developing stand will likely be predominantly white fir because that is the dominant seed source. White fir is a species that is not as long-lived and does not often grow to large sizes (>21"dbh) as Douglas-fir and ponderosa pine. It is more susceptible to insects and disease, and has thin bark that leaves the tree vulnerable to fire. Further decline is expected in white fir dominated stands in mixed mortality and underburned areas. These stands will continue to experience mortality if fire impacted them due to the thin bark of white fir and its intolerance to fire damage. The indirect impact of this to goshawks is that the habitat is then again more susceptible to the disease and fire risk as was the habitat immediately prior to 2003. Within the project area, over 50% of the large structure habitat was white fir-dominant (i.e. late seral stage) before the B&B fire. After the fire, 30% of the large structure habitat is white fir-dominant which is still above the historic range of variability (HRV) for this plant association (mixed conifer). A majority of the stand-replacing burn areas were in mixed conifer areas in the late structural stages, and likely white fir-dominant.

With limited habitat availability, it has become relatively easier to predict where goshawks may be found. The remaining stands are also the remaining habitat for other late-seral dependent wildlife species, thus increasing the competition for prey and territories. In addition, human disturbance in this remaining habitat may increase (e.g., recreation, special forest products) given the existing road density (3.99 mi/sq. mi.). Goshawks do not tolerate human disturbance well, especially during the nesting season.

Known nesting territories in the underburned and mixed mortality areas will likely still serve as habitat. However, increased disturbance in these stands due to the indirect impact of the existing road density and human use of the project area may leave these nesting areas vulnerable to failure (i.e., death of nestlings due to exposure and predation). Also, those stands that have white fir as their dominant tree species will not persist as habitat in the long-term. The No Action alternative does not provide for the re-establishment of early seral species (e.g. Douglas-fir and/or ponderosa pine) through replanting. Field reconnaissance has shown that where there was a conifer seed source the majority of regeneration (80-90%) is comprised of white fir. These stands would become vulnerable to insects, disease, and fire, will be short-lived (80-120 years), and may never be able to produce large trees with limb structure able to support a nest.

Implementation of the No Action alternative will likely have few direct impacts to goshawk populations. With the existing open road densities, however, there will likely be increased disturbance to known and remaining goshawk nest territories. This indirect impact of increased disturbance can exacerbate the impacts of having limited habitat (i.e., increased competition, increased exposure to predation). Additionally, by allowing natural regeneration of burned areas, in stand replacment burn areas shrub species will likely dominate thereby prolonging stand development. In mixed mortality and underburned areas where white fir has dominated, white fir will likely reseed, creating a stand that will be vulnerable to disease, insect outbreaks, and fire. This would likely prolong the development of quality nesting habitat for goshawks.

Action Alternatives

Direct and Indirect Impacts

Alternatives 2 and 5 are the only Action Alternatives that propose units within 0.25 miles of a known nest (Units 132 and 133). These units are within a mixed mortality/stand-replacement burned area. They are likely serving as foraging habitat currently, however only dead trees or those with a low likelihood of survival are proposed for removal. It may alter foraging habitat slightly by removing canopy cover. In addition, implementation of mitigation measures for disturbance during the nesting period will be applied therefore, reducing potential impacts.

Salvage activities focused on the removal of existing dead wood will likely have few additional impacts to goshawks within the project area. Activities are focused in areas that are not currently serving as nesting habitat (this seen as the limiting feature within the watershed)(see Table 3.161). Removal of damaged, green white fir within LSR and all trees with a low probability of survival in the matrix will further reduce habitat effectiveness in the short-term (5-10 years) primarily by removing canopy cover. However, some short term impacts are expected in order to realize the long term benefits of having more resilient stands comprised of longer-lived tree species.

Table 3.161. Proposed treatment acres within existing potential goshawk habitat*.

	Acres of potential habitat in proposed units			
	Nesting		Fledging	
	All allocations	LSR**	All allocations	LSR
Alt. 2	86	75	2,314	1,081
Alt. 3	11	0	1,591	397
Alt. 4	11	0	1,188	0
Alt. 5	86	75	1,850	626

*Nesting habitat acres incorporate units with the HSV-UB-WF prescription that are of structural stages as defined in Table 2. Fledging habitat acres incorporate units that are of structural stages as defined in Table 2.
**LSR = Late Successional Reserve

Replanting areas as opposed to allowing for natural regeneration will benefit goshawk habitat in the long-term. Approximately 6,802 acres of reforestation are proposed. Douglas-fir and ponderosa pine develop into larger, more long-lived trees than white fir. By reintroducing this habitat component (desired tree species), especially in the more severely burned areas, goshawk habitat will potentially develop sooner (200-300 years as opposed to 300-400 years in the No Action alternative), be more suitable (because of the larger trees), and be more resilient to disturbance events. Goshawk habitat would be provided in the long-term, although it will take several decades to develop.

Fuels treatments are proposed for all salvage units. These treatments will reduce both activity fuels and overall fuel loadings to acceptable levels. Fuel treatments will reduce fire risk and will reduce competition to established seedlings resulting in the development of habitat sooner. Fuels treatments will also reduce the understory complexity which may result in a change or reduction in potential prey species. However, adjacent untreated areas may be able to provide the structural complexity for prey species that will be able to provide potential foraging opportunities. Overall, fuel treatments will aid in the development of habitat over time.

Each action alternative proposes to either decommission or inactivate approximately 2.27 miles of road that are in close proximity (within .25 miles) to known goshawk nests. Should the territories prove to be active this action will reduce any ongoing disturbance at the nest, and increase the likelihood of nesting success.

Alternatives 2 and 5 treat the most acres of potential nesting habitat (86 acres) while Alternative 2 treats the most acres overall (2,314 acres). Alternative 2 would have the greatest short-term impacts followed by Alternative 5 but Alternative 2 also results in the greatest number of acres planted leading to more potential suitable habitat over time. Alternative 4 treats the least amount of acres thus having the least short term impacts. It also results in the least amount of acres planted.

Cumulative Impacts for All Alternatives

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to northern goshawks. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (mixed conifer PAGs) is being used as the scale for analysis for the northern goshawk. Based on that review, the potential cumulative impacts are those discussed below.

The majority of nest sites on the Sisters RD are located within the mixed conifer PAGs (14 of 18). These PAGs experienced moderate to heavy mortality with the insect outbreak of the early 1990's with impacts occurring a few years later. This event probably had the greatest influence on goshawk habitat across the district due to the reduction of canopy cover prior to the fires. These open stands are considered unsuitable nesting habitat for goshawks.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 26,700 acres of mixed conifer forests experienced stand replacement fire further reducing cover in this forest type. Not every acre of the mixed conifer forests equated to suitable habitat for the goshawk but all this habitat is now considered unsuitable due to the fires. The recent fires have negated many of the impacts resulting from past management projects.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact goshawk habitat since suitable habitat was avoided. In addition, two vegetation management projects may occur within suitable goshawk habitat (McCache and Metolius Basin Forest Management Project). Measures were incorporated to retain suitable nesting habitat for each project area as well as enhance habitat conditions. Overall, treatments proposed will improve goshawk habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances.

An estimated 30 miles of roads have been decommissioned across the watersheds. In addition, 60 miles of decommissioning is proposed under the Metolius Basin project. These closures, along with proposed closures for the B&B project (71-77 miles), will aid in reducing the disturbance potential to existing nest sites and will lessen fragmentation leading to reduced disturbance potential to future nest sites.

The following table displays how the approximate baseline acres were calculated and the effects the B&B project will have on those acres (Table 3.162).

Table 3.162. Cumulative Impacts Analysis for the northern goshawk for the B&B Fire Recovery Project.

	Accounting of Estimated Acres for the Sisters Ranger District	Percentage of Estimated Total Goshawk Habitat Acres
Pre-fire Existing Habitat*	62,700	
Habitat Lost from Fires	26,704	43%
Habitat Lost or degraded from Metolius Basin	887	1%
Habitat lost or degraded from McCache	500	1%
Total Acres Resulting from Past Events (Baseline Acres)	**34,609**	**55%**
Habitat lost or degraded from B&B Fire Recovery Project	2,314	7% of baseline acres (34,609 acres)
Resulting Habitat Acres	**32,295**	**51% of original 62,700 acres**

*Acres derived from the Metolius Watershed Analysis, Why-chus Watershed Analysis, and professional judgement.

Goshawk populations are expected to decline across the district due to the loss of nesting and fledgling habitat. Most of the currently known nests are expected to remain active territories, especially with associated road closures and subsequent reduction in human disturbance. Fledging and dispersing goshawks, however, will likely have difficulty in establishing new territories due to limited habitat availability and increased competition for what remains. Cumulatively with ongoing forest management projects an estimated 7% reduction in overall potential goshawk habitat is expected with the implementation of this project.

Cumulatively, the action alternatives will not lead to a trend toward Federal listing for the northern goshawk.

Cooper's and Sharp-shinned Hawks

Existing Condition

The Cooper's and sharp-shinned hawks are considered MIS species in the LRMP. They often use dense cover in which to hunt and nest. Cooper's hawks tend to select nest sites in dense second growth of mixed conifer or ponderosa pine stands (Jackman and Scott 1975). Moore and Henney (1983) noted that this species would routinely utilize mistletoe brooms as nesting sites. Sharp-shinned hawks utilize thickets in mixed conifer and deciduous woods. Generally, nesting habitat has been grouped into 3 types by Reynolds (1976): young, even-aged conifer stands with single-layered canopies; mature, old-growth stands of mixed conifer with multi-layered canopies; and dense stands of aspen.

No formalized surveys have occurred for these two species in the planning area, however, both have been documented. Documentations were gathered from sightings from surveys for other species or from casual observations.

The fire has resulted in a decrease in potential habitat especially in the stand replacement and mixed severity burned areas (see Table 3.163).

Table 3.163. Potential Cooper's and sharp-shinned hawk habitat pre-fire and post-fire.*

	Foraging (acres)		Nesting (acres)	
Pre-fire				
Project Area	41,630		17,476	
Watershed	125,414		57,278	
Post-fire		**% change**		**% change**
Project Area	23,984	-42%	3,149	-34%
Watershed	91,096	-26%	26,708	-23%

*Potential foraging habitat is defined as seedling/sapling to medium/large structural stages (avg. stand dbh = 0-21+"); Potential nesting habitat is defined as pole to medium/large structural stages (avg. stand dbh = 5-21"+); Based on these definitions, foraging habitat includes the nesting habitat acres.

Evaluation Criteria

Nesting habitat for the Cooper's and sharp-shinned hawks has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. The amount of potential nesting habitat as described above impacted by salvage activities.
2. The number of acres planted for the establishment of future potential nesting habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts

No known Cooper's or sharp-shinned hawk habitat will be impacted with the implementation of this alternative.

It will be several decades before habitat for these two hawk species develops. Lack of a seed source and increased competition of shrubs will delay forest development in the most severely burned areas. White fir competition and regeneration in less severely burned areas, in the long-term, will recreate the habitat conditions and vulnerabilities present before the fires. Potential habitat that was lost may be provided in approximately 60-80 years. This new habitat, however, will likely be comprised of more monotypic stands with fewer "patches" on the landscape and exhibit variable stand densities. Moore and Henney (1983) found the best potential for nesting habitat are younger successional stands with a high density of foliage in layers from 3 to 15 meters. Habitat produced will be even-aged conifer stands comprised mainly of white fir. Development of old-growth stands, another type of habitat identified for nesting will not occur for an estimated 300-500 years depending on whether trees become established or not. Aspen stands will recover but this habitat type represents a very small percentage of the potential nesting habitat.

In some underburned areas, stand densities would continue to increase due to white fir encroachment. This would increase the potential habitat over time. However, with increased stand densities comes increased risk of loss from disturbance events. These events would likely impact the densest stands the greatest and would likely result in an overall reduced availability of suitable habitat in the project area if it occurs before the previously burned habitat recovers.

The No Action alternative would have some additional impacts upon Cooper's and sharp-shinned hawk populations. Similar to the discussion for the goshawk, increased human use of the remaining habitat may decrease the effectiveness of this habitat. There is more potential habitat currently available in the project area for the Cooper's and sharp-shinned hawk than for the goshawk. However, in stands dominated by white fir, habitat may only be temporary because these stands still face the same vulnerabilities to insects, disease and fire as described for goshawks.

Action Alternatives

Direct and Indirect Impacts

Impacts to these species and their habitats as a result of the action alternatives would be similar to those discussed for the goshawk. Impacts may not be as severe or as long-lasting, however, because of these species ability to utilize a wider range of habitat, especially for nesting. Salvage activities focused on the removal of existing dead wood will likely have few additional impacts to Coopers or sharp-shinneds within the project area as activities are primarily focused in areas that are not currently serving as nesting habitat. However, harvesting of damaged white fir within the LSR and trees with a low probability of survival in matrix would reduce remaining habitat slightly by removing canopy and opening the stand up. This would be a short-term impact because these damaged trees are not expected to live beyond 5-10 years.

Replanting areas as opposed to allowing for natural regeneration will benefit Cooper's and sharp-shinned hawk habitat in the long-term. Reforestation acres range from 6,802 acres for Alternative 2 to 1,725 acres for Alternative 4. Douglas-fir and ponderosa pine develop into larger, more long-lived trees than white fir. This will allow for the development of old growth habitat sooner (200-300 years as opposed to 300-400 years for the No Action alternative). Replanting will also result in more consistent stand densities than allowing for natural regeneration, especially in stand replacement areas. However, stands will utilize wider spacing specifications in order to reduce the need for a pre-commercial thinning. This may not allow for dense canopies to develop. Cooper's and sharp-shinned hawk will develop in the long term although it will take several decades.

Fuels treatments are proposed for all salvage units. These treatments will reduce both activity fuels and overall fuel loadings to acceptable levels. Fuel treatments will reduce fire risk and will reduce competition to established seedlings resulting in the development of habitat sooner. Fuels treatments will also reduce the understory complexity which may result in a change or reduction in potential prey species. However, adjacent untreated areas may be able to provide the structural complexity for prey species that will be able to provide potential foraging opportunities. Overall, fuel treatments will aid in the development of habitat over time.

Alternatives 3 and 4 treat the fewest acres thereby retaining the most short-term habitat. However, among the action alternatives, Alternative 4 also replants the fewest acres and has the lowest acres of potential habitat treated (Table 3.164). The habitat that develops under Alternative 4 would be less resilient and more likely to be impacted by another catastrophic event. Alternative 3 treats fewer acres than Alternative 2 and 5, but incorporates more replanting than Alternative 4.

Table 3.164. Acres of proposed treatment within potential Cooper's and sharp-shinned hawk nesting habitat.*

	Acres of potential nesting habitat
Alternative 2	86
Alternative 3	11
Alternative 4	11
Alternative 5	86

* Potential nesting habitat acres incorporate units with only the HSV-UB-WF prescriptions that are of structural stages as defined in Table 5.

Impacts from disturbance would remain a factor in Cooper's and sharp-shinned hawk habitat. All action alternatives propose to close an estimated 70 miles of road. Alternative 5 proposes an additional 6 miles of closure. Because Alternative 5 proposes to close the most roads, it is the alternative with the least amount of disturbance impacts (e.g. vulnerability to predators and nest failure).

Cumulative Impacts for All Alternatives

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to Cooper's or sharp-shinned hawks. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (small and pole-sized mixed conifer PAGs) is being used as the scale for analysis for these two species. Based on that review, the potential cumulative impacts are those discussed below.

Territories on the Sisters RD have historically been located within the mixed conifer PAGs. These PAGs experienced moderate to heavy mortality with the insect outbreak of the early 1990's with impacts occurring a few years later. This event probably had the greatest influence on Cooper's and sharp-shinned hawk habitat across the district due to the reduction of canopy cover prior to the fires. These open stands are considered unsuitable nesting habitat for these two species.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 26,700 acres of mixed conifer forests experienced stand replacement fire further reducing cover in this forest type. Not every acre of the mixed conifer forests were considered suitable for these two species but all the stand replacement habitat is now considered unsuitable. The recent fires have negated many of the impacts of past management actions within the fire areas.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact Coopers and sharp-shinned hawk habitat since suitable habitat was avoided and concentrated primarily on the removal of dead material within stand replacement burned areas. In addition, several vegetation management projects have occurred or may occur within suitable habitat (McCache, Metolius Basin Forest Management Project, Broken Rim, Walla Bear, Highway 20, and Underline). Overall, treatments proposed will reduce the risk of loss of existing habitat from other large-scale disturbances. However, stand densities were reduced within treatment units below suitable conditions used for nesting in many areas.

An estimated 30 miles of roads have been decommissioned across the watersheds. In addition, 60 miles of decommissioning is proposed under the Metolius Basin project. These closures, along with proposed closures for the B&B project (71-77 miles), will aid in reducing the disturbance potential to existing territories and will lessen fragmentation leading to reduced disturbance potential to future nest sites.

An estimated 150,000 acres of potentially suitable habitat still remains after the impacts of the fires and past vegetation management projects due to the overstocked conditions of many forested stands in addition to existing mature and old growth stands. Cumulatively, less than 1% reduction in suitable habitat is expected with the implementation of this project. Across the district, Cooper's and sharp-shinned hawk populations are expected to decline due to the loss of nesting habitat from the fires and past projects. Populations would begin to recover soon after the forested habitat develops, that is to say, after several decades. The decline is not expected to be as pronounced or as long-lasting as that for goshawks because these species can utilize a wider range of habitat that can be available more rapidly.

Cumulatively, the alternatives will not lead to a trend toward Federal listing for the Cooper's or sharp-shinned hawk.

Great Gray Owl

Existing Condition

This species was identified in the NWFP (1994a) as a protection buffer species requiring surveys due to an apparent range expansion resulting from opening up dense-canopied stands with shelterwood type harvest activities. A Regional survey protocol was developed in 1995 and was updated in January of 2004 (Version 3.0). An amendment to the NWFP occurred in 2001 which moved the great gray owl from a protection buffer species to a Category C species. This category contained uncommon species for which pre-disturbance surveys are practical. Therefore, surveys are conducted at the project level prior to habitat disturbing activities. All known nest sites will be managed according to Management Recommendations; however these have not been established to date. An amendment in 2004 removed or modified the survey and manage requirements identifying eligible species for inclusion on the Regional Forester's Sensitive Species list. The great gray owl was not included on this list but is still considered a Management Indicator Species in the Deschutes LRMP.

This species is associated with mature stands associated with meadows or like openings. Mixed conifer/lodgepole pine/mountain hemlock communities associated with meadows are considered the preferred habitat for this species. Recent studies in the Blue Mountains (Bull and Henjum 1990, Bull et al. 1988) have shown that owls will inhabit openings created by timber harvest activities, especially those that mimic natural gaps.

Great gray owls hunt from perches and can detect prey by sound alone which allows capture of prey beneath the snow. They utilize small prey, primarily pocket gophers and voles. Great gray owls forage in openings, along forest edges, or in open understory stands. (USDA/USDI 2004a). Bull and Henjum (1990) found them utilizing forested stands with less than 59% canopy cover in eastern Oregon while Goggans and Platt (1992) found the birds using recent regeneration harvest units (0-10 years) on the west-slope of the Cascades until these sites became too dense. This habitat is ephemeral in nature but it may allow occupancy of habitat due to the proximity to suitable nesting habitat. Forsman and Bryan (1984) found that meadows where snow persisted beyond mid-April were not occupied. Snow conditions may not allow successful foraging due to the formation of a thick icy crust during this period. This finding may suggest that great gray owl habitat is more likely to be found in the mid to lower elevations of the project area (3,000-4,000 ft.).

Great gray owls do not build their own nests and are dependent on structures built by other species (i.e. ravens, red-tailed hawks, goshawk and Cooper's hawks) or existing substrate like broken top snags or mistletoe platforms. Great gray owls in this region show a high site fidelity to their nest site and exhibit only short seasonal movements. Bull and Henjum (1990) found that great grays prefer to nest in mature and old stands with a fairly open understory and a dense overstory. However, the availability of nest sites and suitable foraging habitat and their proximity to one another seem to dictate use by great grays.

Potential nesting habitat within the project area occurs in mature to old stands that experienced mixed severity fire or were underburned in close proximity to foraging habitat. This occurs primarily within the mid section of the project area especially between Roaring and Jack Creeks. Foraging habitat is widespread.

Great gray owl surveys were conducted in the project area in 2004 and will continue in 2005 with six protocol visits completed each year within suitable habitat. Additional surveys had been conducted within the watershed since 1996 with varied results. See Table 3.165 for more information on survey area and year. In addition, responses have been detected while conducting spotted owl surveys.

Table 3.165. Great gray owl survey areas, year surveys were conducted, and results.

Survey Area	Years Surveyed	Results
Suttle	1996	None located
McCache	1998, 1999	None located
Metolius Basin	2001, 2002	One nest located
Black Butte (part of Metolius Basin)	2002, 2003	None located
Eyerly	2003	One auditory response
B&B Fire Recovery area	2004	Three new nests located, auditory responses detected at one known historic site, and a single detected at the other historic site.

Two historic nest areas were known within the project area prior to the fires. Both sites showed similar characteristics as both were located in mature mixed conifer wet stands with adjacent openings created by past timber harvest. These stands both exhibited a shelterwood appearance and were open for foraging. Both nest stands contained adequate structure for young to utilize after leaving the nest. Three additional nest areas were located during the 2004 surveys and exhibited the same characteristics as the historic sites. All of the sites were either underburned or received a mixed mortality burn.

Evaluation Criteria
Nesting habitat for the great gray owl has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. The amount of potential nesting habitat as described above impacted by salvage activities.
2. The number of acres planted for the establishment of future potential nesting habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
The known nest sites are likely to remain as habitat, and occupied for the short-term. These sites were underburned. Some of the white fir within these stands is likely to die within 5-10 years because of fire damage. Similar to the discussion for goshawks, suitability of remaining habitat may decline, especially those stands with a dominant component of white fir putting remaining habitat at greater risk from increased fuel loadings after dead trees begin to fall. In addition, as stands begin to open up predation on

juveniles by great horned owls and northern goshawks may increase, especially in years where primary prey species are scarce (Nero 1980, Duncan 1987).

The No Action alternative would have little additional direct impact upon great gray owl populations. Indirectly, however, there will likely be less habitat in the long-term because of a long delay between when trees become established (especially in severely burned areas) and large tree structure develops especially in white fir-dominated areas (estimated to take at least 300-400 years). Similar to the discussion for goshawks, developing stands that are predominantly white fir are not likely to provide long-term habitat for the owl (don't develop large tree sizes needed and are short-lived). Being the dominant seed source in some areas, in conjunction with its inherent risks to insects, disease, and fire, will re-create the habitat conditions existing immediately prior to the B&B fire. In areas with little seed source available, development of suitable habitat will likely be prolonged even further (estimated at 500 years).

The large extent of existing foraging habitat will decrease over time as open areas grow into shrubfields and stands of immature seedling/sapling stands. And as trees begin to fall, foraging potential may decrease since open ground needed to hunt will be minimized.

Competition for prey species is likely to occur when prey populations are scarce. Therefore, if many species that rely on forested habitats are concentrated in the mid section of the project area for an extended time period, it may put additional pressure on prey resources further limiting great gray owl use and occupation.

Indirectly, great gray habitat may also become less effective due to human disturbance in the less severely burned areas. The existing high road density in the project area, in conjunction with a large part of the underburned areas being near great gray habitat will likely increase the number of encounters of great gray owls with people.

Action Alternatives

Direct and Indirect Impacts

The Action Alternatives propose units within 0.25 miles of a known or suspected great gray owl nest (All Alternatives have 3 units within 0.25 miles). Each action alternative proposes salvage and removal of damaged white fir within a stand that contains a known owl nest (Unit 120). Mitigation measures include a no harvest buffer around this nest. In addition, each alternative proposes 1.22 miles of road closures that are in the proximity (1/4 mile) of known nests.

Loss of forested cover and large snags within forested cover directly impacts this species' habitat. The action alternatives each to some degree propose to remove trees that have a low probability of survival. These trees may be providing some short-term cover, however they are likely to die within 5-10 years and the cover would still eventually be lost. Alternatives that treat the fewest acres (Alternatives 3 and 4) would have the fewest short-term impacts. Snags will be harvested with each alternative however, except for those stands that are removing low probability of survival trees, this will occur outside potential nesting habitat for the great gray owl. It may result in the reduction of perching habitat used for foraging but not all snags will be removed within units and abundant snag habitat will exist outside proposed units. Removal of excess material may actually increase foraging opportunities by reducing the amount of dead wood that would end up on the ground within the next several years. Fuels treatments would further reduce these levels and allow for foraging for a longer period of time than untreated areas (Table 3.166).

Table 3.166. Proposed treatment acres within potential great gray owl nesting habitat.

Alternative	Acres of Potential Nesting Habitat in Proposed Units*
Alternative 2	687
Alternative 3	404
Alternative 4	316
Alternative 5	685

*Mixed conifer stands with >9"dbh and >30% canopy cover. Applies to HSV-M, HSV-M-WF, and HSV-UB-WF treatments.

The alternatives that treat the fewest acres also replant the fewest acres. This allows for not only more white fir regeneration, but also a longer time period before trees become established in stand replacement burned areas due to a lack of seed source and shrub competition. Similar to the discussion for the goshawk, in stand replacement areas this may prolong the development of great gray owl habitat. Accordingly, Alternative 4 maximizes the long recovery period for late-seral habitat by replanting the fewest acres resulting in stands that will likely have decreased resilience to insects, disease and fire. Reforestation will result in ponderosa pine and Douglas-fir being planted along with other minor species. These species are able to produce the size and structural characteristics needed for potential nest trees as opposed to white fir which does not reach the large sizes or produce the structural characteristics needed. Reforestation acres range from 6,802 acres for Alternative 2 to 1,725 acres for Alternative 4.

Danger trees will be treated along haul routes, high use areas, and within some riparian reserves. Removal of danger trees may remove potential nest trees, especially broken top snags. Most nests on the district have been found in broken top snags and most have been fairly close to roads (within 150 yards).

Each action alternative proposes at least 70 miles of road closures (decommissioning and inactivation) which include roads that are proximate to known nests. Road closures reduce disturbance to nesting great gray owls and indirectly may help off-set some of the risks of reduced forest cover (e.g. vulnerability of nests to predation). Alternative 5 proposes the most road closures, thereby providing the least amount of disturbance to great gray owls.

Cumulative Impacts for all Alternatives

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to great gray owls. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (mixed conifer PAGs within ¼ mile of grass, forb and meadow habitat) is being used as the scale for analysis for the great gray owl. Based on that review, the potential cumulative impacts are those discussed below.

The fires over the past 5 years created a large increase in foraging habitat (albeit not high quality) especially in stand replacement and mixed severity stands. Nesting habitat has also increased. An estimated 16,846 acres of mature mixed conifer forests experienced stand replacement fire reducing potential nesting habitat. Not every acre of the mixed conifer forests were considered suitable nesting habitat for the great gray owl but all habitat impacted by the fire is now considered unsuitable for nesting. Since this species relies on existing nests from other raptor species or broken top snags for nesting, it is assumed many of these structures were potentially consumed in the more severely burned areas. The recent fires have also negated any affects resulting from past management activities. Complex edge habitat has been reduced as there are basically three large patches resulting from the fires as compared to the pattern of past harvest units; two resulting from the B&B, Link, and Cache Mountain fires and another resulting from the Eyerly fire.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact great gray owl habitat since suitable nesting habitat was avoided. Habitat was enhanced under the Metolius Basin Forest Vegetation Management project. Measures were incorporated to retain suitable habitat as well as enhance habitat conditions. Overall, treatments proposed will improve great gray owl habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances. Other ongoing forest management projects (Bear Garden, Big Bear, Broken Rim, Walla Bear, and McCache) and danger tree removal may have reduced nesting habitat on the district. Therefore, nesting structure may be the limiting factor for occupation on the district. However, Bull and Henjum (1990) found that great gray owls readily accept artificial nest structures and that this structure may be relatively unimportant compared to the nest site habitat and the availability of foraging habitat. There is the potential that nesting structure will be created by other disturbance factors such as wind. High wind events could result in snapped off trees and snags which could equate to potential nest structures.

Prior to the fires and incorporating past vegetation management actions, an estimated 2,670 acres of potential nesting habitat was available on the district. Many past harvest units had grown up to a size where they were not functioning as potential foraging habitat any longer restricting great gray owl use. After the fires, potential nesting habitat has increased greatly to 17,225 acres due to the amount of early seral habitat created near potential nesting stands.

Great gray owl populations will likely remain stable in the short-term. Long-term there may be a decrease in the populations due to the long period of time before late seral habitat develops for nesting (due to salvage efforts and ongoing projects) and the newly created foraging areas will become grown over with shrubs and small trees. Habitat excluded from treatment however (e.g. active nest stands and low mortality underburned ponderosa pine and Douglas-fir stands) is expected to provide some potential habitat during this period. More resilient, stable habitat will develop in the long-term over the watershed as a result of the action alternatives and projects such as the Metolius Basin Forest Management. As this habitat develops great gray owl populations will respond.

Cumulatively, this project will minor impacts (4% decline in nesting habitat) to great gray owls. Cumulatively, the alternatives will not lead to a trend toward Federal listing for the great gray owl.

Great Blue Heron

Existing Condition

The great blue heron is one of the most wide-ranging waterbirds in Oregon (Marshall et al. 2003 p. 62). Highly adaptable, it is found along estuaries, streams, marshes and lakes throughout the state. Nest locations are determined by their proximity to suitable foraging habitat. Great blue herons nest in colonies within shrubs, trees and river channel markers where there is little disturbance (Marshall et al. 2003 pp. 62-64). Tree species they could utilize in the project area include ponderosa pine, Douglas fir, and black cottonwood. While the average diameter of nest trees is 4.5 feet and the average height is 79 feet, they use a wide range of sizes from 1.5 to 6 feet in diameter and 43 to 120 feet tall (Marshall et al. 2003 pp. 62-64). They hunt shallow waters of lakes and streams, wet or dry meadows feeding on fish, amphibians, aquatic invertebrates, reptiles, mammals and birds. Foraging habitat in the project area includes the shallow waters of Round Lake and associated ponds, small ponds along the 1210-300 road, Suttle Lake, Dark Lake, Scout Lake, Blue Lake, wetlands in the Meadow Lakes area and associated riparian habitat (Table 3.167 illustrates the fire severity around each of these lakes). There are no known colonies/rookeries in the B&B Fire Recovery project area.

Table 3.167. Great blue heron foraging habitat (lake) and fire severity.

	Fire Severity		
	Stand Replacing	**Mixed Mortality**	**Underburn**
Round Lake	X		
Dark Lake	X		X
Blue Lake	X	X	
Meadow Lakes Area	X		X
Suttle Lake		X	X
Scout Lake			X
1210-300		X	

The fires have led to a decrease in large live trees for nesting and roosting adjacent to potential foraging habitat.

Evaluation Criteria
Nesting habitat for the great blue heron has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. The amount of potential green nesting habitat as described above impacted by salvage activities within riparian reserves.
2. Large snag habitat impacted by salvage activities within riparian reserves.
3. The number of acres planted for the establishment of future potential nesting habitat within riparian reserves.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
The No Action alternative would have little additional short-term impact upon heron populations. Potential rookery habitat for herons is likely now limited within the project area. Large snags in riparian areas and around lakes can serve as habitat, albeit less suitable than large live green trees and temporary (most will fall within 15-30 years). Allowing for largely white fir regeneration may also prolong the development of potential nesting habitat. White fir generally does not get as large nor is it as long-lived as ponderosa pine or Douglas-fir. Also, white fir regeneration may hinder the establishment and growth of black cottonwood, another favored species for heron rookeries. It will take several decades before this type of nesting habitat develops in the riparian areas and lakeshores that were severely burned. Therefore, Round Lake and associated ponds, areas around Dark and Blue Lakes, and some of the Meadow Lakes area will not contain suitable habitat for approximately 75-100 years at which time trees should be at the minimum size required by blue herons for the establishment of a rookery.

Prey numbers within stand-replacing and mixed mortality burns in riparian areas and along lake shores were probably reduced. However, small mammals, reptiles, and amphibians may easily re-colonize areas that are associated with lower intensity burns. Indirect impacts to great blue herons would result from increased recreation use of lakes where there were low severity burns or underburns. Great blue herons could be displaced from these foraging areas.

Action Alternatives

Direct and Indirect Impacts

The action alternatives are not harvesting within riparian reserves with the exception of Round Lake defensible space treatment and danger tree removal on the north side of Suttle Lake between the lake and Highway 20. Entry into riparian reserves is very minimal (approximately 20 acres). There are no direct impacts resulting from this project and no green tree harvest is proposed within potentially suitable habitat. However, indirect impacts would include the removal of large snags within riparian reserves capable of supporting a great blue heron nest. Large snags will be retained around lakes, ponds, and streams identified as potential habitat along with reduced snag levels retained around Round and Suttle Lake providing short term marginal habitat. Danger tree removal will be concentrated in the high use areas around Round Lake and between Highway 20 and the hiking trail at Suttle Lake. Snags targeted for removal will consist of primarily smaller diameter snags. However, snag retention guidelines will apply to these areas ensuring large, likely to persist snags are retained while meeting safety requirements. Options will be assessed for topping larger diameter trees where applicable, especially around Suttle Lake. Dead tree habitat will only provide short term habitat however. It is estimated that about 75% of all snags are likely to fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). Fuels treatments are also proposed for areas treated. This treatment may stimulate herbaceous growth needed for some prey species however short term impacts are expected during the activity.

The only riparian areas to be planted with this project include Round Lake. Planting desired species like ponderosa pine and Douglas-fir will provide large structure preferred by this species. These tree species are longer lived, can grow to larger diameters, and are less susceptible to disease and wildfire than white fir.

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to great blue herons. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (riparian reserves adjacent to perennial water bodies) is being used as the scale for analysis for the great blue heron. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. All these fires have altered riparian vegetation to some degree further reducing potential great blue heron habitat. Approximately 5,100 acres (19%) of 27,300 acres were within stand replacement areas resulting in non-suitable habitat.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales however did not impact great blue heron habitat since suitable habitat was avoided.
In addition, one vegetation management project may occur within suitable great blue heron habitat (Metolius Basin Forest Management Project). Measures were incorporated to enhance habitat conditions. Overall, treatments proposed will improve great blue heron habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances.

Hazard/danger tree activities are usually concentrated along roads and high use areas like campgrounds, many of which are associated with water bodies. It is highly unlikely that great blue herons would choose to nest in these locations; however there is continued removal of danger trees for safety reasons and continued expansion of recreation use into undeveloped areas reducing potential nesting areas due to disturbance primarily.

Great blue heron populations are expected to decline slightly across the district due to the loss of nesting habitat especially within riparian reserves. Great blue heron populations would not begin to recover until the establishment of forested habitats. This may take several decades. Cumulatively, this project will minor impacts (<1%) to great blue herons because green tree stands are not being impacted within suitable habitat.

Waterfowl

Existing Condition

Open lakes, ponds, streams, rivers, and wet/dry meadows provide foraging habitat for most waterfowl species. Some species utilize large snags for nesting, while others utilize open grassy areas near the water's edge. Most waterfowl diets consist primarily of vegetation although some animal matter (caddisflies, crustaceans, and mollusks) may be consumed (Csuti et. al 1997 pp. 66, 84-87, 89, 96, 99-102).

Twelve waterfowl species, excluding the species mentioned earlier in the report, have been documented in the project area (mallard, common merganser, hooded merganser, wood duck, green-winged teal, blue-winged teal, ring-necked duck, Barrow's goldeneye, common goldeneye, common loon, western grebe, and Canada goose). Most sightings have occurred along Suttle Lake, Scout Lake, Round Lake and the Meadow Lakes area (district files). Potential habitat exists along major streams, lakes and some meadow areas. However, much of the suitable meadow habitat occurs on private land. No formal surveys have occurred for most waterfowl species to date.

There were stand replacing and mixed mortality burns around Suttle and Round Lakes. Scout Lakes and the Meadow lakes area received less severe underburning. Habitat in these areas is likely still suitable for waterfowl, whereas habitat around Suttle and Round Lakes has been reduced, at least in the short-term, because of the more severe burns. Much of the streamside habitat in the southern and northern end of the planning area was heavily burned, especially towards the upper elevations. Although, there is still some intact streamside habitat, available habitat overall has been reduced.

The fires may lead to an increase in grassy vegetation along some streams and lakes which would increase forage potential and nesting habitat (e.g. teals, ring-necked duck). However, for species who also consume animal matter, forage may be decreased by the fire as crustaceans and mollusks were likely consumed by the fire. Nesting habitat for some species of waterfowl has been reduced, specifically for those species that utilize cavities in snags (e.g. wood ducks, goldeneyes) and species that utilize large wood along the stream channel (e.g. mergansers).

Evaluation Criteria

Nesting habitat for waterfowl species has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. Large snag habitat impacted by salvage activities within riparian reserves.
2. The number of acres planted for the establishment of future large tree/snag habitat.
3. Meadow habitat impacted by salvage activities.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
Although snags were created by the fire, these snags would not immediately be able to replace habitat for cavity nesters, because the most suitable snags are produced by the inner core rotting from inside the tree (i.e., disease or insect creating the snag) leaving a hard outer layer. Fire-created snags generally result from the bark and cambium layer just inside the bark being consumed, leaving a hard inner core (i.e., case-hardening). Fire-killed trees do not seem to be as effective as snags killed by other means (Smith 2000). It is estimated that approximately 75% of the snags will fall within 20 years reducing habitat for cavity nesting ducks (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). At that time, abundant down woody material will be present. This may provide additional habitat for species that utilize large wood along stream channels. However, downed wood levels may also become too concentrated as snags continue to fall for species to utilize the stream channels. This may render many riparian reserves unsuitable, especially smaller channels where down wood could easily span the channel width. In addition to this, there will likely be a long period of time between when current large snags fall and snags of suitable size (diameter) are again present. In areas of the most severe burns, there are few remnant live trees to provide a seed source for a new stand to develop. Often shrubs dominate before a tree layer can become established. This can prolong a stand's recovery for many years, especially to the point of creating snags suitable for cavity-nesting waterfowl. Shrubs may also out-compete grasses and forbs needed by some species for both nesting and foraging.

A nest box project was implemented in 2004 to mitigate the loss of trees adjacent to lakes and ponds in which cavities were present or had the potential to be present. This project occurred primarily in the Meadow Lakes area but also included Round Lake and the ponds along the 1210-300 road. Boxes were installed to provide for cavity nesting waterfowl in addition to small owls, bats, and swallows.

Foraging habitat for waterfowl that eat vegetation as well as animals (e.g. insects, crustaceans) will likely recover quickly.

The No Action alternative would have some additional impact upon waterfowl populations, especially cavity-nesting waterfowl. Allowing natural regeneration, especially of severely burned areas, will prolong the development of cavity-nesting habitat, and it is unlikely that white fir would develop the large snags needed. In addition, increased human use in riparian areas, especially those that did not burn as severely, will likely displace some individuals of waterfowl. However, this may be reduced due to streamside protection projects already implemented decreasing use directly adjacent to some streams.

Action Alternatives

Direct and Indirect Impacts
In general, riparian reserves will not be entered, protecting existing habitat for waterfowl species associated with rivers and creeks, therefore anticipated impacts from the action alternatives would be similar to those discussed under the no action alternative. The only exception would be the defensible space treatment around Round Lake and danger tree reduction on the north side of Suttle Lake. These riparian reserve treatments along with danger tree removal along haul routes and recreation areas would remove potential snag habitat. Large snags will be retained around lakes, ponds, and streams identified as potential habitat along with reduced snag levels retained around Round Lake and Suttle Lake providing short term cavity nesting habitat. Danger tree removal will be concentrated in the high use areas around

Round Lake and between Highway 20 and the hiking trail at Suttle Lake. Snags targeted for removal will consist of primarily smaller diameter snags. However, snag retention guidelines will apply to these areas ensuring large, likely to persist snags are retained while meeting safety requirements. Options will be assessed for topping larger diameter trees where applicable, especially around Suttle Lake. Dead tree habitat will only provide short term habitat however. It is estimated that about 75% of all snags are likely to fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). Fuels treatments are also proposed for areas treated. This treatment will reduce shrub levels allowing for more grassy understories to develop increasing habitat potential.

The only riparian areas to be planted with this project include Round Lake. Planting desired species like ponderosa pine and Douglas-fir will provide large structure preferred because these tree species are longer lived, can grow to larger diameters, and are less susceptible to disease and wildfire than white fir. Alternatives will result in approximately 20 acres planted within riparian reserves.

Approximately 24 acres of meadow habitat occur within the project area. 12 acres experienced stand replacement fire impacting species slightly but these meadows are expected to recover quickly. There are no units within or adjacent (within 200 feet) of meadow habitat. Little impact is expected to species who rely on this habitat.

Alternative 5 closes the most road miles (77 miles) thereby reducing the need for future danger tree removal and will result in the reduced potential for disturbance in addition to streamside protection projects already implemented.

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to waterfowl species. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (riparian reserves in addition to meadow habitat) is being used as the scale for analysis for the waterfowl. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. All these fires have altered riparian vegetation and meadow habitat to some degree further reducing potential waterfowl habitat. Approximately 7,430 acres (17%) of 42,780 acres experienced stand replacement fire while an additional 2,695 acres (6%) were classified as mixed mortality.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales however did not impact waterfowl habitat since suitable habitat was avoided with the exception of danger tree removal. In addition, one vegetation management project may occur within suitable waterfowl habitat (Metolius Basin Forest Management Project). Measures were incorporated to enhance habitat conditions. Overall, treatments proposed will improve waterfowl habitat conditions by promoting the development of large structure and grassy understories and reducing the risk of loss of existing habitat from other large-scale disturbances.

Hazard/danger tree activities are usually concentrated along roads and high use areas like campgrounds, many of which are associated with water bodies. It is highly unlikely that most waterfowl species would choose to nest in these locations; however there is continued removal of danger trees for safety reasons and continued expansion of recreation use into undeveloped areas reducing potential nesting areas due to disturbance primarily.

Increased human use in riparian areas, especially recreational use, will reduce the effectiveness of remaining habitat. As the more severely burned areas recover, recreational use will become more spread out, allowing for waterfowl nesting to become established.

The B&B nest box project enhanced habitat within potentially suitable habitat by providing nest boxes to mitigate for the loss of natural cavities and the lag time before snags of suitable size are present again. Overall 500 acres were enhanced with approximately 165 acres enhanced specifically for waterfowl.

Cumulatively, there is an estimated <1% reduction in potential habitat is expected with the implementation of this project. The action alternatives will not lead to a trend toward Federal listing for waterfowl.

Red-tailed Hawk

Existing Condition

The red-tailed hawk is found throughout the state in every habitat and at every elevation, although scarce in dense forests (Marshall et al. 2003 p. 156). They are perch hunters (trees, utility poles, etc.) and inhabit mixed country of open areas interspersed with woods (agricultural areas, grasslands, woodlands, meadows). They roost in thick conifers and nest in large conifer snags often in the tallest tree on the edge of the timber (Jackman and Scott 1975). They feed mainly on small to medium prey including ground squirrels, cottontails, voles, pocket gophers, snakes (Marshall et al. 2003 p.157) but may also take larger mammals (skunks), birds, reptiles, and insects (Jackman and Scott 1975).

Past harvest activities had produced habitat conditions favorable for red-tailed hawks by clear-cutting stands adjacent to mature and late-seral stands. This provided open areas for foraging adjacent to potential roosting and nesting habitat. Numerous sightings have occurred throughout the project area, however no known nests have been documented. Sightings where nesting may be suspected received mixed mortality to stand replacing burns.

The fires created a landscape with less edge habitat and an influx of snags. Stand replacement patches occurred as basically two large patches, one centered around Round Lake and the other centered around Abbot Butte.

Evaluation Criteria

Nesting habitat for the red-tailed hawk has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. Large snag habitat impacted by salvage activities.
2. The number of acres planted for the establishment of future large tree/snag habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts

Initially red-tailed hawks will benefit from the increased foraging habitat and potential nesting structures (i.e. snags). However, snags and the open landscape may only be available short term (15-30 years) until new stands/shrubs begin to grow and snags begin to fall. It is estimated that about 75% of all snags are likely to fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). There will be a lag time after current snags fall and when new nesting habitat develops, especially in the most severely burned areas. It is expected to take at least 300-400 years before nesting habitat (i.e. large snags) develops in stand replacement burned areas largely due to the lack of a remaining seed source. Where there is a seed source, the primary species found has been white fir. White fir is a species that is not as long-lived and does not often grow to large sizes (>21"dbh) as Douglas-fir and ponderosa pine. It is more susceptible to insects and disease, and has thin bark that leaves the tree vulnerable to fire. Where there isn't a seed source, shrubs often dominate before a tree layer can become established reducing the open ground and foraging opportunities.

The No Action alternative would have some additional long term impacts upon red-tailed hawk populations. Allowing natural regeneration of burned areas, shrub species will likely dominate in stand replacement areas thereby prolonging stand development. In mixed mortality and underburned areas where white fir has dominated, white fir will likely reseed, creating a stand that will be vulnerable to disease, insect outbreaks, and fire. This would likely prolong the development of quality nesting habitat for red-tailed hawks.

Action Alternatives

Direct and Indirect Impacts

Impacts to red-tailed hawk populations would be similar to those for other forest raptor species (e.g. goshawk, great gray owl). But because of the red-tailed hawk's ability to occupy a variety of habitats, the degree of those impacts is considerably less than for other forest raptors of similar size.

Removal of danger trees and large diameter snags low probability of survival trees decreases potential nesting habitat slightly across the project area. Although salvage of snags will occur, snag retention guidelines focus on retaining large, likely to persist snags distributed throughout treatment units capable of supporting red-tailed hawk nests. Abundant snag habitat will also exist outside proposed units. Areas left untreated range from 83% for Alternative 2 to 96% for Alternative 4. Removal of excess material may actually increase foraging opportunities by reducing the amount of dead wood that would end up on the ground within the next several years. Fuels treatments would further reduce these levels and allow for foraging for a longer period of time than untreated areas. Salvage of low probability of survival trees is proposed in all Alternatives. Treatment of these stands may result in increased edge habitat as only damaged white fir will be removed within the LSR but all low probability of survival trees will be removed in the matrix. This will reduce the risk to the remaining green trees and provide for additional potential nesting opportunities.

Replanting areas as opposed to allowing for natural regeneration will benefit red-tailed hawk habitat in the long-term. Reforestation ranges from 6,802 acres for Alternative 2 to 1,725 acres for Alternative 4. Douglas-fir and ponderosa pine develop into larger, more long-lived trees than white fir. By reintroducing this habitat component (desired tree species), especially in the more severely burned areas, red-tailed habitat will potentially develop sooner (200-300 years as opposed to 300-400 years in the No Action alternative), be more suitable (because of the larger trees), and be more resilient to disturbance events. Red-tailed hawk habitat would be provided in the long-term, although it will take several decades to develop.

Fuels treatments are proposed for all salvage units. These treatments will reduce both activity fuels and overall fuel loadings to acceptable levels. Fuel treatments will reduce fire risk and will reduce competition to established seedlings resulting in the development of habitat sooner. Fuels treatments will also reduce the understory complexity which may aid in prolonging open habitat increasing foraging opportunities. Overall, fuel treatments will aid in the development of habitat over time.

Road closures will reduce the need for danger tree removal and limit disturbance to any nesting red-tailed hawks. Road closures are greatest under Alternative 5.

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to red-tailed hawks. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (mixed conifer PAGs within ¼ mile of openings) is being used as the scale for analysis for the red-tailed hawk. Based on that review, the potential cumulative impacts are those discussed below.

The fires over the past 5 years created a large increase in short term foraging habitat especially in stand replacement and mixed severity stands. Nesting habitat has most likely been decreased. An estimated 16,846 acres of mature mixed conifer forests experienced stand replacement fire reducing potential habitat. Not every acre of the mixed conifer forests were considered suitable nesting habitat for the red-tailed hawk. The quality of nesting habitat has changed due to the fires where prior to the fire, large snags occurring on the edges of forested stands provided potential nest sites, now large existing snags in the open may provide nesting structure exposing nests to predators and only providing short term habitat. Complex edge habitat has been reduced as there are basically three large patches resulting from the fires as compared to the pattern of past harvest units; two resulting from the B&B, Link, and Cache Mountain fires and another resulting from the Eyerly fire.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact red-tailed hawk habitat since impact to suitable habitat was minimized by retaining large snags. Other ongoing forest management projects and danger tree removal may have reduced nesting habitat in the watershed.

Habitat was enhanced under the Metolius Basin Forest Vegetation Management project. Measures were incorporated to retain large tree and snag habitat as well as enhance habitat conditions. Overall, treatments proposed will improve red-tailed hawk habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances.

Cumulatively, red-tailed hawk populations are expected to remain stable across the district due to their generalist behavior. There may be increased competition for remaining nest sites among this species and other large raptor species. Also distribution of red-tailed hawks across the district may become more patchy, focusing on low-severity burn areas near open habitat. Long-term there may be a decrease in the populations due to the long period of time before late seral habitat develops for nesting (due to salvage efforts and ongoing projects) and the newly created foraging areas will become grown over with shrubs and small trees.

Cumulatively, the alternatives will not lead to a trend toward Federal listing for the red-tailed hawk.

<u>Osprey</u>

Existing Condition

Osprey are specialized for catching fish. They nest near lakes and rivers in the tops of large snags or they may use artificial platforms if available. Their main prey is live fish – slow-moving species that swim near the surface. However, they may also take other vertebrate species (birds, reptiles, and small mammals) but this represents a very small proportion of their diet (Csuti et. al 1997 p. 105).

Six nests are documented within the planning area, and upwards of fifteen historic nests were present along the Metolius River (district files). It is unknown how many nests are actually present or active each year as annual surveys are not conducted. Cursory surveys have been conducted for this species and the potential for additional nests to be located in the project area is high. Of the known nests, 3 are in stands that were underburned, 2 in stands that were burned severely (stand replacing), and 1 in a mixed mortality stand.

Larger lakes with fish (Suttle, Dark, Blue, Scout, Round) and larger streams provide suitable habitat for ospreys for both nesting and foraging. These foraging areas have received a variety of burn severities (see discussion for Great blue heron: Table 11).

Evaluation Criteria
Nesting habitat for the osprey has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. Large snag habitat impacted by salvage activities within riparian reserves.
2. The number of acres planted for the establishment of future large tree/snag habitat within riparian reserves.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
The No Action alternative would have little additional impact upon osprey populations. Since osprey need broken top trees or trees with large limb structure, snags created by the fires will only be short term lasting 15-30 years. There will be a long lag time (expected to take 300-400 years) before large structure develops in some of the more severely burned areas (e.g. Blue and Round Lakes). Large ponderosa pine and Douglas-fir snags make ideal nesting habitat for osprey. Some stand replacement areas, however, will have mostly white fir regeneration because it is the dominant seed source. White fir does not often have the large structure that provides adequate platforms for osprey nests. This projected lack of adequate large snags will contribute to the long-term lack of nesting habitat for osprey.

Action Alternatives

Direct and Indirect Impacts
There are no proposed units containing any known nest under any action alternative. Alternative 2 has one proposed unit (Unit 79) within 0.25 miles of known nests. Alternatives 3, 4, and 5 do not have any proposed units within 0.25 miles of a nest.

Impacts from the action alternatives would be similar to those discussed for other large snag dependent species. In general, riparian reserves will not be entered, protecting existing habitat for osprey associated with rivers and lakes, therefore anticipated impacts from the action alternatives would be similar to those discussed under the no action alternative. The only exception would be the defensible space treatment around Round Lake and danger tree reduction on the north side of Suttle Lake. These riparian reserve treatments along with danger tree removal along haul routes and recreation areas would remove potential snag habitat. Large snags will be retained around other lakes and the Metolius River identified as potential habitat along with reduced snag levels retained around Round Lake and Suttle Lake providing short term cavity nesting habitat. Danger tree removal will be concentrated in the high use areas around Round Lake and between Highway 20 and the hiking trail at Suttle Lake. Snags targeted for removal will consist of primarily smaller diameter snags. However, snag retention guidelines will apply to these areas ensuring large, likely to persist snags are retained while meeting safety requirements. Options will be assessed for topping larger diameter trees where applicable, especially around Suttle Lake. Dead tree habitat will only provide short term habitat however. It is estimated that about 75% of all snags are likely to fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999).

The only riparian areas to be planted with this project include Round Lake. Planting desired species like ponderosa pine and Douglas-fir will provide large structure preferred because these tree species are longer lived, can grow to larger diameters, and are less susceptible to disease and wildfire than white fir. Alternatives will result in approximately 20 acres planted within riparian reserves.

Alternative 5 closes the most road miles (77 miles) thereby reducing the need for future danger tree removal and will result in the reduced potential for disturbance.

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to osprey. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District is being used as the scale for analysis for the osprey. More specifically this includes the riparian buffer around large lakes and the Metolius River. Large lake habitat includes Suttle, Blue, Round, Scout, Dark, and Three Creek Lakes in addition to the Meadow Lakes area and Lake Billy Chinook. Based on that review, the potential cumulative impacts are those discussed below.

The fires over the past 5 years have created a large influx of snag habitat however within the riparian reserves snag creation has not been as great (approximately 17% of the total riparian reserves have experienced stand replacement fire). Approximately 9% (3,804 acres) of the total riparian reserves (42,796 acres) are considered potential habitat for osprey. Not all riparian reserves are considered potential habitat for osprey because water bodies are small in size limiting foraging attempts or they lack fish. Of the potential osprey habitat, about 7% has experienced stand replacement fire resulting in short term snag habitat and the direct loss of known nest sites, particularly in the Eyerly fire.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact osprey habitat since suitable habitat was avoided. Habitat was enhanced under the Metolius Basin Forest Vegetation Management project. Measures were incorporated to retain suitable habitat as well as enhance habitat conditions. Overall, treatments proposed will improve osprey habitat conditions by promoting the development of large structure, protecting large snag habitat within riparian reserves, and reducing the risk of loss of existing habitat from other large-scale disturbances.

Danger trees are routinely removed from recreation facilities (campgrounds, summer home tracts, etc.) and major travel routes. Continued loss of large snag habitat in and adjacent to recreation facilities and major travel routes due to safety reasons limits available nesting sites along suitable water bodies (e.g., Suttle Lake, Metolius River, Lake Billy Chinook). Most danger trees removed do not occur directly on the shoreline in most cases but do occur within the riparian reserve. Large snag habitat outside designated recreation areas is important to retain since most, if not all, large snag habitat will eventually be lost in the recreation sites over time.

Additional projects are occurring away from the Metolius River and large lakes but are still having a beneficial effect on osprey habitat. Several fisheries projects have been implemented to reduce impacts to known bull trout streams including a channel restoration project on Brush Creek. In addition, many culverts were replaced under BAER to minimize potential impacts to important waterways.

Overall, nesting habitat has declined but potential habitat still remains outside of managed facilities and away from major travel routes. The quality of habitat has changed due to the wildfires and will continue to change inside and out of the fire areas. The future of osprey use of Round, Blue and Dark Lakes in particular will be determined with continued monitoring. Cumulatively, this project will have minor impacts (<1%) to osprey because large snag habitat is being retained within potential habitat.

Cumulatively, the alternatives will not lead to a trend toward Federal listing for the osprey.

Birds of Conservation Concern

In January 2001, President Clinton issued an executive order on migratory birds directing federal agencies to avoid or minimize the negative impact of their actions on migratory birds, and to take active steps to protect birds and their habitats. Federal agencies were required within two years to develop a Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service to conserve migratory birds including taking steps to restore and enhance planning processes whenever possible. To meet this goal in part the U.S. Fish and Wildlife Service developed the Birds of Conservation Concern released in December 2002 and most recently released the U.S. Shorebird Conservation Plan (2004).

The "Birds of Conservation Concern 2002" (BCC) identifies species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973. Bird species considered for inclusion on lists in this report include non-game birds, gamebirds without hunting seasons, subsistence-hunted non-game species in Alaska, and Endangered Species Act candidate, proposed endangered or threatened, and recently delisted species. While all of the bird species included in BCC are priorities for conservation action, the list makes no finding with regard to whether they warrant consideration for ESA listing. The goal is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservations actions (USFWS 2002). The U.S. Shorebird Conservation Plan (USFWS 2004) revised the 2001 Plan with new information and developed a list of U.S. and Canadian shorebirds considered highly imperiled or of high conservation concern. Conservation measures were not included but these lists should be consulted to determine reasons for conservation concern.

Bird Conservation Regions (BCRs) were developed based on similar geographic parameters. One BCR encompasses the B&B Project Area – BCR 9, Great Basin. See Table 3.168 for a list of the bird species of concern for the area, the preferred habitat for each species, and whether there is potential habitat for each species within the B&B project area. Species appearing in **bold** are those considered highly imperiled or high conservation concern by the U.S. Shorebird Conservation Plan as of August 2004.

Table 3.168. BCR 9 (Great Basin) BCC 2002 list.

Bird Species	Preferred Habitat	Habitat within the B&B Project Area (Y or N)
Swainson's Hawk	Open lands with scattered trees	No
Ferruginous Hawk	Elevated Nest Sites in Open Country	No
Golden Eagle	Elevated Nest Sites in Open Country	No
Peregrine Falcon	Cliffs	No
Prairie Falcon	Cliffs in open country	No
Greater Sage Grouse	Sagebrush dominated Rangelands	No
Yellow Rail	Dense Marsh Habitat	No
American Golden-Plover	Burned Meadows/Mudflats	No
Snowy Plover	Dry Sandy Beaches	No
American Avocet	Wet Meadows	No
Solitary Sandpiper	**Meadow/Marsh**	**Yes**

Whimbrel	**Marsh/Mudflats**	**No**
Long-billed Curlew	**Meadow/Marsh**	**No**
Marbled Godwit	Marsh/Wet Meadows	No
Sanderling	Sandbars and beaches	No
Wilson's Phalarope	**Meadow/Marsh**	**No**
Yellow-billed Cuckoo	Dense riparian/cottonwoods	No
Flammulated Owl	Ponderosa pine forests	Yes
Burrowing Owl	Non-forested Grasslands	No
Black Swift	Cliffs associated with waterfalls	No
Lewis's Woodpecker	Ponderosa pine forests	Yes
Williamson's Sapsucker	Ponderosa pine forests	Yes
White-headed Woodpecker	Ponderosa pine forests	Yes
Loggerhead Shrike	Open country with scattered trees or shrubs	No
Gray Vireo	Arid scrub habitat	No
Virginia's Warbler	Scrubby vegetation within arid montane woodlands	No
Brewer's Sparrow	Sagebrush clearings in coniferous forests/bitterbrush	Yes
Sage Sparrow	Sagebrush	No
Tricolored Blackbird	Cattails or Tules	No

Landbird Strategic Plan

The Forest Service has prepared a Landbird Strategic Plan (January 2000) to maintain, restore, and protect habitats necessary to sustain healthy migratory and resident bird populations to achieve biological objectives. The primary purpose of the strategic plan is to provide guidance for the Landbird Conservation Program and to focus efforts in a common direction. On a more local level, individuals from multiple agencies and organizations with the Oregon-Washington Chapter of Partners in Flight participated in developing a publication for conserving landbirds in this region. A Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington was published in June 2000 (Altman 2000). This document outlines conservation measures, goals and objectives for specific habitat types found on the east-slope of the Cascades and the focal species associated with each habitat type. Sisters Ranger District lies within the Central Oregon subprovince. See Table 3.169 for specific habitat types highlighted in that document, the habitat features needing conservation focus and the focal bird species for each.

Table 3.169. Priority habitat features and associated focal species for Central Oregon.

Habitat	Habitat Feature	Focal Species for Central Oregon
Ponderosa Pine	Large patches of old forest with large snags	White-headed woodpecker
	Large trees	Pygmy nuthatch
	Open understory with regenerating pines	Chipping sparrow
	Patches of burned old forest	Lewis' woodpecker
Mixed Conifer (Late-Successional)	Large trees	Brown creeper
	Large snags	Williamson's sapsucker
	Interspersion grassy openings and dense thickets	Flammulated owl
	Multi-layered/dense canopy	Hermit thrush
	Edges and openings created by wildfire	Olive-sided flycatcher
Lodgepole Pine	Old growth	Black-backed woodpecker

Meadows	Wet/dry	Sandhill Crane
Aspen	Large trees with regeneration	Red-naped sapsucker
Subalpine fir	Patchy presence	Blue Grouse

Fifteen species are identified from these lists with the potential to be found within the B & B Project Area. Some of these species are covered in other sections of this document either as an individual species or as a group of species. The following species can be found in the cavity-excavator/snag discussion section of the document: white-headed woodpecker, pygmy nuthatch, Lewis' woodpecker, Williamson's sapsucker, flammulated owl, and black-backed woodpecker. The remaining species will be addressed as they relate to specific habitat associations.

Open Habitats/Open Understories with Regenerating Pines – Chipping Sparrow and Brewer's Sparrow

Existing Condition

Both species are summer residents preferring open habitats with a shrub or grass component. Chipping sparrows prefer open coniferous forests or stands of trees interspersed with grassy openings or low foliage (Marshall et al. 2003 pp. 538-540). These species seem to be associated with higher elevations with the Brewer's sparrow occupying the widest elevational band (up to 6000' in the Cascades). The Brewer's sparrow is more reliant on shrub-steppe communities while the chipping sparrow can be found in a wider variety of habitat types (Marshall et al. 2003 pp. 540-542). Declines in populations have been noted from Breeding Bird Survey (BBS) results for both species, ranging from 2.6% per year for the Brewer's sparrow to 3.9% per year for the chipping sparrow. Some reasons for these declines include habitat changes due to fire suppression, grazing, invasion of exotic species and fragmentation.

The fires had varying impacts on these species. The Brewer's sparrow most likely inhabits areas on the fringe of the forest or may have been associated with high elevation montane meadows while the chipping sparrow is more likely to be found in ponderosa pine or juniper habitats. Most shrubs (bitterbrush and sagebrush) were consumed and the fire burned through many montane meadows, thus reducing existing potential habitat.

Evaluation Criteria
Habitat for the chipping and Brewer's sparrows has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. The development of open understory ponderosa pine stands with a shrub or grass component.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
Some high elevation meadow habitat was burned through by the fires. However, vegetation associated with these meadows is likely to recover quickly due to increased precipitation levels. This will have little impact on Brewer's sparrows.

Little ponderosa pine habitat was impacted by the fire. However, those areas experiencing mixed mortality will benefit chipping sparrows the greatest as it decreased shrub levels and stimulated herbaceous growth more preferred by this species. Potential habitat for the chipping sparrow may take longer to re-establish than the Brewer's sparrow because it is associated with regenerating trees. In mixed mortality and underburned stands, habitat is likely to recover faster than stand replacement areas. In stand replacement areas with little conifer seed source, ceanothus and manzanita are likely to re-establish and prevail on the landscape for some time resulting in unsuitable habitat until stands begin to recover.

Noxious weed populations were present within the project area prior to the fire and conditions for spread have increased due to the amount of open soil and reduction in native vegetation. Initial noxious weed treatments under the Burned Area Emergency Rehabilitation (BAER) effort have benefited sparrow habitat; especially the chipping sparrow. Threats to habitat would continue to be noxious weed populations since these weeds favor open conditions created by the fire and increase competition with tree seedlings and other desired forbs and grasses.

Indirect impacts of existing open road densities may result in an increased spread of noxious weed populations delaying habitat recovery.

Populations of these sparrow species may decline for the short-term but will likely recover as shrubs and trees become established. The No Action alternative would have some indirect impact upon chipping and Brewer's sparrow populations.

Action Alternatives

Direct and Indirect Impacts

Meadow habitat is not being treated in this project in any alternative therefore; there will be no impacts to Brewer's sparrow. Most suitable habitat for this species lies outside the project area within the wilderness.

Salvage of dead trees will not impact chipping sparrows. The action alternatives focus on restoring the forest which would aid in enhancing chipping sparrow habitat. Restoring the forest through replanting will improve habitat conditions for chipping sparrows. By providing a seed source, and especially species that are more resilient and early seral (e.g. ponderosa pine) chipping sparrow habitat is expected to increase within 20-30 years as planted seedling become saplings and poles. In the long-term, these planted areas will become dominated by large trees and less suitable as chipping sparrow habitat. Chipping sparrow habitat then will occur mostly within large gaps in the forest or along the edges of openings.

Fuels treatments will occur within proposed harvest units. This activity will result in reduced shrub levels and promote grassy understories, preferred by chipping sparrows. However, this may be short-lived until stands reach a size when fire can then again enter the stand.

Indirectly, noxious weeds impact sparrow populations by reducing the suitability of open habitat. Noxious weeds are invasive and aggressive, out-competing many native grasses, forbs and shrubs (and tree seedlings). With increased salvage activities comes the increased risk of spread of these weeds. Alternative 2 carries the highest risk of spreading noxious weeds because of the larger area treated, more haul routes, and fewer road closures. Mitigation measures proposed under all action alternatives would help minimize the risks of noxious weed spread associated with each alternative.

Indirectly, road closures can also aid in the establishment of trees, and chipping sparrow habitat, more quickly. Road closures can help reduce the spread of noxious weeds that compete with tree seedling growth and desired forbs and grasses. Alternative 5 results in the most miles of road closures compared to the other alternatives (77 miles compared to 71 miles).

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to the chipping sparrow. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (mature ponderosa pine forests) is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 489 acres (<1% of 54,860 acres) of mature ponderosa pine forests experienced stand replacement fire. This resulted in a reduction of habitat and shrubs are now re-establishing themselves in lieu of grassy understories further reducing habitat suitability.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact chipping sparrow habitat since suitable habitat was avoided and concentrated primarily on the removal of dead material within stand replacement burned areas. In addition, several vegetation management projects have occurred or may occur within suitable habitat (McCache, Metolius Basin Forest Management Project, and Highway 20). Overall, treatments proposed will reduce the risk of loss of existing habitat from other large-scale disturbances. However, stand densities (regenerating trees) and shrubs were reduced within treatment units impacting habitat for the short term until regeneration occurs again and mowing and burning were widely prescribed helping to re-establish grassy understories.

An estimated 30 miles of roads have been decommissioned across the watersheds. In addition, 60 miles of decommissioning is proposed under the Metolius Basin project. These closures, along with proposed closures for the B&B project (71-77 miles), will aid in reducing the disturbance potential to existing territories and the potential for noxious weed spread. Additional noxious weed treatments will continue and aid in enhancing potential habitat.

An estimated 53,264 acres of potentially suitable habitat still remains after the impacts of the fires and past vegetation management projects due to the overstocked conditions of many forested stands in addition to existing mature and old growth stands. Cumulatively, less than 1% reduction in suitable habitat is expected with the implementation of this project. Chipping sparrow populations are expected to increase (after 15-30 years) and then decrease and stabilize as forest cover returns and then matures from early stages favored by this species. Proposed replanting may aid in re-establishing chipping sparrow habitat that would be lost during the implementation of the Metolius Basin project. In the long-term, chipping sparrow habitat will be focused in gaps within the canopy of forested areas, recent timber sales and plantations, and along forested edge.

Cumulatively, the alternatives will not lead to a trend toward Federal listing for the hermit thrush.

Mixed Conifer, Edges and Openings Created by Wildfire – Olive-sided Flycatcher

Existing Condition

The olive-sided flycatcher is a summer resident that breeds in low densities throughout coniferous forests of Oregon. The olive-sided flycatcher, an aerial insectivore, prefers forest openings or edge habitats where forest meets meadows, harvest units, rivers, bogs, marshes etc. (Marshall et al. 2003). Nesting success was highest within forest burns where snags and scattered tall, live trees remain (Marshall et al. 2003, Sallabanks et al. 2001, Wisdom et al. 2000 p. 215). Common features of nesting habitat include tall prominent trees and snags used as foraging and singing perches. This species forages from high prominent perches at the tops of snags or from the uppermost branches of live trees and needs unobstructed air space to forage. It preys on flying insects and in particular, bees and wasps. (Marshall et al. 2003 pp. 374-375).

Population trends based on BBS data show highly significant declines with an Oregon statewide decline of 5.1% per year from 1966-1996. Factors potentially contributing to population declines on breeding grounds include habitat loss through logging, alteration of habitat through management activities (e.g., clearcutting, fire suppression), and lack of food resources. (Marshall et al. 2003 p. 376). Wisdom et al. (2000 p. 218) also noted that where altered fire regimes result in fewer but larger fire, the juxtaposition of early and late seral habitats becomes less favorable. However, within the Columbia Basin our area (Southern Cascades) shows increases of >60% for the olive-sided flycatcher compared to other areas.

Prior to the fires, habitat for this species occurred scattered across the watershed. Little habitat was available for the olive-sided flycatcher except for areas of previous harvest and some beetle-killed areas that were open enough. The olive-sided flycatcher probably utilized poor quality edge habitats along old harvest units. Existing snag levels varied across the landscape. The fires increased habitat for the olive-sided flycatcher primarily within and adjacent to mixed mortality and underburned stands and along the edges of stand replacement burns. Marshall et al. (2003) noted that olive-sided flycatcher populations increased after a fire. This was based on a mosaic of green trees scattered through-out the fires, so habitat could be over-estimated and limited to edges with green trees or mixed intensity areas.

Evaluation Criteria
Habitat for the olive-sided flycatcher has been altered across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. The amount of mixed mortality stands impacted by salvage activities.
2. Large snag habitat impacted by salvage activities.
3. The number of acres planted for the establishment of future large tree/snag habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
It is estimated to take 300-400 years for large tree habitat within the stand replacing burn areas to recover. Potentially suitable habitat is likely remaining in mixed mortality areas and underburned areas due to the presence of both live and dead trees and the amount of edge created. Stands dominated by white fir are likely to see additional impacts. White fir will continue to decline due to the impacts from the fire resulting in more open stands potentially making these stands more suitable as more edge habitat is created.

Allowing for natural regeneration of forested stands will likely produce white fir dominated stands. These stands will provide for suitable habitat. Due to the variable distribution of seed occurring, patchy stocking may result creating preferred habitat conditions for the olive-sided flycatcher. However, white fir is more vulnerable to insects, disease, and wildfire than ponderosa pine/Douglas-fir dominated stands and does not last as long on the landscape. In areas with little conifer seed source, shrub fields are likely to establish. This will provide for insect populations but without consistent regeneration, most of this habitat will be unusable. No snags will be removed with this alternative however snags are only estimated to occur for the next 15-30 years. It is estimated that about 75% of all snags are likely to fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). This will result in large patches within the project area with little edge habitat preferred by this species.

Existing open road densities will allow for more danger tree removal having minor impacts to this species.

Action Alternatives

Direct and Indirect Impacts

Salvage is occurring primarily within stand replacement areas. Snag densities will be reduced within proposed units. However, different snag retention strategies will be applied depending on the alternative chosen. The Alternatives will result in large trees to be retained within proposed harvest units. These will provide tall perch trees scattered throughout the unit in which this species can forage from and room to carry out foraging bouts. However, without associated green canopy these snags may not be utilized except those adjacent to green stands. Snags and trees with a low probability of survival are proposed for removal within mixed mortality stands. This will result in stands becoming more open with more edge, preferred by this species in relation to green tree habitat.

Salvage activities may occur during the nesting season for this species. Direct impacts may occur with the removal of potential nest sites or with activity occurring in close proximity of nests. This will result in the potential loss of productivity for the time period that activity is occurring or the potential reduction of nesting habitat.

The action alternatives address the need for the long-term recovery of olive-sided flycatcher habitat. Proposed replanting will provide tree species more likely to be retained on the landscape, although it will be several decades (200-300 years) before trees become of suitable size for use. Acres of reforestation vary by alternative and range from 6,802 acres for Alternative 2 to 1,725 acres for Alternative 4.

Fuels treatments will also occur within these units. This activity will lower risk to existing green trees and reduce competition to established seedlings allowing stands to develop into potential suitable habitat more rapidly.

Danger trees are proposed to be removed along haul routes and within high use recreation areas. This has the potential to remove large trees suitable for foraging. This impact is expected to be minor in scope as it is limited to a linear strip along roadways and within high recreation areas. Alternative 2 treats the most miles of haul routes and acres of high use areas resulting in the most potential impact to flycatcher habitat while Alternative 4 treats the least.

Indirectly, road closures can aid in the establishment of trees, and olive-sided flycatcher habitat, more quickly. Road closures can help reduce fragmentation over time and the need for additional danger tree removal.

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to the olive-sided flycatcher. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (mixed conifer stands within ¼ mile of grass, forb, or meadow habitat) is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B creating a large increase in foraging habitat while reducing potential nesting habitat. An estimated

16,846 acres of mature mixed conifer forests experienced stand replacement fire reducing potential nesting habitat. Not every acre of the mixed conifer forests were considered suitable nesting habitat for this species but stand replacement habitat has changed from potential nesting and is now considered potential foraging. The recent fires have negated many of the impacts of past management actions within the fire areas. Complex edge habitat has been reduced as there are basically three large patches resulting from the fires as compared to the pattern of past harvest units; two resulting from the B&B, Link and Cache Mountain fires and another resulting from the Eyerly fire.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact olive-sided flycatcher habitat since suitable nesting habitat was avoided. Habitat was enhanced under the Metolius Basin Forest Vegetation Management project. Measures were incorporated to retain large trees as well as enhance habitat conditions. Overall, treatments proposed will improve habitat conditions by promoting the development of large structure, reducing stand densities, and reducing the risk of loss of existing habitat from other large-scale disturbances. Other ongoing forest management projects (Bear Garden, Big Bear, Broken Rim, Walla Bear, and McCache) and danger tree removal may have reduced nesting habitat on the district. Therefore, nesting habitat may be the limiting factor for occupation on the district. Prior to the fires and incorporating past vegetation management actions, an estimated 2,670 acres of potential nesting habitat was available on the district. Many past harvest units had grown up to a size where they were not functioning as potential foraging habitat any longer restricting flycatcher use. After the fires, potential nesting habitat has increased greatly to 17,225 acres due to the amount of early seral habitat created near potential nesting stands.

An estimated 30 miles of roads have been decommissioned across the watersheds. In addition, 60 miles of decommissioning is proposed under the Metolius Basin project. These closures, along with proposed closures for the B&B project (71-77 miles), will aid in lessening fragmentation leading to reduced disturbance potential and the potential for additional danger tree removal.

Danger trees are routinely removed from recreation facilities (campgrounds, summer home tracts, etc.) and major travel routes. Continued loss of large snag habitat in and adjacent to recreation facilities and major travel routes due to safety reasons limit available nesting and perch sites adjacent to suitable nesting habitat. Large snag habitat outside designated recreation areas is important to retain since most, if not all, large snag habitat will eventually be lost in the recreation sites over time.

Olive-sided flycatcher populations will likely remain stable or slightly increase in the short term due to the amount of early seral habitat created by the fires. Long term there may be a decrease in populations due to the long period of time before late seral habitat develops and newly created foraging habitat becomes too overgrown with shrubs and trees. Cumulatively, less than 2% reduction in suitable habitat is expected with the implementation of this project.

Cumulatively, the alternatives will not lead to a trend toward Federal listing for the olive-sided flycatcher.

Mixed Conifer, Large Trees – Brown Creeper

Existing Condition

The brown creeper is the only North American bird that relies on both the trunk and bark of trees for nesting and foraging. It is found predominantly in coniferous forests but can be located in hardwood stands as well. It nests under loose, sloughing bark of large diameter snags with little to moderate decay. The mean diameter of nest trees range from 16” dbh to 42” dbh. In northeastern Oregon, creeper abundance was positively associated with the height of the canopy and density of trees. (Marshall et al. 2003 pp.453-456). Adams and Morrison (1993) found similar results with creepers being highly correlated with mature-aged stands with moderate overall stand density. Threats to this species include the loss of large diameter snags and live trees.

The fires significantly reduced potential habitat for this species. Most stand replacement fire occurred within mixed conifer plant associations. Approximately 28% of dry mixed conifer (MCD) and 11% of wet mixed conifer (MCW) stands experienced stand replacement fire within the project area. Marshall et al. (2003) reported that brown creeper populations were substantially reduced for at least 3 years following stand replacement fires in northeastern Oregon. Adams and Morrison (1993) reported similar findings in that brown creepers seldom used areas with low overall tree densities and little understory.

Creepers have been documented using several stand structural stages including stem exclusion, closed canopy, understory reinitiation, and old forest structure in the Blue Mountains (Marshall et al. 2003). Therefore, creepers may be able to utilize other structural stages present within the fire area until large tree habitat recovers.

Evaluation Criteria
Nesting habitat for the brown creeper has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. The amount of live large tree habitat impacted by salvage activities.
2. Large snag habitat impacted by salvage activities.
3. The number of acres planted for the establishment of future large tree/snag habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
Due to the loss of habitat, brown creeper populations may be reduced within the project area until stands begin to recover. It is estimated to take 300-400 years for suitable habitat within the stand replacing burn areas to recover. Potentially suitable habitat is likely remaining in some mixed mortality areas and underburned areas. However where stands are dominated by white fir, stands are likely to see additional impacts. White fir will continue to decline due to the impacts from the fire resulting in more open stands potentially making these stands less suitable as creepers prefer denser habitats. Creepers may be forced to use less preferred structural stages until large tree habitat recovers.

Newly created snags (stand replacement areas) would not likely be replacement habitat for this species because the lack of associated green cover would make creepers more susceptible to predation. Mixed mortality areas may have some remnant habitat. However, many of the trees that die within in the next several years would tend to be white fir. This tree species in general does not attain the deep fissured bark preferred by the creeper for foraging. No treatment of mixed mortality areas dominated by Douglas-fir or ponderosa pine would aid in providing some remnant habitat for this species.

In the long-term, habitat for the brown creeper may still be limited. Allowing for natural regeneration over the project area as proposed in the No Action alternative may not provide for as much Douglas-fir regeneration. Douglas-fir appears to be favored by the creeper (Altman 2000). White fir is likely to be the dominant seed source in the mixed mortality areas, and this species does not often get as large or have the deep-fissured bark as that of the Douglas-fir. White fir is also more susceptible to disease and fire, which would further extend the time before brown creeper habitat would develop. In stand replacement areas where there is not a seed source, brush species would dominate prolonging suitable habitat development.

Action Alternatives

Direct and Indirect Impacts
Salvage is occurring primarily outside of potentially suitable habitat for the brown creeper. The action alternatives address the need for the long-term recovery of brown creeper habitat. Proposed replanting will provide tree species favored by this species, although it will be several decades (200-300 years) before trees become of suitable size and texture for use. Acres of reforestation vary by alternative and range from 6,802 acres for Alternative 2 to 1,725 acres for Alternative 4. Although removal of damaged trees may decrease some existing habitat for brown creepers, some of this habitat may be less suitable and short-lived. Damaged trees will likely die and fall within 15-30 years. Some potential, short-term habitat would be retained however. White fir over 28"dbh will be retained. These particular trees may have developed the furrowed bark or have sloughing bark that can creepers can utilize for nesting and foraging. Damaged Douglas-fir and ponderosa pine trees would be retained in the LSR, maintaining potential habitat. In addition, snags will be retained within harvest units. Retention varies by alternative and focuses on the retention of large snags, preferably Douglas-fir and ponderosa pine. However, without associated green canopy these snags may not be utilized except those adjacent to green stands. The amount of large tree habitat impacted varies by alternative (1,039 acres for Alternative 2, 718 acres for Alternative 3, 732 acres for Alternative 4, and 1,029 acres for Alternative 5).

Salvage activities may occur during the nesting season for this species. Direct impacts may occur with the removal of potential nest sites or with activity occurring in close proximity of nests. This will result in the potential loss of productivity for the time period that activity is occurring or the potential reduction of nesting habitat.

Fuels treatments will also occur within these units. This activity will lower risk to existing green trees and reduce competition to established seedlings allowing stands to develop into potential suitable habitat more rapidly.

Danger trees are proposed to be removed along haul routes and within high use recreation areas. This has the potential to remove large trees suitable for nesting and foraging. This impact is expected to be minor in scope as it is limited to a linear strip along roadways and within high recreation areas unlikely to be occupied due to the high level of disturbance. Alternative 2 treats the most miles of haul routes and acres of high use areas resulting in the most potential impact to creeper habitat while Alternative 4 treats the least.

Indirectly, road closures can aid in the establishment of trees, and brown creeper habitat, more quickly. Road closures can help reduce fragmentation over time and the need for additional danger tree removal.

Cumulative Impacts
Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to the brown creeper. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (mature mixed conifer forests) is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 16,846 acres of mature mixed conifer forests experienced stand replacement fire further reducing cover in this forest type. Not every acre of the mixed conifer forests were considered suitable for this species but all stand replacement habitat is now considered unsuitable. The recent fires have negated many of the impacts of past management actions within the fire areas.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact brown creeper habitat since suitable habitat was avoided and concentrated primarily on the removal of dead material within stand replacement burned areas. In addition, several vegetation management projects have occurred or may occur within suitable habitat (McCache, Metolius Basin Forest Management Project, Big Bear, and Bear Garden). Overall, treatments proposed will reduce the risk of loss of existing habitat from other large-scale disturbances. However, treatments reduced stand densities but focused on retaining large structure.

An estimated 30 miles of roads have been decommissioned across the watersheds. In addition, 60 miles of decommissioning is proposed under the Metolius Basin project. These closures, along with proposed closures for the B&B project (71-77 miles), will aid in lessening fragmentation leading to reduced disturbance potential and the potential for additional danger tree removal.

An estimated 64,825 acres of potentially suitable habitat still remains after the impacts of the fires and past vegetation management projects. Cumulatively, less than 2% reduction in suitable habitat is expected with the implementation of this project under any alternative. Across the district, brown creeper populations are expected to decline due to the loss of nesting habitat from the fires and past projects. Populations will begin to recover soon after the forested habitat develops, that is to say, after several decades.

Cumulatively, the alternatives will not lead to a trend toward Federal listing for the brown creeper.

Mixed Conifer, Multi-layered/Dense Canopy – Hermit Thrush

Existing Condition

The hermit thrush is a summer resident preferring mid to high elevation mature and old growth forests. It breeds in mature forests of all types especially those with a shaded understory of brush and small trees ranging from aspen groves to juniper woodlands to moderately open coniferous forests. It nests on the ground or uses small trees in the understory. It is a ground forager of insects; however fruits and berries may also be consumed especially during migration and in winter. Populations seem to be stable at this time. However, threats to this species include the loss of mature forests and controlled burning of forest understories. (Marshall et al. 2003 pp. 483-485). Hermit thrush responses have been known to decrease after fires (Sallabanks 1995).

Fires significantly reduced habitat for the hermit thrush. Approximately 38,570 acres (26%) of the watershed have experienced stand replacement fire in the last several years. In addition, 17,000 acres (11%) experienced mixed severity fire. Understory vegetation was lost in all burned areas as well as most of the overstory in stand replacement and some mixed mortality areas rendering much of the landscape unsuitable for several decades.

Evaluation Criteria

Nesting habitat for the hermit thrush has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. The amount of live mature habitat impacted by salvage activities.
2. The development of dense understories.
3. The number of acres planted for the establishment of future large tree habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts

The No Action alternative would have additional long-term impacts upon hermit thrush populations. Populations are likely to start to decline with the loss of mature forest habitat as a result of the fire, and remain low due to the long time before suitable habitat would develop. It is estimated to take approximately 300-400 years before mature forest stands develop in stand replacement burned areas largely due to the lack of a remaining seed source. Habitat would develop within mixed mortality burned areas sooner (100-200 years). Brush species like manzanita and ceanothus are likely to dominate before a tree layer can become established. This habitat may provide some cover but the diversity of ground cover needed by hermit thrushes for nesting and foraging may not be provided.

Allowing for natural regeneration of forested stands will likely produce white fir dominated stands. These stands will provide for suitable habitat however, due to the variable distribution of seed occurring, patchy stocking may result rendering some areas too open for use by hermit thrushes. White fir is also more vulnerable to insects, disease, and wildfire than ponderosa pine/Douglas-fir dominated stands and does not last as long on the landscape.

White fir within mixed mortality and underburned stands will continue to decline due to the impacts from the fire. This will result in more open stands reducing shaded conditions preferred by the hermit thrush.

Indirect impacts of existing open road densities may result in an increased spread of noxious weed populations that increase competition with tree seedlings and other desired forbs and grasses, thereby delaying habitat recovery.

Action Alternatives

Direct and Indirect Impacts

Salvage is occurring primarily outside of potentially suitable habitat for the hermit thrush. Ground vegetation was consumed in all burned areas regardless of burn intensity however; this is a short term impact as much of the ground vegetation was recovering across the fire area. Only those stands removing damaged white fir will have potential impacts to the hermit thrush. This is also considered a short term impact as trees identified for removal are expected to lose their canopy within 5 years. At this time, stands may become too open for use by this species. However, as ground vegetation recovers, stands may become suitable again. The amount of large tree habitat impacted varies by alternative (1,039 acres for Alternative 2, 718 acres for Alternative 3, 732 acres for Alternative 4, and 1,029 acres for Alternative 5).

Salvage activities may occur during the nesting season for this species. Direct impacts may occur with the removal of potential nest sites or with activity occurring in close proximity of nests. This will result in the potential loss of productivity for the time period that activity is occurring or the potential reduction of nesting habitat.

Fuels treatments will also occur within these units having short term impacts. This activity is expected to impact ground vegetation that has recovered since the fire and will knock it back 1-2 years. A longer term benefit is realized however by lowering risk to the existing green trees allowing stands to develop into potential suitable habitat more rapidly.

Long-term habitat for hermit thrushes is expected to be more resilient with the reforestation of species better adapted for the fire regimes present in the project area. Reforestation also allows tree seedlings to become established more quickly, subsequently establishing the closed-canopied forest hermit thrushes require more quickly. Acres vary by alternative ranging from 6,802 acres for Alternative 2 and 1,725 acres for Alternative 4.

Indirectly, road closures can also aid in the establishment of trees, and hermit thrush habitat, more quickly. Road closures can help reduce the spread of noxious weeds that compete with tree seedling growth and desired forbs and grasses.

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to the hermit thrush. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (mature mixed conifer forests) is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 16,846 acres of mature mixed conifer forests experienced stand replacement fire further reducing cover in this forest type. Not every acre of the mixed conifer forests were considered suitable for this species but all stand replacement habitat is now considered unsuitable. The recent fires have negated many of the impacts of past management actions within the fire areas.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact hermit thrush habitat since suitable habitat was avoided and concentrated primarily on the removal of dead material within stand replacement burned areas. In addition, several vegetation management projects have occurred or may occur within suitable habitat (McCache, Metolius Basin Forest Management Project, Broken Rim, Big Bear, Bear Garden, and Highway 20). Overall, treatments proposed will reduce the risk of loss of existing habitat from other large-scale disturbances. However, stand densities were reduced within treatment units below suitable conditions used for nesting in many areas and mowing and burning were widely prescribed.

An estimated 64,825 acres of potentially suitable habitat still remains after the impacts of the fires and past vegetation management projects due to the overstocked conditions of many forested stands in addition to existing mature and old growth stands. Cumulatively, less than 2% reduction in suitable habitat is expected with the implementation of this project. Across the district, hermit thrush populations are expected to decline due to the loss of nesting habitat from the fires and past projects. Populations will begin to recover soon after the forested habitat develops, that is to say, after several decades.

Cumulatively, the alternatives will not lead to a trend toward Federal listing for the hermit thrush.

Meadows – Sandhill Crane and Solitary Sandpiper

Existing Condition

Both species are rare residents associated with freshwater, high elevation meadow/marsh habitats. However, the sandhill crane utilizes floating nests while the solitary sandpiper is the only arboreal nesting sandpiper using other bird species nests. Both feed on aquatic and terrestrial invertebrates as well as small vertebrates. Little is known about the solitary sandpiper due to its solitary nature and limited occurrence on the landscape. Sandhill crane populations seem to be fairly stable in Deschutes County. However, conversion of wetlands and predation continue to be major threats to this species. (Marshall et al. 2003 pp. 198-200, 216-217).

It is unknown how the fires have impacted these species. Neither species has been documented in the project area but limited habitat did exist. Most meadow habitat occurs outside the project area. Meadow habitats are likely to re-establish quickly due to high precipitation levels found at higher elevations. However, impacts may be more pronounced for the solitary sandpiper where surrounding forests were heavily impacted.

Other projects are occurring or have occurred within meadow habitat across the district enhancing potential habitat. These include Glaze Meadow and Black Butte Swamp where these meadows were burned to reduce the thick thatch layered that had built up and to promote the growth of desired vegetation. Trout Creek Swamp is a project in progress. This project is restoring the natural hydrology of the swamp by removing ditches, reducing undesired non-native vegetation, and reducing conifer encroachment.

Evaluation Criteria
Nesting habitat for sandhill crane and solitary sandpiper may have been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. The amount of forested habitat impacted adjacent (within 200 feet) to meadow habitat from salvage activities.
2. Disturbance activities within ½ mile of suitable meadow habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
The No Action alternative will have little additional impact on these species. Most forested habitat burned stand replacement (22 of 36 acres) surrounding the meadows and alpine meadows within the project area. However, forested habitat surrounding meadow habitat outside the district is largely intact. Therefore, habitat remains for both species.

Action Alternatives

Direct and Indirect Impacts
There are no salvage activities within 200 feet of meadow habitat within the project area. Therefore, remaining habitat will remain. There are proposed units within 0.5 miles of existing meadows which may result in disturbance (Unit 160 in all alternatives but 3 and Unit 79 in alternative 2 only). Proposed road closures will reduce disturbance in some potential sandhill crane and sandpiper habitat. Alternative 5, because it proposes the most road closures, will also result in the greatest reduction of disturbance.

Cumulative Impacts
Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to the sandhill crane or solitary sandpiper. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (meadows and alpine meadows) is being used as the scale for analysis for these species. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 28 acres of meadow habitat and an additional 41 acres of forested habitat adjacent to meadows experienced stand replacement fire further reducing this habitat type slightly. Fires occurring on district may help stimulate herbaceous growth within meadow habitat and impacts are expected to be short term.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact sandhill crane or sandpiper habitat since suitable habitat was avoided and concentrated primarily on the removal of dead material within stand replacement burned areas outside of riparian reserves.

Meadow enhancement projects have occurred on district within potential habitat. The Metolius Basin Forest Management Project has proposed enhancement activities within potential meadow habitat. Overall, treatments proposed will enhance aspen stands by reducing conifer encroachment and treating adjacent meadow habitat to reduce the disturbance and damage by OHV's. Trout Creek Swamp, Glaze Meadow and Black Butte Swamp projects have helped to restore meadow habitats by restoring hydrology, reducing conifer encroachment, and promoting desired vegetation. These projects encompassed an estimated 13% (176 acres) of the total meadow habitat (1,319 acres) on district.

An estimated 30 miles of roads have been decommissioned across the watersheds. In addition, 60 miles of decommissioning is proposed under the Metolius Basin project. These closures, along with proposed closures for the B&B project (71-77 miles), will aid in reducing the disturbance potential.

An estimated 1,265 acres of potentially suitable habitat still remains after the impacts of the fires. In addition, 176 acres of potential meadow habitat was enhanced by other projects. Impacts from the fires is expected to be short term and beneficial. Cumulatively, there is no reduction in suitable habitat is expected with the implementation of this project. Across the district, sandhill crane and solitary sandpiper populations are expected to remain stable due to the implementation of several meadow habitat enhancement projects.

Cumulatively, the alternatives will not lead to a trend toward Federal listing for the sandhill crane and solitary sandpiper.

Aspen – Red-naped Sapsucker

Existing Condition

The red-naped sapsucker is a summer resident typically found in forested habitats, especially riparian areas with aspen and cottonwood. It can be found in ponderosa pine stands as well and occurs less frequently in mixed conifer forests. Most nests are found in large diameter aspen trees with a mean diameter of approximately 10". It also breeds in cottonwood trees and prefers more moderately decayed trees for nesting. It drills holes resulting in sap wells, which provides food for other birds, insects, and mammals. Diet includes sap, cambium, soft parts beneath bark, insects found under bark, and berries. (Marshall et al. 2003 pp. 356-358).

Threats known to this species include long-term degradation of aspen and other riparian forest habitats from fire suppression and the lack of hardwood regeneration (Marshall et al. 2003 p. 358). In the past 100 to 150 years, there has been a dramatic decline in aspen forests due to a change in fire intervals (Bartos and Shepperd 1999). The lack of fire has allowed late successional species (e.g. conifer species) to move into aspen stands and out-compete the aspen. Bartos and Shepperd (1999) stated that most aspen will eventually be replaced by other communities like conifers, sagebrush, and other tall shrubs without some type of disturbance. Most known stands on the Sisters Ranger District have experienced conifer encroachment and are in need of treatment.

The fires probably had fewer impacts to this species because the impacts were more concentrated in the high elevation and mixed conifer plant associations. However, many cottonwood stands were lost or heavily affected. There are few known aspen locations in the project area.

Evaluation Criteria
Nesting habitat for the red-naped sapsucker has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. Large snag habitat impacted by salvage activities within riparian reserves.
2. The amount of hardwood forests impacted by salvage activities.
3. The number of acres planted for the establishment of future hardwood habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
The No Action alternative is likely to have few additional negative impacts to red-naped sapsucker habitat.

In some areas, conditions may have improved for aspen and cottonwood re-establishment through the killing of conifers. In areas of the highest severity burns, however, even the cottonwood and aspen were burned and killed reducing potential habitat.

Abundant snag habitat will be available for the short term. It is estimated that about 75% of all conifer snags are likely to fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999). However, even though abundant snags occur within riparian reserves, most are fire hardened and may be unusable for several years. In addition, there are few aspen and cottonwood snags, potentially limiting sapsucker occurrence.

Aspen and cottonwood re-establishment will also be affected by ungulate browsing. In areas with little grass and shrubs, increased browsing of deciduous trees will delay redevelopment of this habitat until snags begin to fall. Concentrations of downed wood have been shown to protect hardwood seedlings until they reach sizes where browsing is no longer a problem. Noxious weed infestation and spread may also delay the development of habitat.

Action Alternatives

Direct and Indirect Impacts
Riparian reserve treatment is very limited (approximately 20 acres). The only treatment in riparian reserves will occur around Round Lake to reduce hazards to the public and provide a defensible space. This area did not contain any known aspen or cottonwood stands. Snags will be removed within this area removing potential habitat however it is unlikely that sapsuckers would occupy this area due to the lack of hardwoods.

Although the action alternatives do not propose to remove or improve any potential sapsucker habitat (aspen and cottonwood) directly, there may be indirect benefits to potential habitat. The action alternatives seek to reduce white fir encroachment in harvest units by replanting at a wide-spacing to minimize the need for thinning in the near future. This reduced competition may allow for remaining cottonwood and aspen to regenerate and become established in areas where it suffered from conifer encroachment.

Indirectly, road closures can help reduce the spread of noxious weeds that compete with tree seedling growth. Approximately 19 miles of road are proposed to be closed within riparian reserves. Road closures can also help reduce fragmentation over time and disturbance potential.

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to the red-naped sapsucker. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District (aspen and cottonwood stands) is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 42 acres of aspen and an unknown amount of cottonwood stands experienced stand replacement fire further reducing this habitat type. Not every acre of aspen and cottonwood were killed but the majority of the stand replacement habitat is now considered unsuitable. The recent fires have resulted in reduced conifer encroachment within hardwood stands but may have also resulted in mortality of some stands as well.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact red-naped sapsucker habitat since suitable habitat was avoided and concentrated primarily on the removal of dead material within stand replacement burned areas outside of riparian reserves. In addition, several vegetation management projects have occurred or may occur within suitable habitat (McCache and Metolius Basin Forest Management Project). Overall, treatments proposed will enhance primarily aspen stands by reducing conifer encroachment and treating adjacent areas to reduce the risk of loss of existing habitat from other large-scale disturbances.

Aspen enhancement projects have occurred and are occurring on the district (e.g. Metolius Basin project area, McCache project area, First Creek Cottonwood Enhancement project, riparian plantings of hardwoods with BAER work, some hardwood fencing in riparian areas to help reduce ungulate browsing). These will ensure a sapsucker presence within the watershed.

An estimated 30 miles of roads have been decommissioned across the watersheds. In addition, 60 miles of decommissioning is proposed under the Metolius Basin project. These closures, along with proposed closures for the B&B project (71-77 miles), will aid in reducing the disturbance potential and the potential spread of noxious weeds.

An estimated 563 acres of potentially suitable habitat aspen still remains after the impacts of the fires and past vegetation management projects due to the overstocked conditions of many forested stands in addition to existing mature and old growth stands. In addition, several acres of cottonwood stands also remain but surveys have not been conducted to determine the amount present on district. Cumulatively, there is no reduction in suitable habitat is expected with the implementation of this project. Across the district, red-naped sapsucker populations are expected to increase due to the implementation of several aspen and riparian habitat enhancement projects.

Cumulatively, the alternatives will not lead to a trend toward Federal listing for the red-naped sapsucker.

Subalpine Fir – Blue Grouse

Existing Condition

The blue grouse is the largest grouse in Oregon and a short distant migrant throughout coniferous forests. It uses a wide variety of habitats in the spring and summer including forests, forest edges, shrublands, openings, and riparian habitats with dense cover. Nesting occurs on the ground and habitat is highly variable with most successful nests associated with downed logs. This species feeds on insects, berries, and seeds of a variety of forbs and shrubs. (Marshall et al. 2003 pp.181-183). Wisdom et al. (2000 Vol. 2, p. 248) notes source habitats include a mix of early seral habitats, especially sites with high shrub densities and mature forested habitats. Trends for summering habitat were found to be neutral overall for the Columbia Basin while the Southern Cascades (encompasses the Sisters Ranger District) shows increases of ≥20% (Wisdom et al. 2000 Vol. 1, pp 44-46).

Wintering habitat differs. Wisdom et al. (2000 Vol. 2, p. 177) states that source habitat for blue grouse wintering habitat includes old forest structure containing Douglas-fir, ponderosa pine, western larch, and mixed conifer. Marshall et al. (2003) also includes true fir and subalpine fir habitats as well. Pelgren (1996) found that blue grouse selected for open park-like stands of mature Douglas-fir and ponderosa pine rather than dense forests. Winter diets consist primarily of conifer needles, stems, and buds (Pelgren 1996). Trends for wintering habitat show an overall decline for the Columbia Basin. The Southern Cascades shows the same trends with greater than 20% but less than 60% decline in winter habitat (Wisdom et al. 2000 Vol. 1, pp 44-46).

Within the project area, the fires resulted in a 57% reduction of wintering habitat (mixed conifer stands) due to stand replacement fire. Most high elevation forests experienced stand replacement burns but this occurs primarily outside the project area in large patches throughout the high elevation plant associations, potentially resulting in the concentration of birds into remaining habitat. Marshall et al. (2003) notes that methods that maintain mature, park-like stands may benefit this species. Most winter habitat occurs outside the project area within high elevation forested stands.

Evaluation Criteria

Wintering habitat has been shown to be the most at risk habitat for the blue grouse and has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. Old/mature forest and high elevation forests impacted by salvage activities.
2. The number of acres planted for the establishment of future wintering habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts

The No Action alternative will likely have additional long term impacts to blue grouse wintering habitat with the prolonged establishment of mature Douglas-fir, ponderosa pine, and montane forest trees. It is estimated to take 300-400 years in stand replacement areas for forests to reach suitable habitat conditions if a seed source is present. However, the majority of regeneration is comprised of white fir, a non-desired tree species for the establishment of suitable blue grouse habitat. White fir dominated stands will provide some suitable habitat. White fir is more vulnerable to insects, disease, and wildfire than ponderosa pine/Douglas-fir dominated stands and does not last as long on the landscape. In areas with little to no seed source, a longer time period is expected to reach suitable habitat conditions (500+ years) due to the establishment of a brush layer. Manzanita and ceanothus are likely to dominate which will provide some forage and cover potential but may reduce the establishment of higher quality forbs and shrubs reducing foraging habitat. The establishment of early seral habitat benefits summering habitat to some degree. However without associated desired conifer trees habitat potential may be reduced.

There are not many mixed mortality or underburned stands occurring within winter habitat. However, where this does occur, fire likely benefited these stands by reducing stand densities and the white fir component. Remaining stands and large structure will remain at risk due to the high fuel loadings within and adjacent to stands.

Indirect impacts of existing open road densities may result in an increased spread of noxious weed populations that increase competition with tree seedlings and other desired forbs and grasses, thereby delaying habitat recovery.

Long-term winter habitat recovery will likely depend on how strongly forested stands recover. Shrubs compete with tree-seedlings and often favor open conditions created by some burns. This delays the recovery forested stands and indirectly limits winter habitat availability and suitability for blue grouse.

Action Alternatives

Direct and Indirect Impacts

The removal of dead trees, especially within stand replacement areas, will not affect blue grouse habitat greatly. However, associated actions (i.e. fuels treatments and reforestation) are likely to affect habitat more. Wisdom et al. (2000) noted that salvage and reforestation in post-fire habitats may shorten the duration of early seral, desired shrub dominated sites. Fuels treatments will occur within units resulting in reduced levels of shrubs but may result in an increase in other high quality forbs used by blue grouse. This change in ground vegetation species composition may enhance forage quality. A large proportion of the project area will remain untreated (ranges from 83-96% depending on Alternative) and will likely remain as early seral habitat for many decades depending whether there was an existing conifer seed source or not. This habitat condition will provide for summering habitat to some degree. It will provide cover from predators and some forage potential but impacts of manzanita and ceanothus shrub domination will be the same as those discussed in the No Action alternative.

Harvest units will also be reforested. This activity will lessen the duration of early seral habitat within units but the surrounding untreated areas will provide for those conditions. Reforestation will focus on the replanting of Douglas-fir and ponderosa pine with minor amounts of other species like western larch. By reforesting with those tree species, mature forests are likely to develop sooner (200-300 years), be more resistant to disturbance events, and are longer lived than white fir dominated stands. This will result in more wintering habitat in the long term.

Indirectly, road closures can aid in the establishment of trees, and blue grouse wintering habitat, more quickly. Road closures can help reduce the spread of noxious weeds that compete with tree seedling growth and desired forbs and grasses. Road closures can also help reduce fragmentation over time and disturbance potential.

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to the blue grouse. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters

Ranger District (mature mixed conifer and high elevation forests) is being used as the scale for analysis for this species. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 19,960 acres of mature mixed conifer and high elevation forests experienced stand replacement fire further reducing wintering habitat. Not every acre of the mixed conifer forests were considered suitable for this species but all stand replacement habitat is now considered unsuitable as wintering habitat as there is no canopy or green needles remaining.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact blue grouse habitat since suitable habitat was avoided and concentrated primarily on the removal of dead material within stand replacement burned areas. In addition, several vegetation management projects have occurred or may occur within suitable habitat (McCache, Broken Rim, Big Bear, and Bear Garden). Overall, treatments proposed will reduce the risk of loss of existing habitat from other large-scale disturbances. However, stand densities were reduced within treatment units below suitable conditions used for nesting in many areas and mowing and burning were widely prescribed resulting in short term loss of ground vegetation.

An estimated 30 miles of roads have been decommissioned across the district. In addition, 60 miles of decommissioning is proposed under the Metolius Basin project. These closures, along with proposed closures for the B&B project (71-77 miles), will aid in reducing the disturbance potential to existing territories and summering habitat primarily, will lessen fragmentation leading to reduced disturbance potential to future habitat, and reduce the potential for noxious weed spread. Additional noxious weed treatments will continue and aid in enhancing potential habitat.

An estimated 60,225 acres of potentially suitable habitat still remains after the impacts of the fires and past vegetation management projects in addition to existing mature and old growth stands. Cumulatively, less than 1% reduction in suitable habitat is expected with the implementation of this project. Across the district, blue grouse populations are expected to decline due to the loss of wintering habitat from the fires. Populations will begin to recover after the forested habitat develops, that is to say, after several decades.

Cumulatively, the alternatives will not lead to a trend toward Federal listing for the blue grouse.

Bats

Existing Condition

Most bat species are associated with foraging within forested areas while a few other species are closely associated with foraging in and adjacent to riparian areas. Little information is directly known about bats within the project area; see Table 3.170 for a breakdown of the potential bat species that could be found in the B & B Project Area and their habitat characteristics (Csuti et. al 1997 pp. 338-342, 344, 345, 347, 348, 350, and 351).

Table 3.170. Potential bat species and habitat requirements for the B&B Project Area.

Species	Forage Substrate	Roost Site	Main Prey Species	Comments
California Myotis	Forest edges and over water	Cliff faces, tree crevices, caves and structures	Butterflies and small flies	
Western Small-footed bat	Ponderosa pine and mixed conifer	Rock crevices, under boulders, and	Small insects	Will also forage over rocks

	forests	beneath bark		
Yuma Myotis	Riparian, moist woodlands, and open forests	Buildings, caves, and bridges	Moths, midges, flies, and termites	Closely associated with water and very sensitive to disturbance
Little Brown Myotis	Moist forests and riparian areas		Flying insects	Closely associated with water
Long-legged Myotis	Coniferous forests and riparian areas	Crevices, buildings, and caves	Moths	Closely associated with forests
Long-eared Myotis	Forested habitats and forested edges		Moths	
Silver-haired bat	Forested areas and over ponds and streams	Under bark	Soft-bodied prey	Deforestation and loss of snags is a threat
Big Brown Bat	More common in deciduous versus coniferous forests	Structures	Beetles	Forages over open areas and uses hollow trees
Hoary Bat	Riparian and brushy areas	Trees	Moths	Solitary forest dwelling
Pallid Bat	Arid regions and open forest types	Cliff faces, caves, and buildings	Flightless arthropods	Forages on ground and very intolerant to disturbance
Townsend's Big-eared Bat	Arid regions and open forest types	Buildings, caves, mines, and bridges	Moths primarily, flies, true bugs, and beetles	Presence of suitable roosts more important than vegetation type; very intolerant to human disturbance

Three known surveys have occurred on the Sisters Ranger District for bat species. Two surveys were conducted in consecutive years in 1996 and 1997 by Stuart Perlmeter as part of a Forest-wide project. First Creek and Canyon Creek (on district but outside of project area) were surveyed to determine species presence near the 1420 road. Another survey was conducted in the Metolius winter range area near Fly Creek by Mark Perkins in 1998 for PGE. The following species were located: western pipistrelle, Yuma myotis, western big-eared bat, pallid bat, big brown bat, silver-haired bat, California myotis, western small-footed bat, long-eared bat, long-legged bat, and hoary bat. Only the silver-haired bat, big brown bat, hoary bat, little brown bat, long-legged bat, and western small-footed bat have been documented in or near the project area.

It was noted in the 1997 study by Perlmeter that the high number of species found at First Creek indicated that the forest stands around this area offered a variety of day roost options that fulfilled the needs of a broad spectrum of bat species. Also noted in this study is that even though there was a high number of different species found, the number of individual bats captured was low compared to other places on the forest. Potential habitat exists across the project area in varying degrees of quality.

The fires of 2002 and 2003 impacted potential bat habitat in various ways. The fires created a complex edge pattern which occurs primarily in the mid section of the project area. Species associated with this habitat element may remain stable. However, species associated with mixed conifer forests, large snags with sloughing bark, riparian areas, and unique habitat features like hollow trees were heavily impacted.

Evaluation Criteria

Habitat for bats has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. Large snag habitat impacted by salvage activities.

2. The amount of forested stands impacted by salvage activities.
3. The number of acres planted for the establishment of future large tree/snag habitat.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts
The No Action alternative will maintain more potential roost sites (large dead and dying trees) in the short-term. However, depending on fire intensity, many snags may be unusable due to the loss of bark, fire hardening of many snags, and the loss of snags present before the fire which provided conditions (cavities, sloughing bark) used by bats. Snag habitat is short term as most snags will fall within 15-30 years. As snags fall, roosts will be lost and there will likely be a long period of time (300-400 years) before new roosts are available, especially at concentrations seen pre-fire and immediately post-fire. Many bats use snags in conjunction with forested stands. Loss of forested stands will limit use by some species (e.g., long-legged bat and silver-haired bat) until stands recover. Recovery of forested stands will depend on the presence of conifer seed sources. In many areas, the absence of a seed source will delay recovery by several decades (estimated at least 100 years more). Where there was a seed source, the majority (80-90%) is comprised of white fir. This is not as desired a tree species for bats as white fir does not get as large as Douglas-fir or ponderosa pine or develop deep fissured bark used by bats for roosting but does result in hollow snags more often than the other species. Mixed mortality and underburned stands will likely serve as habitat especially for species like the California and long-eared myotis. These areas will still maintain the forested condition used by many bat species. However, in stands dominated by white fir, these stands will likely see additional impacts over the next 5-10 years as white fir damaged by fire are likely to die due to the thin bark and root system near the surface. This will provide more snag habitat but will also reduce the canopy. Many species use of riparian areas and habitat recovery will be the same as mentioned for forested stands with the exception of deciduous stands. These will likely recover more quickly than conifer stands unless fire intensity was at a level to kill the root systems. Bats that roost in rock crevices, bridges, cliff faces, and buildings are not likely to see any decrease in roost sites (e.g., Yuma myotis, long-legged myotis, and pallid bat).

It is unknown what long-term impacts the fire had on insect populations. In a study completed for the spraying of BT for the spruce budworm outbreak on the Sisters Ranger District, it was found that the largest concentrations of insects were associated with shrub species, primarily bitterbrush, ceanothus, rose, and manzanita. Therefore, it is assumed that there may be a slight decrease in insect populations for the short term until shrubs can repopulate impacted areas. This could have a negative impact on some bat species for the short term. However, especially in areas with little conifer seed source, ceanothus and manzanita are dominating the regeneration.

Indirect impacts from existing open road densities will allow for continued danger tree removal limiting the availability of snag habitat, especially near riparian areas.

Shifts in recreation use or general forest use to remaining green areas may result in an increase in disturbance levels. Increased human use of the project area can also lead to increased disturbance of day and night roosts, maternity sites, and winter hibernaculum.

Action Alternatives

Direct and Indirect Impacts

Bat species that roost in snags or trees often need large trees and many of them since bats will often change individual roost sites but remain in a particular area (Betts 1995, Ormsbee 1995, Perkins 1995). Based on this information, retention of large diameter snags and trees (those that would provide sloughing bark and large chambers inside for roosts) within a given area is important for bat populations and species diversity in the project area. A variety of bat species will forage and hunt over open areas (Perkins 1995), and this is not seen as limiting within the project area.

Salvage activities will remove potential roost habitat by removing dead trees. However, most dead trees removed were killed by the fire and do not possess habitat characteristics needed by bats (i.e. sloughing bark). Alternative 2 results in the most acres treated (6,802) while Alternative 4 treats the least (1,725). However, treatment of white fir dominated stands may reduce habitat suitability for some species. The amount of large tree habitat impacted varies by alternative (1,039 acres for Alternative 2, 718 acres for Alternative 3, 732 acres for Alternative 4, and 1,029 acres for Alternative 5).

Snag retention varies by alternative with the density, distribution, and size of snags retained. Alternatives 3 and 5 retain a more varied density of snags than Alternative 2. Alternative 4 retains a high level of snags mainly by the provision of not salvaging in the LSR (i.e. treating fewer acres). All alternatives focus on retaining large snags with a preference for retaining Douglas-fir and ponderosa pine. Large Douglas-fir and ponderosa pine usually have thicker bark, are larger and will remain on the landscape for a longer period of time. This will provide for a wider variety of bat species. In addition, all hollow snags will be retained unless cut for safety considerations. Alternative 5 is preferred due to the amount of Douglas-fir and ponderosa pine retained providing more potential roost sites.

Fuels treatments will occur within harvest units. This will result in decreased shrub densities and insect populations associated with shrubs reducing foraging opportunities. However, adjacent untreated areas will provide abundant foraging opportunities as shrubs recover. Fuel treatments will also reduce the risk to existing large tree habitat and reduce the competition to established seedlings resulting in the development of habitat sooner.

Replanting areas as opposed to allowing for natural regeneration will benefit bat habitat in the long term. Alternatives vary in the amount of reforestation proposed ranging from Alternative 2 planting 6,802 acres while Alternative 4 plants 1,725 acres. Douglas-fir and ponderosa pine would be preferred species to plant. By proposing to replant Douglas-fir and ponderosa pine, large tree habitat preferred by bats will potentially develop sooner (200-300 years as opposed to 300-400 years), be more suitable (larger trees with thicker bark), and be more resilient to disturbance events.

Road closures will also help maintain existing snags by removing the need for danger tree removal. Alternative 5 proposes to close the most roads (77 miles in comparison to 71 miles under the other action alternatives) and has a lower mileage amount of danger tree removal on haul routes than Alternative 2 (121 miles for Alt. 5 and 146 miles for Alt. 2).

In summary, Alternatives 2 and 3 would have the greater short-term impacts to bat roost habitat because more acres will be treated and more miles of haul roads will need danger tree removal. Alternative 4 provides more roost sites in the short-term, especially within the LSR, but may not provide more long-term habitat because of delayed recovery of forest structure from a lack of a seed source in stand replacement burned areas and regeneration of susceptible white fir in mixed mortality and underburned areas. Alternative 5 provides a better combination of proposals (i.e. planting of resilient species, more road closures, and retention of ponderosa pine and Douglas-fir snags) to maximize long-term benefits to bat species while minimizing short-term negative impacts.

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to bat species. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District is being used as the scale for analysis for bats, in particular mature mixed conifer and ponderosa pine forests and riparian reserves. Based on that review, the potential cumulative impacts are those discussed below.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 17,335 acres (13%) of mature mixed conifer and ponderosa pine forests experienced stand replacement fire further reducing green mature forests. Not every acre of the forests equated to suitable habitat for bats but this habitat is considered unsuitable due to the fires for some species and unusable for a period of time for other species until decay begins.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact bat habitat greatly as recently killed trees don't possess the characteristics needed by bats for roosting (decay and sloughing bark). In addition, two vegetation management projects may occur within suitable bat habitat (McCache and Metolius Basin Forest Management Project). Measures were incorporated to retain large tree and snag habitat for each project area as well as enhance habitat conditions. Overall, treatments proposed will improve bat habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances.

An estimated 30 miles of roads have been decommissioned across the watersheds. These closures, along with proposed closures for the B&B project (71-77 miles), will lessen fragmentation and reduce the need for additional danger tree removal.

Hazard/danger tree activities are usually concentrated along roads and high use areas like campgrounds, many of which are associated with riparian reserves. Increased loss of large snag habitat within riparian reserves continues to limit available habitat for many species. Increased human use in riparian areas, especially recreational use, will reduce the effectiveness of remaining habitat. As the more severely burned areas recover, recreational use will become more spread out, reducing disturbance potential.

Because a majority the potential habitat was severely burned, bat populations will likely decrease across the district especially those populations that rely on forests for both for roosting and foraging. Actions to reduce fragmentation and human disturbance, reduce the loss of large snags, and recover more fire-resilient habitat or that which is considered to be more within its historic disturbance regime will benefit bat populations in the long-term. Cumulatively an estimated 2% reduction in overall potential bat habitat is expected with the implementation of this project.

Cumulatively, the action alternatives will not lead to a trend toward Federal listing for bats.

American Marten

Existing Condition

The American marten is associated with mixed conifer and high elevation hemlock/lodgepole pine late-successional habitats, and is a focal species for climax habitats. Marten habitat generally involves a dense-canopy (greater than 40% canopy cover) and supports significant amounts of large down logs ($\geq$20"dbh at rest sites and > 30"dbh at den sites, 8-20/acre) and snags (2-3/acre) $\geq$20"dbh. Moist forests where marten are usually found have down woody material densities as high as 39 pieces per acre with

40% of the pieces >20”dbh. Raphael and Jones (1997) found that martens use snags and logs with intermediate levels of decay with greatest use in the larger (30 inches in diameter or larger) size classes when available. Especially significant are riparian areas, ridgetops, and areas where high concentrations of down logs and snags occur (Ruggiero et al. 1994). Natal dens are largely found in trees, logs, and rocks (Ruggiero et. al. 1994)). Martens mainly eat forest rodent species (e.g. squirrels) or riparian rodent species (e.g. voles). Complex physical structure, especially near the ground, helps provide foraging/hunting areas and shelter from weather and predators (Buskirk and Powell 1994 as cited in Ruggiero et. al. 1994). Canopy cover plays a greater role in winter where marten select for higher canopy cover during snow periods than snow-free periods. A study conducted in lodgepole pine forests of the Winema National Forest estimated 0.2 live trees, 0.3 snags, 0.6 logs and 1.3 slash piles/ha (0.08 live, 0.12 snags, 0.24 logs, and 0.52 slash piles per acre) of appropriate size would meet denning and resting needs (Raphael and Jones 1997).

Surveys were conducted in the winters of 1997/1998 (Dec. through March) and 1999 (Feb. through April) according to the protocol outlined in Ruggiero et al. (1994). These consisted of Trailmaster baited camera set-ups located along the Mt. Jefferson wilderness boundary. Four of nine stations were located within or directly adjacent to the B&B project area (Table 3.171). Marten were detected in all four locations.

Table 3.171. Carnivore Bait Station Results

Year	Station Location	Results
1997/1998	T.11S, R.8E, Section 36	Marten
1997/1998	T.12S, R.8E, Section 33	Marten
1997/1998	T.13S, R.8E, Section 16	Marten
1999	T.13S, R.8E, Section 4	Marten

A minor portion of the project area is comprised of plant associations considered suitable for marten habitat (e.g., mixed conifer, lodgepole wet). Tables 3.172 and 3.173 illustrate pre and post fire conditions of mature forest* by plant association. Guidelines used for computing marten habitat included mixed conifer, lodgepole pine, mountain hemlock, and riparian PAGs above 3400’ in elevation. Below this elevation, stands become dominated by ponderosa pine and are more typical of dry sites. These areas do not typically produce the canopy cover or downed wood levels needed by marten.

Table 3.172. Total acres of potential marten habitat within the B&B project area and Metolius Watershed and percent change post-fire.

	Total Acres of Potential Marten Habitat and % Change for the Project Area	**Total Acres of Potential Marten Habitat and % Change for the Watershed**
Pre-fire Habitat	9,211 acres	35,114 acres
Post-fire Habitat	1,199 acres	13,834 acres
% Change	**-13%**	**-39%**

* Structural stages 4 and 5 (average stand diameter of 9”dbh or greater) were considered for potential habitat

Table 3.173. Acres of potential marten habitat within the B&B Project Area and Metolius Watershed and percent change post fire.

		Plant Association				
		High Elevation	**Lodgepole**	**Mixed Conifer Dry**	**Mixed Conifer Wet**	**Riparian**
Project Area	**Pre-fire**	4	375	6,264	2,555	0
	Post-fire % change	0 (-100%)	192 (-49%)	565 (-91%)	429 (-83%)	0 (0%)
Watershed	**Pre-fire**	12,991	2,646	12,393	6,934	127
	Post-fire % change	7,570 (-42%)	954 (-64%)	3,337 (-73%)	1,886 (-73%)	64 (-50%)

Several authors in Ruggiero et al. (1994) found martens tend to avoid openings and stands that lack horizontal structure. However, martens were shown to attain high local densities in post-fire environments in Alaska that had complex physical structure in the form of horizontal boles or dense herbaceous vegetation (Johnson and Paragi 1993, Magoun and Vernam 1986). In contrast, Fager (1991) found little to no use in forests burned by the Yellowstone fires of 1988. Therefore, marten responses to burned areas appear to vary by region. Changes due to the fire have resulted in loss of canopy cover, horizontal structure, and connectivity which has resulted in a loss of suitable marten habitat or habitat of degraded quality.

Evaluation Criteria

Habitat for the American marten has been reduced across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. Mature forest habitat within suitable PAGs impacted by salvage activities.
2. Large snag and down woody material habitat impacted by salvage activities within suitable PAGs identified for marten.
3. The number of acres planted for the establishment of future large tree/snag habitat.

Environmental Consequences

All Alternatives

Direct and Indirect Impacts

No marten habitat is proposed to be treated in any alternative. Therefore, impacts will be the same for all alternatives unless otherwise specified. The Alternatives will retain greater amounts of downed wood habitat after snags have fallen (approximately 15-30 years). Much of the fire burned in the mature forests at higher elevations, and fire-created snags often last longer as downed wood (Smith 2000). Although this may increase downed wood levels in the form of dead trees falling, acres of potential marten habitat have been reduced because of the reduction in green canopy cover. Prey species populations may also have been reduced. Smith (2000) reported that red squirrels and voles generally avoided recent, stand-replacing burns. Habitat development will occur over several decades and suitable habitat conditions are not expected in areas that experienced stand replacement or mixed severity burns for at least 200-400 years. The No Action Alternative will retain the maximum level of downed wood recruitment as forests return.

Factors affecting the recovery of habitat include time and species composition. In stand replacement burn areas development of suitable overhead cover will be prolonged if reached at all. It is likely that shrubs will re-colonize and prolong the establishment of any tree species especially in areas with little conifer seed source. In some mixed mortality areas and areas where there was a conifer seed source, white fir comprised the majority (80-90%) of the regeneration (approximately 30% of the remaining large structural stages are white fir dominated). White fir dominated stands are not as resilient nor grow as large as other earlier seral species (e.g. Douglas-fir). Large structure is a character of marten denning habitat. A developing stand's lack of resilience could prolong recovery of the canopy and large structural requirements of marten habitat. It will be many decades (300-400 years) before all components of marten habitat are restored.

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to American martens. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District is being used as the scale for analysis for the marten, in particular the lodgepole pine, mountain hemlock and mixed conifer (down to 3400' in elevation and 40% canopy closure) plant associations. Based on that review, the potential cumulative impacts are those discussed below.

The majority of potentially suitable habitat outside the wilderness on the Sisters RD is located within the mixed conifer PAGs. This PAG experienced moderate to heavy mortality with the insect outbreak of the early 1990's with impacts occurring a few years later. This event probably had the greatest influence on marten habitat outside the wilderness due to the reduction of canopy cover prior to the fires. These open stands are not considered suitable for martens. A mountain pine beetle infestation is also occurring on the district primarily within the Three Sisters Wilderness. A large area approximately ranging from south of Black Crater to Three Creek Lake and about 3-4 miles wide is now showing signs of mass mortality within the lodgepole and high elevation PAGs. This may lead to unsuitable habitat conditions for the marten as stands lose their canopy cover further reducing potential habitat on the district.

Several large wildfires have occurred on district in the past 5 years – Cache Mountain, Eyerly, Link, and B&B. An estimated 22,377 acres of mixed conifer, mountain hemlock, and lodgepole pine forests experienced stand replacement fire further reducing cover in this forest type. Not every acre of these forests equated to suitable habitat for the marten but now all this habitat is considered unsuitable due to the fires. Abundant down woody material will be present on the landscape due to these events however canopy cover will be absent. The recent fires have negated many of the impacts resulting from past management projects.

Activities proposed under the Eyerly Fire Salvage project, Coil Fiber, and Lower Jack Reoffer timber sales did not impact marten habitat since suitable habitat was avoided. Most vegetation management projects do not impact marten habitat greatly as treatments are focused on the reduction of stand densities by thinning from below. Large tree habitat and abundant down woody material are not proposed to be removed. McCache and Metolius Basin Forest Management Project will not impact marten habitat.

An estimated 30 miles of roads have been decommissioned across the watersheds. These closures, along with proposed closures for the B&B project (71-77 miles), will lessen fragmentation leading to reduced disturbance potential.

Because a majority the potential habitat was severely burned, marten populations will likely decrease across the district. Actions to reduce fragmentation and human disturbance, reduce the loss of dead and downed wood, and recover more fire-resilient habitat or that which is considered to be more within its historic disturbance regime will benefit marten populations in the long-term. Cumulatively there is no reduction in potential marten habitat expected with the implementation of this project.

Cumulatively, the action alternatives will not lead to a trend toward Federal listing for the American marten.

Big Game

Existing Condition

Deer: Most of the project area consists of deer summer range (82%). This delineates the biological potential of the area developed during the Integrated Fuels Strategy process (1998). It is not considered an official allocation in the Deschutes LRMP; however, it was recognized by ODFW as an important area for mule deer. There is no allocated Management Area 7 – Deer Habitat outlined in the Deschutes LRMP within the project area.

The B&B Project Area is within the Metolius Mule Deer Winter Range Plan area, which was initiated in 1986 as a cooperative venture between the USFS, Portland General Electric, BLM, and ODFW. It outlined issues, goals, objectives and action items for this land area. Some of the major issues identified include declining forage quality, the need for road closures, and the loss of mule deer habitat primarily related to private lands. Although, the project area has little private land within its boundary and the majority of these lands lie outside winter range, other actions have been planned or implemented regarding forage (e.g. thinning, mowing and burning) and roads (e.g. closures).

Elk: There is also a portion of the Metolius River Key Elk Habitat Area (KEHA) located in the project area. Specific management guidelines can be found in the Deschutes LRMP regarding this area. See Table 3.174 for a breakdown of big game habitat for the project area.

Table 3.174. Big game habitat acres in the B&B Project Area.

Deer Habitat Type	**Acres of Habitat**	**Percent of Project Area**
Winter Range	6,607 acres	16%
Summer Range	34,700 acres	82%
Transition Range	836 acres	2%
Management Area 7	0 acres	0%
Elk Habitat Type	**Acres of Habitat**	**Percent of Project Area**
Metolius River Key Elk Habitat Area	1,832 acres	4%

Target road densities for the project area are 2.5 miles/sq. mile. Target road densities for the KEHA are much lower ranging from 0.5 to 1.5 miles/sq. mile. Road densities are above target densities for deer winter and transition range and for the Key Elk Habitat Area as shown in Table 3.175. Some road closures have been proposed through other project specific analyses however, few have been implemented to date.

Table 3.175. Open road densities by big game habitat type for the B&B Project Area.

Road Information	Deer Habitat (not differentiated by season)	Elk Habitat: KEHA
Miles of Road	*262.84*	*29.51*
Project Area (mi^2)	*65.92*	*9.57*
Open Road Density	***3.99***	***3.08***
Target Road Density	***2.5***	***0.5-1.5***

The B&B fire occurred primarily within deer summer and winter range and impacted the KEHA somewhat. Two areas used heavily by big game were located in the highest fire intensity areas, the First Creek and Abbot Butte areas.

The following table displays the amount of big game habitat impacted by the B&B fire. Percent of project area refers to the amount of habitat impacted relative to the total amount of big game habitat. Roughly the cover to forage ratio before the B&B fire was 80% cover (hiding cover) and 20% forage. This assumes that any stand that had an average diameter of at least 5 inches provided hiding cover. After the fire, the ratio had shifted to 46% cover and 54% forage (Table 3.176).

Table 3.176. Severity of Big game habitat impacts by fire within the B&B Project Area.

Deer Habitat	Mixed Severity	Percent of Big Game Habitat in Project Area	Stand Replace.	Percent of Big Game Habitat in Project Area	Underburn	Percent of Big Game Habitat in Project Area	Total Acres	Total Percent
Summer	6573	16%	15089	36%	13039	31%	34700	82%
Transition	128	<1%	3	<1%	705	2%	836	2%
Winter	1002	2%	2566	6%	2959	7%	6,905	16%
Totals	**7703**	**18%**	**17658**	**42%**	**16783**	**40%**	**42144**	**100**
Elk Habitat								
KEHA	429	7%	547	9%	856	14%	1,832	4%

Evaluation Criteria

Habitat for big game has been reduced or changed across the project area due to the fire. The following measures will be used to evaluate the impacts of the planned activities:

1. Acres of deer winter range treated.
2. Acres of KEHA treated.
3. Number of road miles reduced (road densities) in the KEHA.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Impacts

Forage species are expected to increase dramatically, as seen in the Eyerly fire area, and improve foraging opportunities for big game populations within the project area. However, there may be a lowered quantity and quality of forage species in some areas if shrubs like ceanothus and manzanita become established over large tracts of the fire. These species do not equate to valuable forage and replace other potential species like bitterbrush and desired grasses and forbs which are more heavily utilized. Winter forage was also lost as a result of the fires. Lichens and shrubs utilized during the winter months were consumed during the fires. However, much of the area that experienced stand replacement fire is not typically occupied during the winter months so this impact to winter range may be minor.

The fires also resulted in a loss of cover. This can lead to an increased chance of mortality due to hunting, predation, etc. due to the increased visibility. This impact will become greater as snags begin to fall across the landscape. Loss of green cover also means big game will likely need to expend more energy during extreme weather conditions trying to stay warm or cool. A lack of green canopy can mean snow levels will increase resulting in additional energy needs to move. These impacts, in combination with the existing high road density, may result in decreased big game populations or herds of big game moving to other locations (i.e. private land or tribal lands) for forage and security in times of high pressure (i.e. hunting season).

Noxious weed populations were present within the project area prior to the fire and conditions for spread have increased due to the amount of open soil and reduction in native vegetation. Initial noxious weed treatments under the Burned Area Emergency Rehabilitation (BAER) effort have benefited big game forage habitat. Threats to habitat would continue since these weeds favor open conditions created by the fire and increase competition with tree seedlings and other desired forbs and grasses. Indirect impacts of existing open road densities may result in an increased spread of noxious weed populations delaying habitat recovery.

Open road densities would remain at current levels. This may result in increased disturbance to big game during critical time periods and may result in increased mortality due to increased hunting pressure and potential collisions with motor vehicles.

The No Action alternative is not likely to add or subtract from these impacts to big game habitat. Indirectly, however, without associated road closures the above described impacts on security will be likely.

Action Alternatives

Direct and Indirect Impacts

Salvage logging will likely have minor impacts on big game. The removal of dead material that impedes movement may benefit big game as they move throughout the project area. Negative impacts would include that some of the dead material may have been providing some hiding cover especially where removed along roads. In addition, salvage operations occurring during calving and fawning periods may displace big game. There is some harvest of mixed severity stands within deer winter range (114 acres for Alts. 2 and 5). This may reduce cover slightly however, this reduction would occur with or without treatment as trees die.

Associated actions of replanting and road closures will have the biggest benefits to big game habitat. Replanting will help establish trees sooner thereby developing cover (hiding and thermal) sooner. Fuels treatments will also benefit big game by decreasing shrub densities and promoting desired forbs and grasses for forage.

Thermal and hiding cover levels within the project area are not likely to increase for many years. It will take a long time before trees become established and grow to heights that will provide these types of cover. Smith (2000) reported that it could take at least 30-50 years before hiding and thermal cover levels respond (Table 3.177).

Table 3.177. Biological winter range and KEHA acres treated by alternative for the B&B project.

Area	Alternative 2 Acres	Alternative 3 Acres	Alternative 4 Acres	Alternative 5 Acres
Winter Range	908	153	0	365
KEHA	141	0	0	2

Acres treated within the KEHA will occur in stands that experienced stand replacement fire and will not alter cover or forage values. Only minimal acres (114 acres for Alts. 2 and 5) will occur outside stand replacement burned areas within winter range potentially reducing cover slightly (Table 3.178).

Table 3.178. Cover levels within KEHA in the project area by alternative[1].

	Required (LRMP)	Existing/No Action	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Hiding Cover	30%	39%	NC	NC	NC	NC
Thermal Cover[3]	20%	26%	NC	NC	NC	NC
Black-bark Pine	30%	25%	18%	NC	NC	NC

[1]For this analysis, hiding cover is assumed to be any stand with an average dbh of 5” or more; thermal cover is assumed to be any stand with an average dbh of 9” or more.
[2] NC=No Change from existing condition
[3] Required thermal cover levels only apply to KEHA winter range

Road closures will aid in providing security and reducing disturbance to big game, especially during the long period of time before hiding cover develops and will aid in reducing the spread of noxious weeds. Alternative 5 proposes the most road closures. See Table 3.179 for information on road closures proposed.

Table 3.179. Open road densities for the KEHA by alternative for the B&B Fire Recovery Project.

Road Information	**Elk Habitat: KEHA - No Action**	**Alternatives 2-4**	**Alternative 5**
Miles of Road	*29.51*	*25.84*	*25.19*
Project Area (mi^2)	*9.57*	*9.57*	*9.57*
Open Road Density	***3.08***	***2.70***	***2.63***
Target Road Density	***0.5-1.5***	***0.5-1.5***	***0.5-1.5***

Cumulative Impacts

Activities identified in Tables 2 and 3 were reviewed to assess whether, in combination with the likely impacts of the B&B Fire Recovery Project, there would be any cumulative impacts to big game. Additional projects occurring outside the Metolius 5th field watersheds were also assessed. The Sisters Ranger District is being used as the scale for analysis for big game, in particular winter range, MA-7, and the KEHA. Based on that review, the potential cumulative impacts are those discussed below.

Several large vegetation management projects have occurred in the past several years. These include Big Bear, Bear Garden, Broken Rim, Highway 20, Jack Canyon, McCache, Santiam Corridor, and Santiam Restoration. With the exception of Highway 20, all occurred within summer range and were developed to address the mass mortality caused by insects in the early 1990’s. Within these project areas, there has been an overall decrease in cover. However, stands were declining or dead. A decrease in cover was going to occur whether the area was treated or left alone. Down woody material levels also increased across the landscape. This provides added benefits in the form of hiding cover, especially in fawning and calving areas; but abundant down woody material levels also impede movement and increase the risk of loss of existing cover to a large fire event. An increase in forage also resulted in these project areas. This forage increase may have helped to increase the health and vigor of resident herds using the area leading to increased survival rates.

The Highway 20 project area was located within deer transition range and MA-7. Approximately 1,044 acres were treated with this project. The Metolius Basin project area was the first vegetation management project planned to occur within biological winter range. Overall, an estimated 12% of the winter range on the Sisters Ranger District is proposed to be treated with the Metolius Basin project. This area is not as important as other portions of the winter range in that snow conditions may preclude use for much of the winter. It was noted in the Metolius Mule Deer Winter Range Plan that approximately 90% of the deer occupying the Metolius Basin area during the summer move toward the east to the high plains area for the winter months. No vegetation management projects have occurred within the KEHA.

During the summer of 2002, two large wildfires occurred on the district. The largest fire, Eyerly, occurred within biological winter range and MA-7 and resulted in a decrease in cover and winter forage opportunities. The fire did not enter the KEHA. An estimated 7,069 acres of winter range resulted in stand replacement which eliminated cover and most of the bitterbrush in the area. However, summer forage values were expected to increase dramatically within the fire area with the resprouting of forbs and shrubs. This prediction held true with an explosion of grasses, forbs, and shrubs occurring throughout the fire area. It was also noted through casual observation, increases in the amount of big game use, primarily elk, within the fire area. The summer of 2003, two additional wildfires occurred; Link and B&B. These occurred within biological winter range and the KEHA. An estimated 2,566 acres resulted in stand replacement within winter range and 547 acres within the KEHA. Impacts and vegetation responses are similar to the Eyerly fire.

Eyerly salvage will occur within biological winter range and MA-7 habitat for deer. There should not be added impacts of this salvage as the impacts occurred as a result of the fire.

An estimated 30 miles of roads have been decommissioned across the district. In addition, 60 miles of decommissioning is proposed under the Metolius Basin project. These closures, along with proposed closures for the B&B project (71-77 miles), will aid in reducing disturbance to big game and reduce the potential for noxious weed spread. Additional noxious weed treatments will continue and aid in enhancing potential habitat.

Over the entire watershed and taking into account past and ongoing projects, big game cover habitat (hiding cover and thermal cover) has been reduced and foraging habitat increased. Reductions in cover were not as great in the winter range as they were in summer and transition range. High road densities within the watershed can compound the impact of a lack of cover. This could result in a shift in habitat use patterns by big game (Table 3.180).

Table 3.180. Cumulative Impacts Analysis for big game for the B&B Fire Recovery Project.

	Accounting of Estimated Acres for MA-7 on the Sisters RD	**Accounting of Estimated Acres for Biological Winter Range on the Sisters RD**	**Accounting of Estimated Acres for the Metolius KEHA on the Sisters RD**
Total Acres	37,282	69,322	6,123
Past Projects Impacting Habitat			
Metolius Basin	0	8,319	0
Highway 20	1,044	0	0

Fires (Stand Repl.)			
Cache Creek	0	0	0
Eyerly	3,408	7,069	0
Cache Mountain	0	0	0
Link	0	0	0
B&B	0	2,566	547
Acres Impacted from Past Events (Baseline)	**32,830**	**51,368**	**5,576**
Habitat lost or degraded from B&B project	0	0	0
Resulting Habitat Acres – Change from Baseline	**32,830**	**51,368**	**5,576**

Big game populations are expected to increase across the district due to the increase in foraging habitat and reduced road densities. Use patterns are expected to change as well due to the loss of cover. Cumulatively, there is no estimated reduction in cover habitat is expected with the implementation of this alternative as treatment primarily occurs in areas already impacted by the fire (i.e. stand replacement).

Key Elk Habitat Area

1. An average of 30% hiding cover, 20% thermal cover, and 30% black-barked ponderosa pine stands are needed within the KEHA as a whole. Harvest in mixed severity stands may alter the amount of these components. Follow the guidelines below if any component is below required levels and harvest is occurring within mixed severity stands (Table 3.181):

Table 3.181 Habitat Component and Specifications

Habitat Component	Required %	Habitat Specifications	Comments
Hiding Cover	30%	Stand height average 10’ Stand not thinned in past 20 years Able to hide 90% of an adult elk at 200’	Black-barked stands don’t count
Thermal Cover	20%	≥10 acres Average stand height 40’ Average canopy cover of 40%	Black-barked stands don’t count
Black-bark Stands	30%	Unthinned in past 20 years Average canopy cover of 40% Minimum stand height of 40’ Dispersed clumps	

2. Habitat specifications are listed as guidelines for types of areas that would qualify as those listed habitat components.

Summary

The following table (Table3.182) indicates which alternatives result in the greatest long term benefits while minimizing short term impacts for each MIS species.

General summarizations:

- Species relying on green forested habitats will see some short term impacts from proposed harvest within mixed mortality and underburned stands. However, this impact would result whether salvage was occurring or not as trees are dead or expected to die within 5 years. Salvage is only making those impacts occur sooner. Long term benefits of re-establishing desired forest structure will be realized most with the implementation of Alternative 2 as it results in the greatest number of acres replanted. Species included: northern goshawk, Cooper's hawk, sharp-shinned hawk, chipping sparrow, Brewer's sparrow, brown creeper, hermit thrush, blue grouse, bats, and American marten.

- Species relying on riparian habitats will not see much impact from the implementation of this project as only minimal acres of riparian reserves were proposed for harvest. Species included: great blue heron, waterfowl, osprey, sandhill crane, solitary sandpiper, and red-naped sapsucker.

- Species relying on edge habitat will see some short term impacts from the loss of snags within mixed mortality stands. More complex edge habitat is being created with the implementation of the alternatives which will benefit these species. Long term benefits of re-establishing desired forest structure will be realized most with the implementation of Alternative 2 as it results in the greatest number of acres replanted. Species included: great gray owl, olive-sided flycatcher, elk, deer,

- Species relying on large snag habitat will be impacted by the implementation of Alternative 2 the most. Provisions are in place to minimize impacts with snag retention guidelines. These impacts are short term as post fire snag habitat will eventually be lost as snag fall. The greatest long term benefits for these species is realized in Alternative 2 as well as it results in the greatest number of acres reforested which will attain large snag habitat sooner than allowing for natural regeneration. Species included overlap those mentioned above.

Table 3.182. Management Indicator Species Impacts Summary*.

Species	Action Alternatives				
	Concerns	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**
Northern Goshawk (*Accipiter gentiles*)	Mature and old-growth forests; especially high canopy closure and large trees		X		X
Coopers Hawk (*Accipiter cooperi*)	mature forests with high canopy closure/tree density		X		X
Sharp-shinned Hawk (*Accipiter striatus*)	Similar to goshawk in addition to young, dense, even-aged stands		X		X
Great Gray Owl (*Strix nebulosa*)	Mature and old growth forests associated with openings and meadows		X		X
Great Blue Heron (*Ardea herodias*)	Riparian edge habitats including lakes, streams, marshes and estuaries	X			X
Waterfowl*	Lakes, ponds, streams			X	X
Red-tailed Hawk (*Buteo jamaicensis*)	Large snags, open country interspersed with forests			X	X
Osprey (*Pandion haliaetus*)	Large snags associated with fish bearing water bodies		X		X
Brewer's and Chipping Sparrow	Open habitat; small trees		X	X	X
Brown Creeper	Mature forests; large trees and snags		X		X
Hermit Thrush	Mature, multi-layered stands		X	X	X
Olive-sided Flycatcher	Post-fire snag habitat and edges of green forest				
Blue Grouse	True firs, shrubs				X
Sandhill Crane & Solitary Sandpiper					X
Red-naped Sapsucker			X		X
Bats*	Forested areas, riparian				X
American Marten (*Martes americana*)	Mixed Conifer or High Elevation late successional forests with abundant down woody material		X	X	X
Elk (*Cervus elephas*)	Mixed habitats				X
Mule Deer (*Odocoileus hemionus*)	Mixed habitats				X

*X = greatest long-term benefits while minimizing short-term impacts

3.14 Fisheries

Existing Conditions

FISH SPECIES OVERVIEW

The proposed project would occur within the 145,500 acre Upper Metolius Watershed. This watershed is composed of 11 subwatersheds within the B& B Fire perimeter. Bull trout *Salvelinus confluentus* is a federally listed threatened species. Redband trout *Oncorhynchus mykiss* is on the Regional Foresters sensitive species list. These two species exist within the project boundary (Map 3.7 and Map 3.8). Essential chinook salmon *O. tshawytscha* habitat is also defined by NOAA Fisheries within the Upper Metolius Watershed. These species will be used to analyze the effects to aquatic fish habitats, including other native species associated with similar habitats.

Eight fish species occur within the project boundary and are: brook trout *S. fontinalis*, bull trout, redband trout, brown trout *Salmo trutta*, kokanee salmon, *O. nerka*, mountian whitefish, *Prosopium williamsoni*, longnose dace *Rhinichthys cataractae*, and sculpin *Cottus* sp. These species inhabit lakes and the intermittent and perennial streams within the project area.

BULL TROUT STATUS AND DISTRIBUTION

The Metolius bull trout population continues to recover since listing in 1988, with redd counts peaking in 2004 at over 1000 redds (Figure 3.38, data on file). Continued protection of the spawning population made through restrictive angling regulations in the entire watershed has resulted in this recovery. Bull trout spawn in most perennial tributaries of the Metolius River. Recent surveys have found bull trout are expanding spawning habitat to include Spring Creek, and the Metolius River upstream of Lake Creek. Additional rearing only habitat includes Brush Creek and Abbot Creek and recently Lower Lake Creek.

Bull trout are associated with a range of habitat types depending on life history strategy and age. Juvenile bull trout are closely associated with headwater streams, preferring water temperatures <13^{o}C (Fraley and Shepard 1989; Rieman and McIntyre 1993; Houslet and Riehle 1998a). Subadults typically emigrate from these natal headwater streams to large bodies of water such as lakes, large rivers and reservoirs where they live and feed until age five when spawning migrations occur to their natal stream. Bull trout spawning begins in late May and June as they stage at the mouth of the Metolius River and begin moving upstream. Spawning occurs in September and completed by the middle of October. For a more comprehensive life history of the Metolius bull trout population see (Riehle and Nolte 1992, USDA and USDI 2003).

The Metolius River bull trout population contains a mixture of both river dwellingand lake dwelling fish. Some resident fish may exist in the upper Jefferson Creek tributaries. All life strategies use tributaries to the Metolius River for spawning. Spawning occurs in spring-fed reaches of Jack Creek, Heising Spring, Canyon Creek, Roaring Creek, Candle Creek, Jefferson Creek and Whitewater River (Map 3.7). Mainstem river spawning has been documented in only a 0.5 mile reach of the upper Metolius River near the mouth of Jack Creek. Rearing habitat is known in all spawning streams plus Brush Creek, Spring Creek near Lake Creek, and the Metolius River. Abbot Creek is dominated by redband trout but an occasional bull trout is reported during annual surveys. Lake Billy Chinook (Round Butte Dam) provides additional rearing habitat. Street and Spring Creeks, tributaries to the Metolius Arm of Lake Billy Chinook, are suspected to provide additional secondary rearing habitat for the Metolius bull trout population. Fish surveys of these two streams found only one juvenile in Street Creek but not in Spring Creek.

Most juveniles move out of the spawning and rearing streams at age 2 and move into the Metolius River and eventually into Lake Billy Chinook. Primarily, age 3 and older bull trout reside in the lake. At age 5, most bull trout mature and move up the Metolius River and into tributaries to spawn.

In the Metolius basin, young bull trout less then 100 mm were found most consistently in the coldest, spring-influenced tributaries (Ratliff 1992). In the Metolius River system, bull trout Age 0+ range between 20-40 mm, 1+ range between 60-99 mm, 2+ range between 100-159 mm and 3+ are greater than 160 mm (Ratliff et al. 1996). In other systems, bull trout less than 110 mm feed on aquatic insects, macro-zooplankton, and mysids while those larger are primarily piscivorous (Horner 1978; Shepard et al. 1984). Growth differs little between resident and migratory forms during stream residence but diverges as migratory fish move into larger and more productive waters. Resident adults range from 150 to 300 mm in length (Geotz 1989; Mullan et al. 1992) while migratory bull trout commonly exceed 600 mm (Pratt 1984; Shepard et al. 1984; and Goetz 1989).

The Metolius River/Lake Billy Chinook bull trout is a sub-population of the Deschutes Recovery Unit and is healthy as stated by Ratliff and Howell (1992) and Buchanan et al. (1997). Trends in spawning population size have increased since 1986 from 27 redds to over 800 redds by 2003 (Figure 3.38). The increase is attributed to protection from harvest by more restrictive angling regulations (Riehle et al. 1997). The Metolius bull trout population is the only population with an allowable angler harvest in the state of Oregon. Oregon Department of Fish and Wildlife regulations allow one bull trout over 24 inches to be harvested daily on Lake Billy Chinook.

Significant increases in bull trout spawning counts were made in Jefferson Creek and Candle Creek. There was concern for the population after the Jefferson Fire of 1996, where 2 miles of Jefferson Creek and 2 miles of upper Candle Creek were burned. Also, a 100-yr flood event occurred in 1996 prior to the Jefferson Fire that scoured much of the existing spawning gravel, reducing the available bull trout spawning habitat (Houslet et al. 1999). Bull trout in these two streams were observed spawning during the B and B Fire in 2003.

The known spawning areas in the Metolius River are confined to a ½ mile reach near the mouth of Jack Creek, where there is significant groundwater upwelling in the channel and from various spring along the riverbank. Spawning habitat has expanded with the increased numbers of adults in the system. Newly documented spawning areas have been found in Spring Creek and the Metolius upstream of Lake Creek. Juvenile bull trout have been found in Lower Lake Creek, near the springs.

Juvenile bull trout densities in the tributaries and in the upper Metolius River monitoring sites have remained relatively unchanged (**Error! Reference source not found.**3.39). The most change in juvenile densities was noted from a high in 1995 and a decrease after the 1996 flood (USFS 2004a); most significantly in rearing only streams. Juvenile densities recovered within a short period after the flood. Densities of bull trout in the streams in which rearing but no spawning occurs have been more variable. The year 1995 was a significantly high year for Brush Creek and Upper Canyon Creek (USDA 2004a).

Growth of bull trout within this drainage is slow for juveniles due to cold temperatures, yet fast for ages three and older that move to Lake Billy Chinook (Pratt 1991). There is some evidence from the trap at the mouth of the Metolius River that fry growth rates may be decreasing, possibly a result of increased densities (Scott Lewis, Portland General Electric, personnel communication). Growth rates in Lake Billy Chinook are some of the highest reported in the literature (Riehle et al. 1997). Survival estimates have not been calculated but the population has increased with more restrictive angling regulations since 1983 (Riehle et al. 1997).

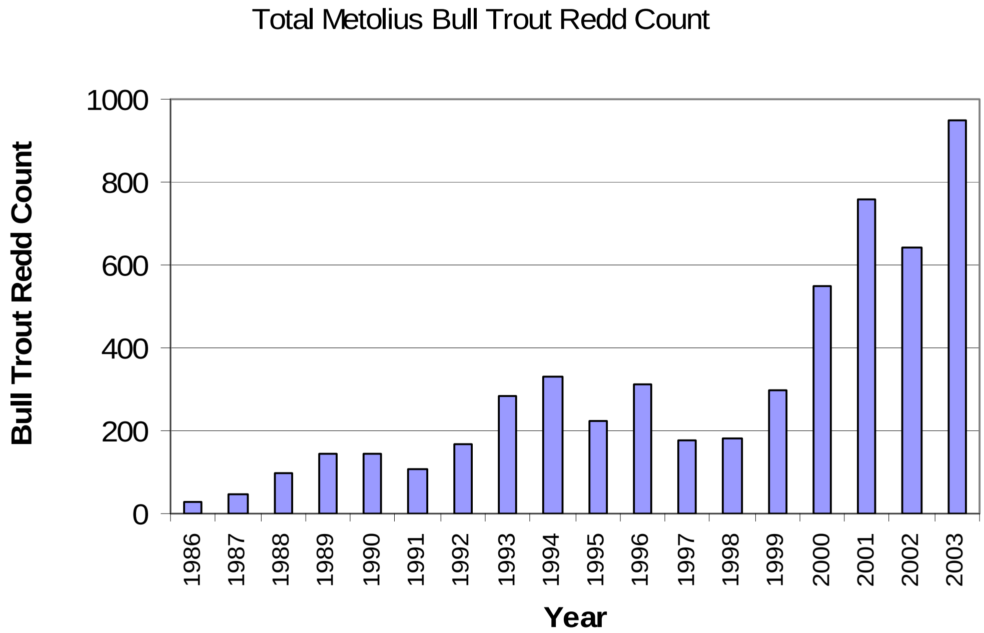
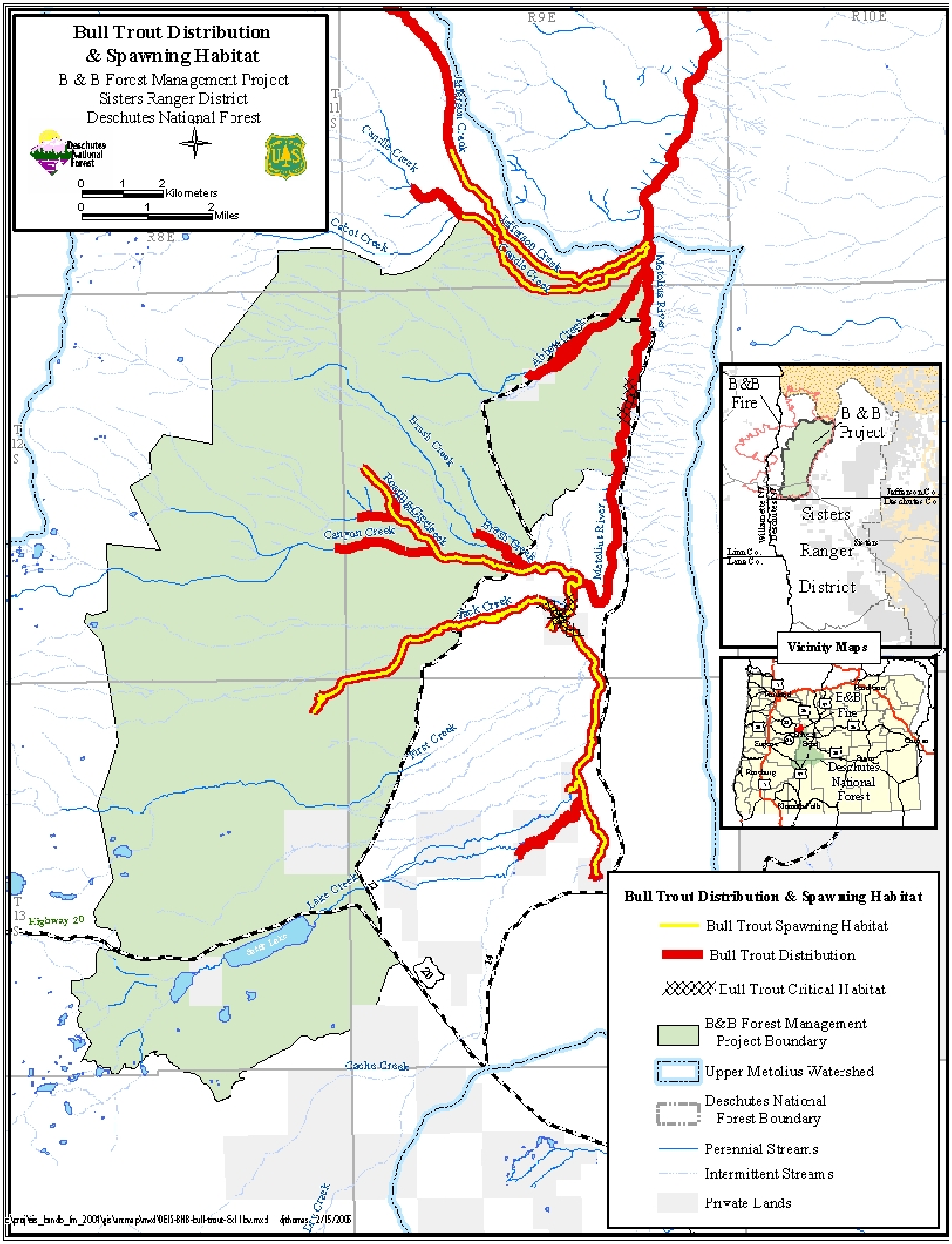


Figure 3.38. Redd counts for bull trout spawning areas in the Metolius Watershed from the year 1986 to 2003.

Map 3.7 – Bull trout spawning habitat and rearing habitat in the Metolius River and tributaries in relation to the project area. Critical habitat as designated on the Metolius River by the USFWS in located near the confluence of Jack Creek and the Metolius River, and 4 miles downstream.



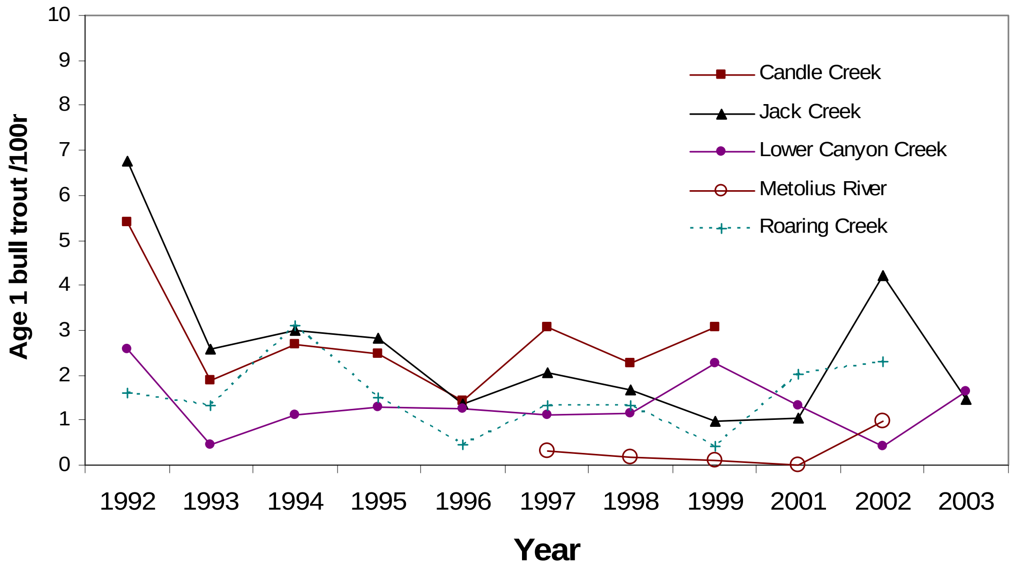


Figure 3.39. Juvenile bull trout densities for spawning streams in the Metolius Watershed.

REDBAND TROUT STATUS AND DISTRIBUTION

Redband trout population in the Upper Metolius Watershed has increased significantly since monitoring began in 1995. The Metolius spawning population has increased from 141 redds counted in 1995 to 1197 redds in the upper Metolius River in 2003 (Figure 3.40, data on file). Much of this increase may be attributed to the elimination of hatchery rainbow releases in 1995, more restrictive angling regulations, increase of instream wood from habitat projects and recovery from drought conditions. Redband trout inhabit most streams in the project area but have only been documented spawning in the Metolius River, South Fork Lake Creek, and Abbot Creek.

The Deschutes River population of interior redband trout spawns from April to July (Schroeder and Smith 1989). Within the Metolius Watersheds, Wilcox and Riehle (1996) suggested two distinct spawning periods may occur; a winter period and a smaller spring period. Recent studies have found redband trout in the Metolius River spawn from October to July (Hemmingsen and Buchannan 1993) now more narrowly defined from late December to June (Houslet and Riehle 1997).

Spawning temperatures ranged from 5^{o}C to 11^{o}C with the mode being 8^{o}C (Houslet and Riehle 1997). Water temperatures were very important to increasing redband trout spawning habitat.

Redband trout populations have recovered dramatically since the early 1990s (**Error! Reference source not found.**3.40). Listed as a ‘depressed population’ by ODFW in the Metolius Basin Fish Management Plan (Fies et al. 1996), the Metolius population has increased from 141 redds in 1995 to 1197 redds in the upper Metolius River in 2003. In year 2003-2004, redband trout spawning counts total 818 redds, 26% down from the previous year. Much of the overall increase may be attributed to the elimination of hatchery rainbow releases in 1995, increase of instream wood from habitat projects or recovery of low flow from the drought.

Redband trout use the upper 2.5 km of the Metolius River exclusively for winter spawning. As the Metolius River below the confluence of Lake Creek begins warming starting in February redband trout spawning habitat becomes increasingly available from Lake Creek to Jefferson Creek (Houslet and Riehle

1997). The tributaries Lake Creek and Abbot Creek are used only from February through May as water temperatures near 7°C (Map 3.8).

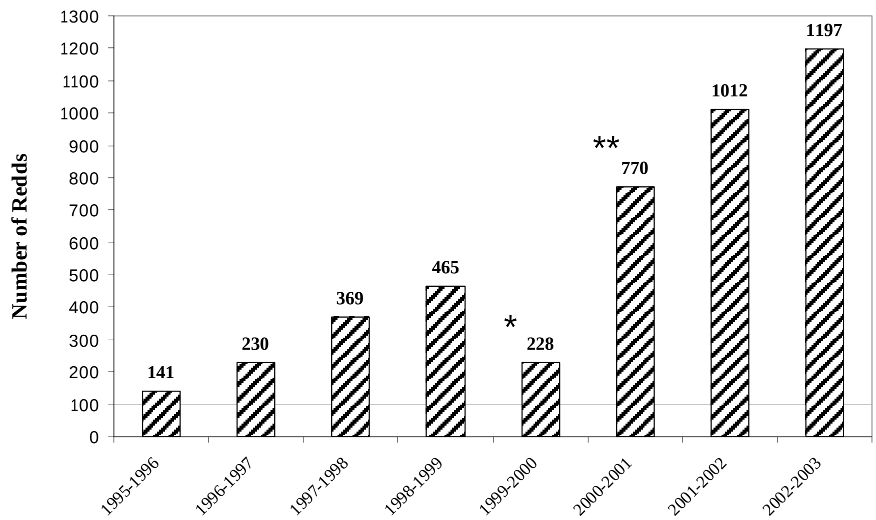
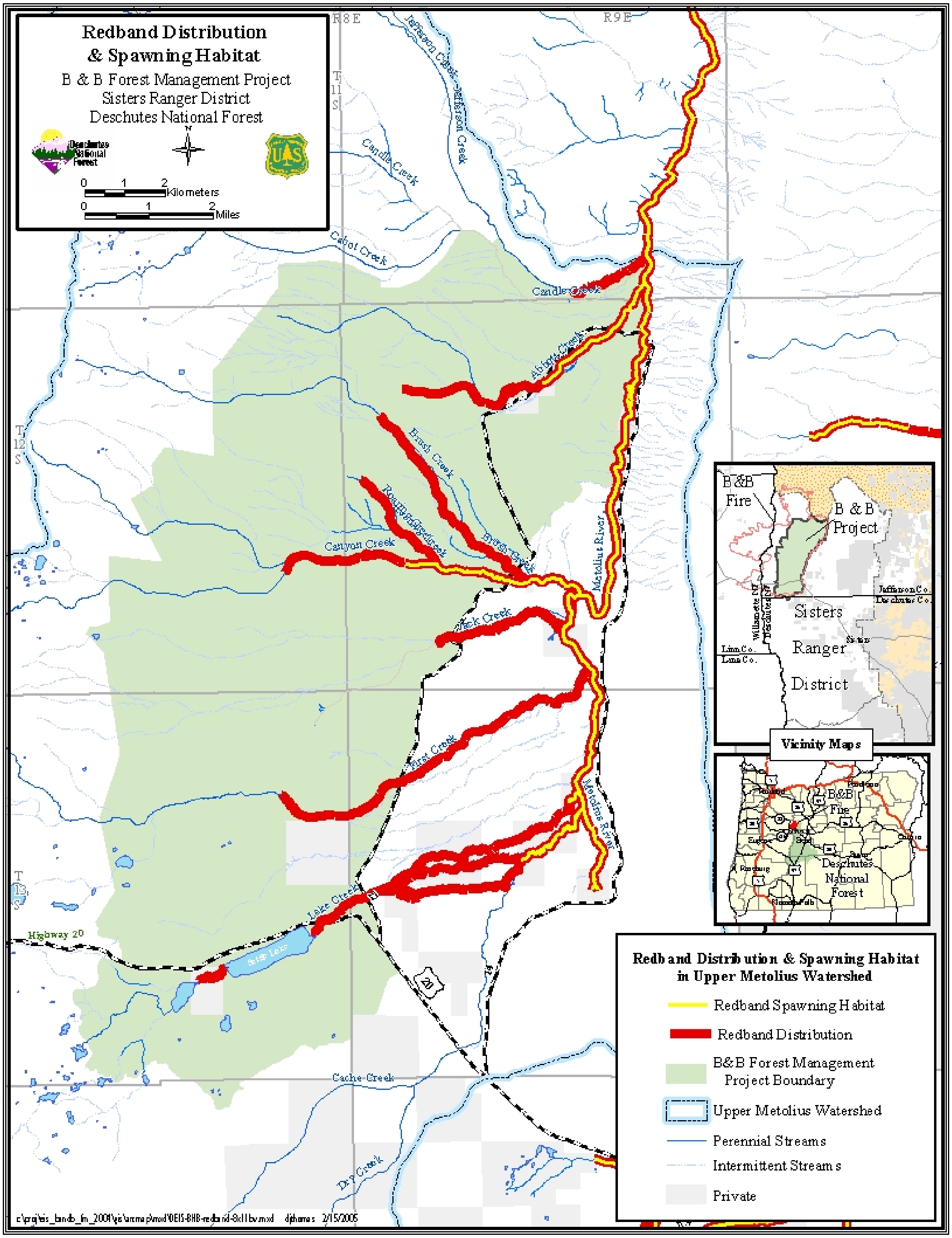


Figure 3.40. Metolius River Redband Redd Counts 1995 through 2003 (Sections 0 through 7). Single asterisk denotes Sections 6-7 were not surveyed in 1999-2000 and sections 0-5 were not surveyed as frequently as other years. Double asterisk denotes Sections 6-7 were sampled less frequently in 2000-2001 than in other years.

Map 3.8 - Redband trout spawning and rearing habitat distribution in the Metolius River and tributaries in relation to the project area.



CHINOOK SALMON STATUS AND DISTRIBUTION

Chinook salmon and sockeye salmon have been released on an experimental basis into the Metolius River and selected tributaries. The upper Deschutes and Crooked River basins have been identified as Essential Fish Habitat under the Magnuson-Stevens Act. This act protects habitat important to commercial ocean fisheries. The Listing included the Upper Deschutes Subbasin with the likelihood future passage of anadromous fish will be passed through Deschutes River dams. Under the proposed new hydropower operating license for Pelton Round Butte Dams, fish passage will be a part of the new operation at the dam complex on the Deschutes River. This proposed reintroduction marks a return to anadromy to the watershed.

Chinook salmon may be released for reintroduction as early as 2008 under the fish passage plan for Pelton Round Butte Dams. Returns of adult salmon to the Metolius River are not expected until at least 2012.

OTHER FISH SPECIES

Sockeye salmon were native to the watershed, and once reintroduced, would use the Metolius River for spawning and Lake Billy Chinook for rearing. The native population used Link Creek for spawning and Suttle Lake for rearing. Native kokanee salmon reside in Suttle Lake today and with fish passage renewed at Pelton Round Butte Hydroelectric Project, sockeye salmon may again use the Suttle Lake/Link Creek system once again, as well as spawning in the Metolius River.

Brook trout have been introduced in high mountain lakes, primarily in the wilderness areas. Fish introduced to the lakes in some cases are suspected to reduce native amphibian populations. These introduced brook trout populations could also distributing downstream in the watersheds that contained native bull trout. Brook trout populations have been monitored since 1992 in habitat where they overlap with bull trout rearing areas. Houslet and Riehle (1997) show a 20% niche overlap between the two species using only water temperature. In all habitats monitored, brook trout populations have been low and variable. Under the ODFW Metolius Fish Management Plan (Fies et al. 1996) brook trout are no longer stocked in lakes within the Upper Metolius Watershed that could contribute to bull trout habitat. Naturalized populations of brook trout remain in some high lakes such as Round Lake and First Creek where streams provide adequate late season spawning habitat. Brook trout are also found in Canyon Creek and have been documented hybridizing with the native bull trout.

Mountian whitefish are a native species to the Metolius River and is found in the lower reaches of some of the major tributaries. This species inhabits similar habitat as trout but may use areas of the stream slightly faster than trout in some cases. This species is numerous in the Metolius River, and can outnumber trout in some reaches.

Brown trout were introduced in the 1930’s (Fies et al. 1996). Brown trout populations are not monitored in the Upper Metolius Watershed. Brown trout are found in Suttle Lake, Link Creek, Lake Creek, the Metolius River and Lake Billy Chinook.

FISH HABITAT OVERVIEW

Tributaries of the Metolius River originate at the crest of the Cascade Divide, and flow approximately 10 miles east to the Metolius River. The high elevation meadows have low gradients, and then the streams become steeper as the channels descend into glacial valleys on the eastern edge of the wilderness. These steeper A and B type channels (Rosgen 1996) have cascades and falls that can act as natural barriers to fish migration. Below the glacial valley is an area of glacial outwash, with low gradient valley bottoms that are defined by ancient lava flows or lateral moraines. Channel types in the lower 3 or 4 miles of the tributaries are generally Rosgen C channel types and have meanders that form lateral scour pools and riffles. Much of the spawning habitat is located within the C type channels where groundwater springs rise to the surface and gravel is abundant.

Abbot Creek- This stream is a low gradient spring fed stream with meadows and wetlands in the middle reaches. The upper watershed is primarily intermittent north and west of Abbot Butte. The watershed was 80% burned stand replacement in the BandB Fire. Redband trout use the stream as a primary spawning tributary from April through June. Due to the small size of the stream and the loss of live trees in the riparian area, the stream may be warmer in the short term during the summer as a result of the wildfire, and may remain at higher temperatures than bull trout would use for spawning. Bull Trout only use Abbot Creek for rearing habitat.

Candle Creek- A cold spring- fed stream, Candle Creek has its origins in the Mt Jefferson Wilderness. As much as 70% of the flow originates from springs in the lava flow that runs along the stream bank for nearly half of its length. The stream is a primary spawning habitat for bull trout and the lower reach is used for kokanee salmon spawning. Habitat is complex, with logs, boulders and overhanging shrubs. This stream was burned in the BandB Fire and has a 2 mile reach that has mostly dead trees. One of the coldest streams in the Metolius Basin, Candle Creek may increase in temperature slightly but will likely remain good spawning habitat as the riparian shrubs regrow.

Canyon Creek – Canyon Creek is a snow melt driven subwatershed that receives spring-fed flow from Roaring Creek and Brush Creek in its lower reaches. The character changes to a cool water, pool-riffle stream downstream of Roaring Creek and offers spawning habitat for bull trout and kokanee salmon. The substrate downstream of Roaring Creek is low in fine sediment, possibly a reflection of the frequent winter and springtime high flows. Log jams in the pools are common in this larger tributary. Roaring Creek is a cool water spawning tributary to Canyon Creek and offer good spawning gravel for bull trout. Brush Creek is a smaller tributary with a upper watershed that was burned with high tree mortality in the B and B Fire. This stream had bull trout rearing but is not cool enough to be used by spawning bull trout. This stream may be warmed by the loss of canopy from the fire.

First Creek – This stream is a flashy snowmelt drive stream with low summer flow. The flow diminishes to zero in the lower reach in the summertime but perennial reaches in the upper watershed support redband trout and brook trout. Large flows during runoff and high snow melt periods yield increased flows and sediment to the Metolius River, just 1 mile upstream of bull trout spawning habitat. The entire upper watershed was burned with high serverity, with even the downlogs consumed. Some rill erosion was noted during the first rains in the fall of 2003 and 2004, but no major sedimentation has been observed to occur to date.

Jack Creek – This spring driven stream supports a large population of spawning bull trout and is a major bull trout rearing habitat in the upper Metolius Watershed. The high instream wood density and spawning gravels make Jack Creek an important refuge for bull trout in the system. Although the upper watershed was burned with high mortality, the riparian area of Jack Creek received only underburns and small pockets of tree mortality from the fire. Little change is expected to occur to Jack Creek, although there is some risk of sediment entering the system from the upper subwatershed from intermittent tributaries.

Jefferson Creek – This watershed is primarily in the Mt Jefferson Wilderness or in Conditional Use Areas of the Confederated Tribes of the Warms Springs Reservation of Oregon. The larger subwatershed was burned in the BandB Fire and there is a reach approximately 2.5 miles long that was burned stand replacement along the channel. This stream is used by bull trout for spawning and has many log jams and rock waterfalls that bull trout negotiate on their migration. There is a significant bedload of glacial fines originating in the glacial tributaries draining Mt Jefferson that impact the spawning habitat of Jefferson Creek. Kokanee salmon spawn in the lower reach of the stream.

Lake Creek – This stream is listed on the 303(d) list for temperature because its source is the outlet watershed from Suttle Lake. The creek is relatively high gradient as it drops off the glacial moraine that forms Suttle Lake. The lower reaches are split into 3 forks that meander toward the Metolius River. The lower reaches may have been spawning habitat for chinook salmon historically. Redband trout use the lower reaches for spawning habitat in the springtime. The source of flow for Lake Creek and Suttle Lake is Link Creek, which is the outlet of Blue Lake. Blue Lake is mostly spring fed but in the summertime, the waters are warmed in the shallow Suttle Lake before entering Lake Creek. The flow regime is moderated by the lake.

Metolius River – The Metolius River is a large springfed river that offers important spawning habitat for redband trout, bull trout, chinook salmon, kokanee salmon, brown trout and mountain whitefish. The upper reach near the spring is the most important spawning and rearing habitat due to the spring flows and the abundant gravel. Pools and large wood are limited in the river but are important for habitat for the variety of fish species. Water quality is high due to the spring fed source and the relative low level of development in the watershed.

Suttle Lake – This lake has its source in springs that feed Blue Lake, which flows ½ mile downstream in Link Creek to Suttle Lake. The water quality changes to warm and algae rich in the summertime. Monitoring is 2004 found high levels of bluegreen algae but no dangerous levels of toxin. Native kokanee salmon and introduced brown trout dominate the fish community. Bull trout and sockeye salmon were native to the lake historically.

Round Lake – The glacial lake lies within the upper headwaters of an intermittent tributary to First Creek. There are no native fish in the lake, but brook trout inhabit the lake from introductions by Oregon Department of Fish and Wildlife. The lake has a small inlet and is habitat for a variety of wildlife.

Bull Trout Critical Habitat

Responding to a court order, the U.S. Fish and Wildlife Service announced in September of 2004 that it had designated approximately 1,748 miles of streams and 61,235 acres of lakes in the Columbia and Klamath River basins of Oregon, Washington, and Idaho as critical habitat for the bull trout under the Endangered Species Act. The Service also recognized conservation and management efforts by states, tribes and agencies.

Critical habitat refers to specific geographic areas that are essential for the conservation of a threatened or endangered species and which may require special management considerations. A designation does not set up a preserve or refuge and only applies to situations where Federal funding, permits, or projects are involved. It does not affect citizens engaged in activities on private land that do not involve a federal agency.

In the Metolius Basin, critical habitat was designated at Heising Spring and along the Metolius River on a ½ mile reach between Wizard Falls and Bridge 99 (Figure 2). The Heising Spring area, including Jack Creek and the Metolius River is an important spawning habitat for bull trout. The Metolius River reach downstream of Wizard Falls has good island and side channel habitat for rearing bull trout but no spawning has been documented in that segment.

Bull trout habitat in the Metolius River drainage and Upper Deschutes below Steelhead Falls are generally in good condition. Water temperature in most spawning and rearing streams are below 10° C during spawning and rarely exceed 12° C during the peak of the summer. Juvenile habitat in the form of undercut banks, overhanging vegetation, aquatic vegetation and wood is abundant in many of the rearing streams tributary to the Metolius River. Wood density is high compared to other basins. Due to the stability of the streams, little wood is transported out during normal spring flows. Fine sediment in spawning areas is a concern and may have increased from past road construction and riparian logging. The low gradient, spring-fed reaches are particularly sensitive to fine sediment loading due to their low sediment transport rates. The percentage of fine sediment in spawning gravel monitored is moderate to low and has declined as a result of the 1996 flood (Houslet and Riehle 1998b). If fine sediment had historically increased from past management activities, we may still be witnessing the effects to the springs today, due to their stable nature.

Redband Trout Habitat

Redband trout primarily use the Metolius River, Lake Creek and Abbot Creek. Because of the removal of wood in the early 1900s, the Metolius River has low wood densities and few main channel pools. The upper reaches of the Metolius River have particularly low large wood densities, low percent cover and few slow velocity rearing areas for redband trout. Although some recovery of wood is occurring though habitat projects by the USFS, the recovery of large instream wood is slow. Spawning gravel in the river is in good condition, particularly in the upper reach near the spring. Nearly 90% of the spawning of redband trout in the basin occurs in the upper 2 miles of the river. Low flows in recent years have made the spring reach shallow, and may be reducing the spawning area used by redband trout in that reach of the Metolius River. Habitat in Lake Creek is stable because the fire burned little of the riparian area and the flows are controlled by Suttle Lake. Abbot Creek is a tributary used for spawning and this stream is impacted by the fire. All of the Abbot Creek watershed is burned and 52% of it in high mortality, and 54% high mortality in the riparian reserves. The redband trout spawn primarily in the lower reaches of this stream, where tree mortality is mixed. There is some risk of sedimentation from the fire in Abbot Creek and increases in summer temperatures (USDA 2004a).

Chinook Salmon Essential Fish Habitat

Habitat for chinook salmon was documented in historic reports in a review by Nehlsen (1995). She described chinook salmon spawning in the Metolius River and collection were made in the Camp Sherman area to supply the hatchery with eggs. Historic reports of salmon being caught in traps in Lake Creek were given as evidence of use in that stream. The upper reach of the Metolius River is thought to be the primary spawning habitat for historic Chinook salmon populations. Recent growth rates examined of age 1 chinook were fastest in the experimental fry released in the springs at the Head of the Metolius River and condition factors were good in lower Lake Creek. (Jens Lovtang, OSU, personnel communication). Although rearing could occur in other tributaries and lower in the Metolius River, the springs may be important for early rearing and spawning habitat.

Rearing habitat is thought to be within the optimum temperature range for Chinook salmon in limited reaches of the Metolius River and in most of the year in Lake Creek. Juvenile Chinook salmon caught in juvenile trap in the mouth of the Metolius River were found to be small on average. It is unknown if additional rearing and growth would occur after the juvenile chinook migrate out of the Metolius River system. Larger smolts would have better survival to the ocean.

Fish Habitat Risk Analysis From Watershed Analysis

Risk to channel morphology and fish habitat was assessed in the Metolius Watershed Analysis Update by integrating streamflow and sedimentation concerns for streams known to provide fish habitat (USDA 2004a). Analysis consisted of rating existing key fish habitat and comparing it to the predicted watershed response ratings. The predicted watershed response ratings were taken directly from the tables in the Water Quantity and Water Quality analysis sections of this document (see hydrology section). Fish habitat variables that were rated include percent unstable stream banks, water temperature, percent pools, large woody debris per mile, and percent fine sediment. In addition, the miles of current bull trout and redband spawning and bull trout rearing habitat were considered when assigning the fish habitat value factors. All these variables describe the existing fish habitat condition (USDA 2004a).

The fish habitat value factors were determined by summing the number of variables meeting or exceeding the criteria for each stream. The criteria used to evaluate the existing fish habitat were general and should only be used as a tool to evaluate relative risk differences between streams. The predicted risk to fish habitat and channel morphology by stream was rated by summing the fish habitat value factor, the streamflow risk factor and the sedimentation risk factor (USDA 2004a).

Based on this exercise, fish habitat and channel morphology risk was summarized by subwatershed (USDA 2004a, p Aq-67, 68). Subwatersheds within the project area with the highest aquatic risk are Candle subwatershed (including both Candle Creek and Cabot Creek drainages), Canyon subwatershed (specifically upper Canyon Creek and Brush Creek drainages), and Headwaters of the Metolius subwatershed, (from the Head Spring to Jefferson Creek confluence, primarily due to tributary inputs). These subwatersheds were of particular interest in the assessment of aquatic and fish effects for the proposed actions of the B&B Fire Recovery Project on important bull trout, redband and chinook salmon habitat.

EFFECTS OF THE ALTERNATIVES

A Biological Assessment (BA) was prepared to document and review the findings of the B&B Fire Recovery Project for potential effects on species that are:

1. listed or proposed for listing by the USDI Fish and Wildlife Service as Threatened or Endangered; or
2. designated by the Pacific Northwest Regional Forester as Sensitive; or
3. required consultation with the National Marine Fisheries Service under the Magnuson-Stevens Fishery Conservation Act. It was prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4, and the Endangered Species Act of 1973, as amended (Subpart B; 402.12, Section 7 Consultation).

The determination in the Biological Assessment (BA) was that the project would not likely adversely affect (NLAA) bull trout or their habitat, or impact redband trout individuals or their habitat. The project was found to have no adverse effects to Essential Fish Habitat for Chinook salmon.

The following section describes the potential effects of salvaging timber within the project area on threatened, endangered, and sensitive fish species. This determination, required by the Interagency Cooperation Regulations (Federal Register, January 4, 1978), ensures compliance with the Endangered Species Act (ESA). Changes to the R-6 Regional Forester’s Sensitive Species List were instituted on November 28, 2000.

The effects of the B&B Fire Recovery Project will be assessed using bull trout, redband trout and chinook salmon habitat requirements. Other fish species that are sympatric with these species will have similar habitat requirements associated with the listed species. Listed species will be surrogates for the other species and their habitat needs.

SUBPOPULATION CHARACTERISTICS

Measure: fish population size, number of life history strategies, growth rates

Direct, Indirect and Cumulative Effects
Alternative 1
There would be no direct or indirect effects to the bull trout and redband trout populations by implementing alternative 1. Disturbances to individuals would not occur and populations are not expected to change because of no action. There are no expected cumulative effects to population size from no action because the population is not expected to change as a result of no action.

Growth rates of bull trout or redband trout would not be significantly affected by no action. There is some chance in that increased sun exposure to rearing streams such as Abbot Creek and Brush Creek may increase growth rates slightly but over all, growth rate changes may not be detected in the population. Nutrients, primarily nitrate and phosphorous, may increase for several years in the post fire environment but there is no expected change in growth rates because nutrients are not known to be a limiting factor for trout growth rates.

The no action alternative will not change the life history diversity of the Metolius bull trout population because assess to habitats will not change.

Alternative 2, 3, 4, and 5.
There are no direct effects to population sizes of bull trout or redband trout from the action alternatives. Any effects from salvage, haul or road work would result in possible habitat changes and not directly impact population size. There are no expected cumulative effects to population size from the action alternative because the population is not expected to be impacted as a result of the proposed actions.

Growth rates for bull trout or redband trout would not be changed directly, indirectly nor cumulatively by the action alternatives. No shade will be reduced because of the actions in the alternatives and stream temperatures will not be affected. Nutrient changes are not expected to change as a result of the action alternatives.

The action alternatives will have no direct, indirect or cumulative effects on the life history diversity of the bull trout population. Access routes will not be affected, and rearing in the tributaries will continue. Lake Billy Chinook should not be affected by any action alternatives because of the limited influence the action alternative will have on sediment and flow at the watershed scale (see Hydrology section). Cumulative effects from other projects in the watershed are not expected to contribute to changes in the life history of bull trout populations in the watershed.

FISH REARING HABITAT

Water Temperature

Brush Creek and Canyon Creek exceeded the 2002 water temperature criteria for bull trout and First Creek exceeded salmonid spawning temperatures. The temperature profiles for these three streams were evaluated under the Upper Deschutes and Little Deschutes Water Quality Restoration Plan (Draft; USFS 2004b). Prior to the B&B Fire, Brush Creek and Canyon Creek met the 2004 ODEQ bull trout temperature criteria. Water temperatures were altered to some degree in streams used by bull trout for rearing only, after the B&B fire burned much of the Upper Metolius Watershed. The 7-day average maximum water temperatures in Brush Creek, Candle Cr and Abbot Creek increased in 2004 over previous sampling years (see Hydrology section). Water temperatures in Jack Creek, Jefferson Creek, and Canyon Creek did not increase in 2004, compared to previous sampling years (see Hydrology section).

For Essential Fish Habitat for chinook salmon, water temperature criteria needs to be between 10 and 13.8^{o}C for a appropriately functioning system (NOAA criteria, programmatic Biological Assessment, USDA and USDI 2003). All perennial fish bearing streams meet this range except the Lake Creek system. The warm surface water released from Suttle Lake precludes Lake Creek from meeting the salmon temperature range during the summer months and can get as low as 3^{o}C during the winter.

Measure: streams meeting bull trout 12 ^{o}C criteria, stream shade

Direct, Indirect and Cumulative Effects

Alternative 1

There would be no direct or indirect effects to water temperature of fish bearing streams by implementing the Alternative 1. No harvesting would occur. Current shading of intermittent and perennial streams would be maintained and improved as natural recovery processes continue. Water temperatures within bull trout spawning streams are currently meeting bull trout water temperature criteria one year after the fire. Lake Creek is currently listed for not meeting summer salmonid rearing water temperature criteria. A water quality restoration plan is being written to address this concern (USFS 2004b). For 2004 Lake Creek is required to meet bull trout water temperature criteria of 12^{o}C because two bull trout juveniles were found in Lake Creek within 1 mile of the mouth. Brush Creek is the only other stream in the Upper Metolius Watershed containing rearing bull trout not meeting the 2004 bull trout temperature criteria. After the B&B fire, water temperatures in Brush Creek increased, having a 7-day average maximum water temperature of 13.4^{o}C. As riparian vegetation continues to recover water temperatures are expected to recover to less than 12^{o}C. Cumulative effects of no action are not expected because there are no effects to stream shade from this alternative. Subsequent future wildfires that occur in the riparian reserves of Brush Creek may reduce future shading from the trees that grow back after the B&B Fire.

Alternatives 2, 3, 4, and 5

Direct effects to stream shade are not expected from any action alternatives because no shade will be removed. Danger trees removed from the riparian reserve will not reduce shade because the hazards will be felled greater than 100ft from the stream. No temperature changes to bull trout habitat, redband trout habitat or Chinook habitat are expected to occur as a result from any action alternative or in addition to other past or foreseeable projects occurring in the basin (see Hydrology section). Indirect effects of decommissioning and inactivating stream crossings and the riparian trees that may grow in the former road increase long term shade a minor amount. Since many of these crossings are not along fish bearing streams, this effect to bull trout, redband trout and Chinook salmon habitat is minimal, but beneficial.

There are no cumulative effects to water temperature in fish habitats from this project or in addition to other past, present and foreseeable projects.

Streambed Embeddedness

Embeddedness was measured in most of the spawning streams and the Metolius River in 1988 and was near 30% for most streams except the Metolius River and Abbot Creek (Riehle 1993). Low cobble embeddedness, providing spaces between the gravel and cobble, can provide cover for juvenile fish but other habitat features, such as undercut banks and wood, may provide adequate juvenile rearing habitat in most streams of the project area (Riehle 1993). Under current conditions redband and bull trout spawning populations continue to rise, suggesting the current embeddedness, or other cover components, may be appropriate for the environment and not hindering trout production in the Upper Metolius Watershed.

Measure: percent gravel/cobble embeddedness

Alternative 1

Direct, Indirect and Cumulative Effects

The effects to sedimentation of streams are assessed in detail in the Hydrology section. The direct and indirect effects of sedimentation from Alternative 1 were found to be similar to the current level of sedimentation from the existing roads that are eroding fine sediment to the streams. Under the no action alternative, the 37 miles of high risk roads would not be decommissioned or inactivated and the 88 connected road segments would not receive improved drainage work. The effects of these roads and the interaction with the fire effects would continue under Alternative 1. The streams most at risk are those in high risk watersheds identified in the Watershed Analysis Update (USDA 2004a, p72-75), and include Abbot, Candle, Canyon, First and Lower Lake. Of these, redband trout spawning habitat in Abbot Creek may continue to receive sediment inputs from roads. In Canyon Creek, the tributary Brush Creek may continue to receive some fine sediment input from roads that contribute to bull trout rearing habitat downstream of the burned area. Candle Creek also was identified as have elevated risk from the fire and having opportunities for road reductions (USDA 2004a, pEX-25). There is expected to be some trapping of fine sediment inchannel as dead trees fall and create log jams. However, the increase in surface fuels could increase the risk of a future high severity fire, reduce effectiveness of future fire suppression efforts, and increase associated soil erosion in some stands.

The effect to cobble embeddedness from no action would not add to the current level of embeddedness or the potential for increased embeddedness resulting from the fire. Current levels of embeddedness is not considered limiting bull trout or redband production in Brush Creek, Canyon Creek, Candle Creek or Abbot Creek, subwatersheds identified with the most risk to fish habitat in the Watershed Analysis (USDA 2004a, p 67). Chinook salmon habitat in the Metolius River is little affected by the roads needing work because of distance from the river and the primary spawning habitat for Chinook is upstream of the major tributaries (Abbot Creek, Canyon Creek, Candle Creek, Brush Creek) most affected by the roads.

Alternatives 2, 3, 4 and 5

Direct, Indirect and Cumulative Effects

Upland erosion caused by activities in Alternative 2 would have only a negligible effect on sedimentation because only minimal activity would occur in the areas most likely to deliver sediment to the streams and stringent project design elements based on soil and water concerns would be implemented (see Hydrology section). Road decommissioning and inactivation, especially of the 37 miles of road most associated with aquatic concerns, would help restore infiltration and reduce overland flow and sedimentation to the same degree as the other action alternatives. In addition, Alternative 2 would have the most long-term beneficial effects from road drainage improvements associated with haul roads because the most road miles would receive treatments (93 miles). Effects of activities in Alternative 3 on sedimentation would be negligible and would have the least risk of increasing sedimentation in the long-term and the second least risk in the short-term due to a minimal amount of harvest (only danger tree removal) in the potential sediment contribution area and a substantial amount of long-term road improvements. Alternative 4 has the least impact on sedimentation and effects of the activities on sedimentation risk are negligible; however, reduction of sedimentation in the long-term would be less than the other alternatives because there would be less road improvement work. Overall, effects of activities in Alternative 5 on sedimentation would be negligible and would be very comparable to Alternative 3, except that the reduction in sedimentation over the long-term would be slightly less because culvert improvements would not occur (see Hydrology Section for detailed analysis of sedimentation effects).

No direct or indirect change in embeddedness is expected from the alternatives. The volume of sediment released from the treatment areas is not expected to be significant enough in volume to change the embeddedness, or open space in gravels in the streams of the project area. Much of the habitat for early fry cover for bull trout, redband trout and Chinook salmon is provided in overhanging streambanks, instream wood, aquatic vegetation and large substrate. Because the proposed activites would not increase landslide risk, the volume of sediment expected from this project would be minimal, and changes to existing intergravel space or rearing cover are not expected (see Hydrology, Sedimentation section). No added cumulative effect to embeddedness is expected from the action alternatives because the direct and indirect effects are estimated to be negligible.

Large Wood

Densities of large wood meet PACFISH and INFISH standards based on USDA FS level II stream surveys (Riehle 1993; USDA 1995). Sizes of instream wood tend to be in medium size classes predominately. Trees that have died from the effects of drought and associated insects and disease have been increasing instream wood densities in most mid elevation streams of the Metolius watershed. The Metolius River remains low in large wood due to instream wood removal programs during the earlier half of the century (USFS 2004a).

Instream wood densities of streams inventoried within the Metolius Watershed were generally above the INFISH standard of 20 logs >12 inch diameter per mile (USFS 2004). Wood densities were greatest in mixed conifer plant associations and meadow riparian areas with mixed vegetation types. Channels flowing along lava were generally in mixed conifer stands but had reduced wood densities due to the narrow riparian forests. Ponderosa pine forests had lower average densities and averages just above the INFISH standard of 20 logs/mile (USFS 2004a). Two reaches in the upper Metolius River in ponderosa pine wet forest type, did not meet the INFISH standard.

Measure: number of large wood pieces per mile

Direct, Indirect, and Cumulative Effects

Alternative 1
Little indirect effects to bull trout spawning or rearing habitat would occur as a result of implementing alternative one and allowing natural processes to occur. No effects to wood recruitment would occur that would affect bull trout and redband trout rearing habitat in water bodies within or downstream of the project area. There would be no effects to redband trout spawning and rearing habitat within the Upper Metolius Watershed on wood recruitment from implementing alternative one.

Disturbance is very important to the development and maintenance of habitat and for maintenance of community composition that ecosystems tend to depend on (Reeves et al. 1995). These disturbances provide the source material for wood recruitment. Wood will continue to be recruited to stream channels and across riparian habitat and uplands over the next decade. Benda et al. (2003b) and Bilby and Bisson (1998) provide a review of wood recruitment processes to channels. Chronic and episodic methods are reviewed and their importance was raised. The majority of trees recruited to channels occur within 120 ft of the stream edge (Benda et al. 2003b). Tree mortality as a result of wildfires especially stand replacement wildfires can provide chronic recruitment over decades as boles weaken and become susceptible to wind (Benda and et al. 2003b). After this initial spike in recruitment, wood inputs will lessen over time until stands adjacent to the channels mature and a new disturbance (e.g., insects, disease, fire) again occurs. These indirect effects of continued recruitment of wood to replace wood lost from the fire will continue to support the fish populations in the Upper Metolius Watershed over the next two to three decades. There is estimated to be a low rate of recruitment 40 to 50 years post fire, when the natural stands may begin to provide some larger wood to the stream as trees mature, especially in Abbot Creek, Canyon Creek, and Candle Creek (USDA 2004a). Any subsequent return of wildfire in the interim may set back the natural regeneration of the riparian trees and the recovery of large trees that could contribute to instream wood.

Alternatives 2, 3, 4 and 5
The B&B Fire Recover Project will not change the way wood is recruited to stream channels under any of the action alternatives. There are no activities impacting wood recruitment in within 100ft of a fish bearing stream. In Alternatives 2, 3 and 5 falling and removing along 2.7 miles of haul roads in riparian reserve would not remove trees that could fall into the stream naturally. In alternative 4, the miles of road with danger trees removed from the riparian reserve would be 0.9 miles. Removing the limited number of danger trees from farther than 100ft from the streams, while meeting down wood standard for riparian reserve function, would have the same effect on instream wood as under no action. No removal of danger trees will affect instream wood. A delayed effect of improved long term recruitment of wood would result from riparian reserve road decommissioning in the action alternatives. The acres along streams that would be improved would be small and primarily at the 43 stream crossings proposed for closure in the Abbot, Canyon Creek and Jack Creek subwatersheds..

Pool Frequency/ Pool Quality

Pool frequency is low (Table 26) in many of the tributaries of the Metolius River (USFS 1995). Pools can have good habitat from undercut banks and wood and overhanging vegetation (Riehle 1993), especially in streams such as Jack Creek (Table 3.183). Large pools occur in the Metolius River and provide holding habitat during spawning migrations of bull trout. The lower reaches of the tributaries have a few large pools for habitat of spawning adults but large wood, undercut banks and overhanging vegetation seem to provide holding habitat for spawners as well. Pool frequency is based on wetted width and not adjusted for channel type and local conditions. As studies progress, the desired pool frequency will be further defined for the Upper Metolius Watershed.

Pool quality for fish is described as large pools with greater than 3 ft in depth and pools with abundant cover from large wood. Streams that have good pool quality habitat in the project area include Jack Creek, a strong bull trout spawning stream (Table 3.184). The Metolius River has deep pools but wood is in short supply in the upper reaches. Jefferson Creek, Cabot Creek, Candle Creek, and upper Link Creek have pools with some wood.

Measure: pools per mile, pool depth, pools with large wood

Table 3.183. Average pools per mile and percent pools for streams in the Upper Metolius Watershed from Watershed Analysis (USDA 2004a).

Stream	Pools/Mile	Percent Pool
Abbott Creek	1	2
Bear Valley Creek	34	26
Brush Creek	5	2
Cabot Creek	18	23
Candle Creek	27	22
Canyon Creek	19	24
First Creek	18	51
Heising Spring Creek	0	13
Jack Creek	24	24
Jefferson Creek	7	11
Lake Creek	9	8
Link Creek	20	15
Metolius River	4	11
Roaring Creek	7	2
South Fork Link Creek	50	7
Upper Link Creek	40	18
Grand Total	18	19

Table 3.184. Inventoried pools, average residual pool depth, number of deep pools and number of pools with large wood in stream reaches within or draining to the project area.

STREAM	REACH	Average residual pool depth ft	Pool >3ft deep/mi	Number Pools >3ft deep	Pools with 1-3 large logs	Pools with > 3 large logs
Cabot Creek	1	2.0	9.9	46	26	1
Candle Creek	4	2.0	6.9	8	9	0
	5	2.0	0	0	5	0
Jack Creek	1	1.0	0	0	16	14
	2	2.0	36	4	8	0
Jefferson Creek	1	3.0	15.1	20	8	1
	2	3.0	6.3	11	4	0
	3	3.0	5.4	20	11	1
	4	3.0	6.7	7	4	1
	5	3.0	2.5	3	2	0
Link Creek	1	2.0	12.7	7	1	0
Metolius River	1	5.0	11.1	24	6	1
	2	3.3	13	25	12	1
	3	9.0	4.5	11	6	0
	4	5.0	4.2	5	2	0
	5	7.0	5.7	2	0	0
South Fork Link Creek	1	1.0	1.6	1	6	0
Upper Link Creek	1	2.0	4.2	5	10	0
	2	1.0	0	0	3	0

Direct, Indirect, and Cumulative Effects

Alternative 1

Implementing Alternative one would have no direct or indirect effects to pool frequency and quality. No wood will be removed from the riparian reserve. Pools will not change because no actions will be taken to change wood recruitment or instream wood. Alternative one would not increase fine sediment delivery from current levels from roads not closed under this alternative. Current levels of fine sediment are not filling pools, nor would it affect pool temperature. No cumulative effects to pools or pool quality will occur because no direct or indirect effects from no action will occur.

Alternatives 2, 3, 4 and 5

Action alternatives within the Upper Metolius Watershed would not affect pool frequency or alter the quality of pools in the system because natural wood recruitment would not be altered in any alternative. Because soil and water design criteria will be implemented in the action alternatives, the amount of fine sediment delivered to streams in the project area will not approach that required to fill pools or reduce their habitat value. Primary habitat for juvenile bull trout and chinook salmon is slow water habitats but cover is also a primary component. Increased sediment transport from the action alternatives alone will not measurably affect pool volume (for sedimentation analysis, see hydrology section).

Off-Channel Habitat

Backwaters and side channels provide important habitat for juvenile bull trout in spawning tributaries (Riehle 1993). Stable flow regimes provide alcove and backwater areas during all seasons. Natural recruitment of snags into the streams from the fire will increase side channel formation along streams in the high burn mortality areas. Log jams and the flooded areas that result can create side channels that can provide important rearing habitat for bull trout. Streams that received stand replacement or high tree mortality where this may occur include Brush Creek, Candle Creek, Abbot Creek and Roaring Creek (USDA 2004a).

Side channels are an important off channel habitat in upper Candle Creek, Jefferson Creek and the Metolius River (Table 3.185). More stable flow regimes maintain these side channels and provide long term habitats for rearing juvenile bull trout, redband trout and Chinook salmon.

Table 3.185. Percent side channels for inventoried streams in the project area.

Stream	Reach	Percent side channel
Cabot Creek	1	3.9
Candle Creek	4	0.0
	5	13.4
Jack Creek	1	9.0
	2	7.4
Jefferson Creek	1	1.7
	2	3.9
	3	5.9
	4	7.3
	5	6.7
Link Creek	1	8.6
Metolius River	1	4.5
	2	2.4
	3	18.1
	4	0.0
	5	0.7
South Fork Link Creek	1	1.0
Upper Link Creek	1	0.0
	2	0.0

Measure: percent side channels

Direct, Indirect, and Cumulative Effects

Alternative 1

Wood will not be removed from the zone of primary wood recruitment (100ft either side of channel) on fish bearing streams and there would be no effect from this alternative because there are to activities impacting instream wood. Side channels will increase as dead trees from the fire fall into the streams. This process is not effects by alternative 1. There are no direct, indirect of cumulative effects on side channels from this alternative.

Alternatives 2, 3, 4 and 5

Off channel habitats or side channels should not be changed measurably by the action alternatives. Wood and sediment deposition are the primary causes of side channel formation in the watershed. Because wood will not be removed from the zone of primary wood recruitment (100ft of each side of the channel) on fish bearing streams and there would be no effects to side channel habitats from these alternatives because side channels would not be altered. The direct, indirect or cumulative effects are negligible.

FISH SPAWNING HABITAT

Spawning Gravel Quality

Spawning habitat in the watershed has low to moderate levels of fine sediment and has declined with the flushing effects of the 1996 flood (Houslet and Riehle 1998b; USFS 2004a). Due to distribution of the species within the watershed, the levels of fine sediment for habitats used by bull trout is used as a measure of spawning habitat quality for all gravel spawners in the Upper Metolius Watershed.

As reviewed in the Watershed Analysis Update (USDA 2004a), fine sediment in trout and salmon spawning habitat remains a concern for the Metolius Watershed . Although the flushing effects of the 1996 flood remains in many streams, some increases of fine sediment has occurred in Canyon and Lake Creek since 1996. The flushing effect of the 1996 flood on Jefferson Creek may have also moved spawning sized gravel from the stream, reducing available area of spawning habitat. The Metolius River upstream of Lake Creek increased in fines, but may have had too high of sampling variability to provide an adequate test (USDA 2004a).

Average fine sediment (< 6.4 mm) in all tributary spawning sites is approximately 29% (range from 17 to 44%), and approximately 28% in the Metolius River above Lake Creek. US Fish and Wildlife Service recommends fine sediment <20% in spawning gravels for a properly functioning bull trout habitat (USDA and USDI 2003). Although, fine sediment levels (<6.4 mm diameter) are slightly above the USFWS recommendation for <6.4 mm fines, the Upper Metolius Watershed supports a robust spawning population of both redband trout and bull trout. Levels of fine sediment in the Upper Metolius Watershed streams were found to be similar to that of the chinook salmon and bull trout spawning habitat of the upper Warm Springs River (personal communication, Mike Weldon, Fishery Biologist, Bureau of Natural Resources, Warm Springs).

Houslet (2000) found fine sediment <0.85 mm to be sensitive to disturbance in the Upper Metolius Watershed, more than measurements of fines <6.4 mm diameter. USFWS criteria for appropriately functioning bull trout habitat also suggests fine sediment <0.85 mm diameter to be less than 12%. Current levels of fine sediment <0.85mm are less than 10% for spawning and rearing habitat within the Upper Metolius Watershed (USDA 2004a). Fine sediment <0.85 mm diameter continue to show fluctuation in sampling years but remain within the levels recommended by USFWS as functioning appropriately.

The Metolius Watershed Analysis Update identified Candle Creek, Canyon Creek (including Brush Creek), and the Headwaters of the Metolius River (Head Springs to Jefferson Creek), for increased risk to fish habitats after the B&B Fire (USDA 2004a, p. 69-71). These subwatersheds were assessed using indicators of risk to changes in sedimentation and stream flow (and subsequent channel changes). The risk factors were then considered together with the value of the habitats for bull trout and redband trout.

Measure: percent fine sediment in spawning gravel

Alternative 1

Direct and Indirect

There would be limited indirect effects of fine sediment by implementing alternative one. Soil disturbance from skidding, slash disposal and hauling within the uplands and potential sediment contribution areas would not occur under alternative 1, allowing vegetation to continue to recover. Dead trees would be slowly recruited to the forest floor over decades providing sediment retention and organic matter improving forest floor functioning of plant growth and stability.

Under no action, sedimentation from roads would continue to occur and there would be no decommissioning or drainage structure construction that would reduce these impacts. Although much of the erosion control work to roads has been done under BAER treatments, including upsizing large culverts and bridge replacements, many miles of road were not worked on and would continue to contribute sediment even without logging and haul. Under the no action alternative, the 37 miles of high risk roads would not be decommissioned or inactivated and the 88 connected road segments would not receive improved drainage work. The effects of these roads and the interaction with the fire effects would continue under Alternative 1. The streams most at risk are those in high risk watersheds identified in the Watershed Analysis Update (USDA 2004, p72-75), and include Abbot, Candle, Canyon, First and Lower Lake. Of these, redband trout spawning habitat in Abbot Creek may continue to receive sediment inputs from roads. In Canyon Creek, the tributary Brush Creek may continue to receive some fine sediment input from roads that contribute to bull trout rearing habitat downstream of the burned area. Candle Creek also was identified to have elevated risk from the fire and having opportunities for road reductions (USDA 2004a, pEX-25).

Dead trees killed by the wildfire would fall, with greater than 50% of the smaller trees falling after the first 10 years (Dahms (1949) and 75% percent of all snags falling within the first 20 years after the fire (Keen 1929, Dahms 1949, Parks et al. 1999 and Everest et al. 1999). These down trees would contribute to soil retention during runoff events and would reduce the amount of soil erosion at the subwatershed scale.

Cumulative Effects

No cumulative effects on sediment are expected from no action because no direct and indirect sediment effects are expected. The primary risk of sedimentation from the wildfire will not be changed by this alternative. Those subwatersheds with important fish habitat determined to have a high risk of sedimentation include Abbot Creek, Candle Creek, Canyon Creek, First Creek and Lower Lake Creek (USFS 2004a). The effects of poorly drained roads and the interaction with the fire effects would continue under Alternative 1.

Alternative 2

Direct and Indirect

Upland erosion caused by activities in Alternative 2 would have only a negligible effect on sedimentation because only minimal activity would occur in the areas most likely to deliver sediment to the streams and stringent project design elements based on soil and water concerns would be implemented (see Hydrology section). Road decommissioning and inactivation, especially of the 37 miles of road most associated with aquatic concerns, would help restore infiltration and reduce overland flow and sedimentation to the same degree as the other action alternatives. In addition, Alternative 2 would have the most long-term beneficial effects from road drainage improvements associated with haul roads because the most haul road miles would receive treatments (93 miles).

Although upland timber harvest and fuels treatments would reduce future wildfire severity and suppression difficultly in some stands, it would not likely reduce sedimentation effects from a future catastrophic wildfire because treatments are not at a magnitude or in a location that would considerably reduce sedimentation risk.

The risk of sedimentation in bull trout spawning habitat will be moderated because subwatersheds with the greatest inherent risk from the wildfire are not important bull trout spawning streams (USFS 2004a). Although streams like Candle Creek and Canyon Creek have significant portions of the watersheds in high mortality, the amount of PSCA ground-based salvage and road use proposed in those subwatersheds is relatively low. There is between 19 to 34 acres proposed for ground based salvage in PSCA, respectively and between 1.1 and 4.7 miles of roads used for haul in the PSCA, respectively. There are few acres proposed for salvage near Roaring Creek and Canyon Creek. Landslide prone areas in the Canyon Creek subwatershed are not proposed for salvage. Candle Creek has large portions of the watershed in wilderness and lava flows. Jefferson Creek has no proposed salvage under this project (the area north of the creek was salvage by the Confederated Tribes of the Warm Springs).

The potential risk to bull trout critical habitat and chinook salmon habitat is from a possible increase in fine sediment delivered to the Metolius River downstream of First Creek. This risk is from the 6.9 miles of haul road in PSCA and the proposed salvage in the PSCA (69 ac), most using helicopter yarding. This reach of the Metolius River is used for bull trout spawning habitat, an area also designated as critical habitat for bull trout by the USFWS. It was also a site to have documented use by chinook salmon historically. The use of helicopter yarding in many units in the First subwatershed in alternative 2 does reduce the risk of sedimentation because of the reduced soil disturbance. The improvements to the haul road system in this alternative will reduce the drainage of fine sediments to the stream and result in a negligible effect on sedimentation to fish habitat (see hydrology section for complete analysis).

Redband trout habitat has some risk from sedimentation in Abbot Creek subwatershed because of the portion of the subwatershed proposed for salvage in the PSCA 26 and the number of miles used for haul in PSCA (4.7 miles). This risk is lowered by the road drainage work proposed for drainage work (35.2 miles) and road decommissioning and inactivation proposed (25.8 miles) in the alternative. The road mitigations help to make the overall effect negligible (see hydrology section.

Alternative 3

Direct and Indirect

Effects of activities in Alternative 3 on sedimentation would be negligible and would have the least risk of increasing sedimentation in the long-term and the second least risk in the short-term due to a minimal amount of harvest (only danger tree removal) in the potential sediment contribution area and a substantial amount of long-term road improvements (see hydrology section).

The sedimentation effects to bull trout, redband trout and Chinook salmon habitat from alternative 3 would be less that alternative 2 because of reduced acres of salvage in the PSCA (0 ac), reduced haul roads in PSCA used (3.8 miles less), and decrease in temporary roads needed (1.1 miles less). There will be slightly fewer haul roads used in this alternative and there will be proportionately less associated runoff, although the difference is minor. The same number of miles of road decommissioning/inactivation and similar miles of road improvements would be done and would have a similar effect on reduction of sediment delivered to streams as alternative 2.

The most benefit of no salvage in the PSCA is in the Abbot, Candle, Canyon, and First subwatersheds (Hydrology Table 3.20). These subwatersheds were identified in the watershed analysis as having increased risk to sedimentation to fish habitat from the fire. Not salvaging in the PSCA in these subwatersheds would reduce the risk of increased sediment eroded from these areas into fish habitat. The road work proposed to increase effective drainage and to closed high risk roads will serve to disconnect these sources of sedimentation from fish habitats.

Because of the road closure and drainage repair and the exclusion of treatment in the PSCA, this alternative will not measurably increase the risk of sedimentation to bull trout spawning areas of Jack Creek, Roaring Creek, Canyon Creek, Candle Creek or the Metolius River. Redband trout spawning habitat will not have measurable increases in fine sediment in Abbot Creek or Lake Creek from this alternative. Chinook salmon spawning habitat in the upper Metolius River will not be measurably changed because the primary area of spawning is upstream of the tributaries effected by the project. Because the effect on sedimentation is negligible (see hydrology section for detail analysis), there is no measurable effect to spawning habitat from alternative 3.

Alternative 4

Direct and Indirect

Alternative 4 has the least impact on sedimentation and effects of the activities on sedimentation risk will be negligible; however, reduction of sedimentation in the long-term would be less than the other alternatives because there would be less road drainage improvement work over the entire project area.

Because of the substantially reduced acres of salvage and haul roads, alternative 4 will have the least effect on sediment delivery to streams and fish habitat. Similar road miles will be decommissioned and inactivated under this alternative but fewer temp road miles will be required for salvage. The direct and indirect effects of alternative 4 will be similar to the no action alternative for sedimentation except in the Jack Creek and Canyon Creek (Brush Creek) subwatersheds. There is a low risk from the effects of salvage on Canyon Creek because of the low number of ground based acres treated in the PSCA in that subwatershed (15 ac). Risk from alternative Alternative 4 activities will be minimized by the high priority road decommissioning/inactivation (37.4 mi), road drainage improvements (37.9 mi) and PSCA/ riparian reserve protections in the Soil and Water Design Elements.

Alternative 5

Direct and Indirect

Overall, effects of activities in Alternative 5 on sedimentation would be negligible and would be very comparable to Alternative 3, except that the reduction in sedimentation over the long-term would be slightly less because culvert improvements would not occur (see Hydrology Section for detailed analysis of sedimentation effects).

The direct and indirect effects of alternative 5 would be similar to those of alternative 3, but slightly higher risk because of the ground based salvage of PSCA (63 ac). An additional 4.2 miles of road would be decommissioned under this alternative that other action alternatives, but these are upland roads and will have little benefit to reducing sediment delivery to fish habitats. Soil and Water Design Elements of PSCA activities, road improvements and PSCA road reduction work are needed to reduce the sediment delivery risk under this alternative.

Effects from Alternative 5 to spawning habitats for bull trout, redband trout and chinook salmon will be negligible because of the road drainage work and the Soil and Water Design Elements. The effect on sedimentation is slightly higher than alternative 3 because culvert improvements would not occur.

Cumulative Effects of Action Alternatives

The cumulative sedimentation effect as a result of the added effect of the B&B Fire Recovery Project would be negligible; therefore, any increases in sedimentation above natural conditions would be attributed to fires or past, future, or other present management activities (see hydrology section for a complete discussion of sedimentation effects). Salvage acres proposed in all alternatives of the B&B Fire Recovery Project would be less than 2% of the Upper and Lower Metolius 5^{th} field watersheds. Although up to 31 percent of any one subwatershed (which occurs in Abbot Creek SWS in Alt. 2) could be affected by salvage activities in the most impactive alternative, only 26 of these acres are in the potential sediment contribution area (Hydrology Table 3.19). In addition, no salvage activities are proposed within Riparian Reserves or within a half mile of the mainstem Metolius River. Any sediment input to the Metolius River resulting from disturbance activities associated with the B&B project would be delivered via flow from the tributaries.

Although 6802 acres would be salvaged under the most impactive alternative (Alternative 2) in the B&B Project, only 168 ground-based salvage acres, 7 mi of danger tree removal, and 29 miles of haul road are within the PSCA of 6 subwatersheds draining into the Metolius River. In addition, long-term sedimentation from roads would be reduced from the B&B Project because 37 miles of road affecting aquatic conditions would be decommissioned or inactivated and drainage improvements would be made on 38 to 92 miles of haul road, depending on the alternative chosen.

The cumulative effects of the B&B Fire Recovery Project and future foreseeable projects mentioned above at the watershed scale (5^{th} field) and other future foreseeable projects outside the analysis area but within the Upper or Lower Metolius 5^{th} field watersheds (i.e. Eyerly Fire Recovery, 4877 acres) would also be negligible. The only additional project at this scale would be the Eyerly Fire Recovery project (4877 acres) and no harvest activities are proposed within Riparian Reserves. Also, this project proposes 4 miles of roads for decommissioning, which would beneficially affect sedimentation. The B&B Fire Recovery Project would only affect 2% of the Metolius 5th field watersheds and the combined affect of all these projects, including the B&B project, would affect less than 10% of the watersheds and very little of that would occur in areas likely to contribute sediment to the streams (see Hydrology section for complete cumulative effects analysis to sedimentation).

The cumulative effect of sedimentation to spawning habitat of bull trout, bull trout critical habitat or chinook habitat from the action alternative is negligible. The use of Soil and Water Design Elements will reduce the disturbance of the PSCA and the connection of the soil disturbance to the stream network. The improved road drainage work and road decommissioning/inactivation will further reduce the delivery of sediment to streams draining to habitats in the Metolius River.

SPECIAL FISH HABITATS

Fish Passage

There are no barriers from road culverts limiting adult bull trout migrations in the subwatersheds of the project area. Adult redband trout migrations are not blocked by any known barriers. Upstream passage for juvenile fish may be limited by some culverts that have been inventoried (Riehle et al. 2000)(Table 4). Culverts rated as red (or not passable) are generally in the upper portion of the subwatersheds. There are six culverts that were rated red in the project area that are not being addressed under a current proposed project. One is on Baer Valley Creek on the 1235 rd, where brook trout have been reported but flow is intermittent. Another one is on a culvert on the 1235rd on Canyon Creek, where brook trout and redband trout have been found. Two red culverts were located on the North Fork of Lake Creek, just downstream of the project area. The main Lake Creek culverts on the 12 road are currently being assessed for repair work but replacement have not been planned at this time.

Lake Creek has a seasonal irrigation dams that are installed each year that may restrict the dispersal movement of bull trout during the spawning season, perhaps restricting the expansion of bull trout into the historic range of Suttle Lake. Improvements to small dams may be made in the future to allow for increased range of bull trout in the Lake Creek/Suttle Lake watershed. Round Butte Dam allows only limited downstream passage on an experimental basis and limits connection of Metolius populations to those downstream populations of Shitike Creek and Warm Springs River.

Measure: number of fish bearing stream crossings with fish passage improved

Direct, Indirect, and Cumulative Effects

All Alternatives

No direct, indirect or cumulative effects to habitat access for bull trout, redband trout or Chinook salmon are expected from the no action alterative. No crossings will be improved or decommissioned. Although adult bull trout and redband trout distribution are not limited by culverts, juvenile dispersal may be limited in Lake Creek and the upper reach of several small tributaries to Roaring Creek, Jack Creek and Link Creek.

Alternatives 2, 3, 4, and 5

Two culverts on perennial streams in the upper Link Creek drainage are proposed for removal under the action alternatives (Table 3.186). These streams are above Blue Lake and are known to hold introduced brook trout and in some reaches may be fishless. The removal of these culverts will not affect bull trout, redband trout or Chinook salmon because they are located outside of that habitat.

One culvert is proposed for removal on a tributary to Roaring Creek on the 1260760 (Table 3.187). This spring has a small culvert that will be pulled when the road is decommissioned. This stream is upstream of bull trout habitat and is not know to have habitat for rearing bull trout. The effects of this activity are short term sediment in the form of turbidity downstream of the site. Only slight long term effects to reductions in runoff and fine sediment are expected to bull trout habitat downstream in Roaring Creek. The low gradient of the spring is not expected to transport sediment a long distance downstream to Roaring Creek.

On a Brush Creek tributary, two road crossings will be decommissioned that were previously closed. The culverts at these locations would be pulled. Bull trout are known to rearing in Brush Creek but not the tributaries that will receive the road work. This stream is upstream of bull trout habitat and is not know to have habitat for rearing bull trout. The effects of this activity are short term sediment in the form of turbidity downstream of the site. Some long term reductions in runoff and fine sediment that will benefit bull trout habitat downstream in Brush Creek.

Seven other crossings will be decommissioned on streams in the Project Area (Table 3.187). These are fords on Brush Creek, Abbot Creek and First Creek. The effects of closing these fords will benefit the streams by disconnecting the road runoff from the streams and keeping vehicles from entering the streams. As vegetation returns to the streambanks, added filtering of sediment will reduce long term sedimentation effects from the roads.

The road inactivation on a spring in the upper Jack Creek drainage will reduce the traffic over the spring and could reduce associated runoff from the road if the culvert is pulled. The effects to fish habitat will be minor because the spring does not contribute to fish bearing waters because it is isolated from Jack Creek by intermittent channels.

Cumulative Effects

Cumulative effects of stream crossing decommissioning will improve access to small springs that have not been know to be occupied by bull trout or redband trout. Whether these habitats where limited by these culverts is not known. Some improvements to culverts were made with the culvert replacements done under the BAER treatments. Fish passage will be improved from the BAER projects to a larger extent than that of the B&B culvert removal projects. The road crossing decommissioning will have more long term effects on sedimentation reductions than fish passage. Additional fish passage projects may be planned after the B&B Fire Recovery Project (Roaring Creek and Bear Valley Creek). The B&B Project will not have any negative effects to these projects but may increase fry dispersal habitat on a short 1/3 mile segment of the tributaries Roaring Creek.

Table. 3.186. Results of fish passage inventory at culverts in the B&B Fire Recovery Project Area (Riehle et al. 2000). Red rating mean the culvert does not pass juvenile trout and salmon. Green rating means the culvert is passable by juvenile fish. Gray ratings mean fish passage barrier is possible but a determination would require more data be collected.

Road number	Milepost	Stream_Name	Shape	Fish Species Present	Fish Passage Rating	Project Status
1200000	10.80	Abbott Creek	Circular	Bull, Redband	Red	BAER Replaced
1200000	10.85	Abbott Creek	Pipe Arch	Bull, Redband	Red	BAER Replaced
1200900	0.10	Abbott Creek	Pipe Arch	Bull, Redband	Red	BAER Removed
1280000	0.10	Abbott Creek	Circular	Bull, Redband	Red	BAER Replaced
1230500	1.21	Bear Valley Cr.	Pipe Arch	Brook Trout	Red	NEPA 2005
1235000	3.27	Bear Valley Cr.	Pipe Arch	Brook Trout	Red	
1200000	8.20	Brush Creek	Pipe Arch	Bull, Redband	Red	BAER Replaced
1200500	1.45	Brush Creek	Pipe Arch	Bull, Redband	Red	BAER Removed
1230000	5.83	Brush Creek	Pipe Arch	Bull, Redband	Red	BAER Replaced
1235000	1.60	Canyon Creek	Pipe Arch	Bull, Redband	Red	
1210000	4.64	First Creek	Circular	Brook, Redband	Red	BAER Replaced
1210000	1.19	First Creek	Circular	Brook, Redband	Red	BAER Replaced
1210000	1.19	First Creek	Circular	Brook, Redband	Red	BAER Replaced
1210000	1.19	First Creek	Circular	Brook, Redband	Red	BAER Replaced
1210000	5.70	First Creek	Circular	Brook, Redband	Red	BAER Replaced
1200000	5.52	Jack Creek	Open Bottom Arch	Bull, Redband	Grey	
1420000	2.40	Jack Creek	Open Bottom Arch	Bull, Redband	Green	
1200000	0.73	Lake Creek	Circular	Redband Trout	Red	
1200000	0.73	Lake Creek	Circular	Redband Trout	Red	
2076250	0.10	Link Creek	Circular	Brook Trout	Red	**B&B EIS Decommission**
2076410	1.10	Link Creek	Circular	Brook Trout	Grey	**B&B EIS Decommission**
1419300	0.80	N. F. Lake Cr.	Circular	Redband Trout	Red	
1419000	1.50	N. F. Lake Cr.	Circular	Redband Trout	Red	
1260000	1.20	Roaring Creek	Pipe Arch	Bull Trout	Red	NEPA 2005
1260000	1.20	Roaring Creek	Pipe Arch	Bull Trout	Red	NEPA 2005

Table 3.187. Perennial streams that will have road crossings proposed to be decommissioned or inactivated under the action alternatives.

Road Number	Stream Name	Treatment in Action Alternatives	Type of crossing	Fish Habitat
1220530	Brush Creek	Previously Decommissioned	BAER project removed culvert	Bull, Brook, Redband Trout
1200540	Brush Creek	Decommissioned	Ford	Bull, Brook, Redband Trout
1200542	Brush Creek	Decommissioned	Ford	Bull, Brook, Redband Trout
1200547	Brush Creek	Previously Decommissioned	BAER project removed culvert	Bull, Brook, Redband Trout
1200983	Abbot Creek	Decommissioned	2 Fords	Bull, Brook, Redband Trout
1210950	First Creek	Decommissioned	Ford	Brook trout, Redband Trout
1220725	Unnamed spring, intermittent tributary to Jack Creek	Inactivate	Culvert	No fish
2068410	Outlet to Cache Lake, upper Link Cr tributary	Decommissioned	Two culverts	Brook trout
2076250	Intermittent tributary to Blue Lake	Decommissioned	culvert	Brook trout/ no fish
1260760	Tributary to Roaring Creek	Decommissioned	culvert	No fish

Refugia

Measure: fish passage, water temperature, spawning and rearing habitat quality

Direct, Indirect and Cumulative Effects

All Alternatives

Refugia are primarily provided by the cold water springs, stable habitats with abundant cover and complex rearing habitats. These habitats and their connectivity will not be changed in any alternative. Since no salvage activities would occur within riparian reserves and no significant increases in sediment are expected, there will be no direct, indirect of cumulative effects from the alternatives are expected, because no change to these habitat features will occur from the proposed actions. The lake habitats that are used by bull trout, such as Lake Billy Chinook, are not expected to be changed because no measurable change in sediment or flow is predicted. Chinook salmon primarily pool-like habitat in the Metolius River and Lake Creek, are not expected to be changed by the action alternatives. No cumulative effects are expected to bull trout of chinook salmon refugia.

Streambank Condition

Streambank instability was generally low (<1.6 percent) prior to the B&B Fire (Hydrology section). Some fish habitats may have increased stream bank instability following the fire. On Brush Creek one year after the fire, reaches that were underburned had less than one percent bank instability but in the upper most reach, in the stand replacement mortality area, bank instability was over 5 percent (Bizjak and

Dachtler 2004). Stream bank instability in bull trout and redband habitat of Abbot Creek was less than 1 percent in all reaches post fire (Bizjak and Dachtler 2005). Instability may have increased in areas contributing to fish habitat in the upper First Creek drainage, although no post fire surveys were conducted.

Another measure of streambank condition is width to depth ratio. This measure is used as a general indicator of the stream shape and it ability of passing the bankfull flow and sediment loads. A wide shallow stream are generally less stable, have more lateral scour and less undercut bank for fish cover. Stream reaches that are spring fed, with stable flow regimes, also can have high with to depth ratios. Width/depth ratios are generally less than 20, with most reaches with ratios between 10 to 15 (Table 3.188). Most spawning and rearing areas of the Upper Metolius River, Jack Creek, Link Creek (historic sockeye habitat) are spring-fed reaches and naturally have high width to depth ratios, although they are stable and provide good rearing habitat for juvenile fish along their overhanging banks.

Measure: percent stream bank instability, channel width to depth ratio

Direct, Indirect, and Cumulative Effects

All Alternatives

No direct, indirect of cumulative changes are expected from the alternatives because most of the streams are spring fed, there is little change expected from the increases in flow from the project activities because there are no predicted stream flow or sedimentation effects from the action alternatives, if soil and water design criteria are met (see hydrology section for flow analysis). Streambank stability is expected to not change as a result of the project. No streambank disturbance will occur. Stream crossing repaired under the action alternatives will not increase bank instability because of the limited area treated. No downstream impacts to streambank stability is expected from the road work because of the limited area being treated.

Table 3.188. Stream channel width to depth ratio at bank full flow for inventoried streams prior to the BnB Fire.

STREAM	REACH	Average bankfull width to depth ratio
Cabot Creek	1	9.2
Candle Creek	4	7.8
	5	6.4
Jack Creek	1	49.5
Jefferson Creek	1	14.8
	2	12.9
	3	11.0
	4	12.6
	5	11.4
Link Creek	1	18.2
Metolius River	1	30.1
	2	47.9
	3	38.3
	4	41.8
	5	19.1
South Fork Link Creek	1	10.6
Upper Link Creek	1	11.4
	2	9.0

Floodplain Connectivity

Floodplains are relatively free of barriers to flooding along streams of the project area. Road crossings can reduce floodplain area but many of these crossings are repaired when fish passage is improved or have been improved under the culvert replaced done under BAER project post fire (Table 4). Road segments identified having roads reduce floodplain area have been inventoried from GIS and field observations (Table 3.189). None of these roads are proposed for use during haul in the BandB Fire Recovery Project. All roads but the road along Upper Canyon Creek will be decommissioned after the B&B Project.

Table 3.189. Road segments and distance of road that constrict floodplains and the proposals for treatment under all action alternatives in the B&B Fire Recovery Project Area.

Stream Name	Road Number	Distance ft	Used in Haul	Treatment
First Creek	1210870	1100	no	Decommission
	1210950	220	no	Decommission
Upper Davis Creek	1210500	various	no	Decommission
Canyon Creek	1235100	454	no	open
Candle Creek	1292500	1134	no	Decommission

Measure: distance of road fill restricting floodplain

Direct, Indirect and Cumulative Effects

Alternative 1

Little restriction of the floodplain of most streams has occurred. Other than road crossings, streams fully use the off-channel flood areas and maintain wetland areas and riparian vegetation. The fire may increase the flow of streams with a large portion of the watershed with high tree mortality but the no action alternative will not change this process. There is currently less than one mile of floodplain along streams in the project area that have been inventoried having restricted floodplains.

Alternatives 2, 3, 4 and 5

Decommissioning nearly 90% of inventoried roads that restrict the floodplains in the action alternatives will reduce concentration of flood waters in these stream segments and will help reduce stream bank instability in short segments along Candle Creek, First Creek, and upper Davis Creek. These limited segments of stream, together with the stream crossings that will be decommissioned, with improve floodplain connectivity in the action alternatives. No measurable change to the flow regime is expected. The fire may increase the flow of streams, with a large portion of the watershed with high tree mortality, but none of the alternatives will impact this relationship. Since no change in flow in expected, small changes in floodplain connectivity are expected from this project in localized areas. No other treatments are expected to alter floodplain connectivity from the action alternative and will not combine to measurably change floodplain connectivity on a watershed scale.

ESA AND MSA EFFECTS DETERMINATIONS

ALTERNATIVE 2, 3, 4, and 5 DETERMINATIONS

Direct Effects To Bull Trout

There is little risk of direct effects to bull trout by disturbance because there is no instream work in bull trout streams in the project. Danger trees will be felled 100 ft or more away from streams that may contain bull trout, and therefore this work will avoid effects to bull trout. Culvert removal will not be on bull trout streams.

Indirect Effects to Bull Trout

This project may affect but is not likely to affect bull trout. The effects of the fire has increased the risk of sedimentation to some streams due to the loss of riparian vegetation and standing live trees in the riparian reserve. All action alternatives slightly raise the risk of some increased sediment to streams used by bull trout, primarily upper Jack Creek spawning habitat, Brush Creek and Abbot Creek rearing habitats. This slight increase in fine sediment inputs may result from the use of riparian reserve haul roads, salvage and danger tree removal in potential sediment contribution areas and the short term effects of increased road drainage improvements and road decommissioning and inactivation. There is a short term risk from sedimentation from the haul and ground disturbing activities. This effect has been determined to be negligible because of the required soil and water design criteria used to avoid effects. The long term benefits of the improved road drainage and road decommissioning and inactivation targeted at aquatics will increase bull trout spawning habitat quality. Largely, the action alternatives do not treat in the riparian reserves, except in danger tree treatments in defensible space (and exceptions in unit 34). All wood will be retained within 100ft of fish bearing streams. This protection of the riparian reserves along bull trout habitats will serve to minimize effects for bull trout habitat.

Cumulative Effects to Bull Trout

The contribution of this project to effects of other projects, like the Metolius Basin Forest Management Project, BAER work post fire and private land salvage (Abbot Creek), will not combine to cause a measurable effect to sedimentation in bull trout streams. The effect of the wildfire may increase, due to the direct effects of the loss of riparian vegetation, increase temperature of Abbot and Brush Creek, and potential of increased sediment from bank instability in highly burned channels. The action alternatives will not measurably add to that risk, with appropriate design criteria and road improvements being met. The spawning population is at the highest level in 2004 since survey started in 1987. Since most of the spawning habitat for bull trout is located in streams dominated by springs, the effects of the alternatives on the bull trout population will not change the stability of the population in the watershed. Determination: **Not Likely to Adversely Affect Bull Trout or their habitat.**

Indirect Effects to Bull Trout Critical Habitat

This project may affect but is not likely to affect bull trout critical habitat. All action alternatives raise the risk of some increased sediment to streams used by bull trout, primarily upper Jack Creek spawning habitat, Brush Creek and Abbot Creek rearing habitats. Alternative 4 does not affect Abbot Creek subwatershed. A slight increase in fine sediment inputs may result from the use of riparian reserve haul roads, salvage and danger tree removal in sediment delivery risk zones and the short term effects of increased road drainage improvements and road decommissioning and inactivation. The long term benefits of the improved road drainage and road decommissioning and inactivation targeted at aquatics will improve bull trout habitat. The short term risk from sedimentation from the action alternatives has been determined to be negligible if design criteria are met. The risk to First Creek has the most potential to impact bull trout Critical Habitat downstream in the Metolius River, near Heising and Jack Creek. The sedimentation effects to First Creek from this project are negligible if design criteria are met.

The Critical Habitat downstream of Wizard Falls on the Metolius is primarily rearing habitat for bull trout and not as affected by First Creek. The islands and side channels provide good rearing habitat and are less effects by fine sediment.

Road work designed to reduce the drainage runoff and sediment discharge from the 1210 rd will reduce the effects of the action alternatives on First Creek. The use of helicopter yarding on steep slopes in the First Creek valley will reduce the ground disturbance on many of the acres proposed for salvage in alternative 2 (those acres will be dropped in other alternatives). The restrictions on haul and winter logging, road drainage improvements and decommissioning in the First Creek subwatershed will minimize the risk to bull trout critical habitat in the Metolius River.

The effects of the fire increase the risk of sedimentation to Critical Habitat due to the loss of riparian vegetation and standing live trees in the riparian reserve. Largely, the action alternatives do not treat in the riparian reserves, except in danger tree treatments in defensible space. This protection of the riparian reserves along bull trout habitats will serve to make the effects to bull trout critical habitat negligible.

Cumulative Effects to Bull Trout Critical Habitat

The contribution of the action alternative to that of other projects, like the Metolius Basin Forest Management Project, BAER work post fire and private land salvage (Abbot Creek), will not combine to cause a measurable effect to sedimentation of bull trout critical habitat. Since spawning habitat for bull trout is located in the critical habitat in the Metolius River near Jack Creek confluence, the cumulative effect of the project on this habitat is limited. The mitigating effect of the spring fed river upstream of First Creek may also reduce any effects of First Creek on the Metolius River critical habitat.
Determination: **Not Likely to Adversely Affect Bull Trout Critical Habitat**

Indirect Effects to EFH

Effects to Chinook habitat from the action alternative will be minimal because there is no activity planned near the Metolius River or Lake Creek. Road drainage work may reduce some sediment in Lake Creek but this effect is not measurable in chinook habitat. Because the important spawning habitat for Chinook is upstream of the tributaries affected by the fire or the project, the effects to Chinook habitat is negligible.

Cumulative Effects to EFH

Cumulative effects from the other projects occurring in the basin or from private lands is not expected to produce a measurable effect to chinook habitat. The Metolius Basin Forest Management project is expected to occur in the same timeframe as this project. The effects from that project are expected to be minor because thinning and defensible space treatments along Lake Creek will be by hand and have 60 ft no cut buffers along fish bearing streams. The recovery of wood in the Metolius River is the major limiting factor for chinook habitat. The restoration of instream wood from annual danger tree placement has lead to restoration of wood, but at a slow pace. Determination **- No Adverse Effects to Chinook Essential Fish Habitat**

Direct Effects to Redband Trout

There is little risk of direct effects to redband trout by disturbance because there is no instream work in proposed redband trout streams in the project area. No direct disturbance effects are expected to redband trout.

Indirect Effects to Redband Trout

Indirect effects to redband trout habitat may occur in Abbot Creek, because of haul road use and the short term sedimentation impacts of road drainage work and road decommissioning and inactivation. These short term effects are expected to be negligible. There is a long term benefit of improved drainage of hydrologically connected road segments and the decommissioning/inactivation of stream crossings and roads that deliver increased sediment to tributaries of Abbot Creek. The primary habitat for spawning redband trout is the Metolius River is above most of the influence of the project. Abbot Creek is used for spawning and the road decommissioning/inactivation and salvage design criteria proposed to reduce the risk of sedimentation to these habitats will reduce the effects to a minimal level. Habitat for redband trout will be protected by project design elements and road work and the overall effects of the action alternatives is negligible.

Cumulative Effects to Redband Trout

Cumulative effects of this project are not expected to cause measurable combined effects to redband trout habitat. The largest project, Metolius Basin Forest Management project, will not add to the effects to sedimentation to redband trout habitat because of the limited effect on riparian areas of Lake Creek and the Metolius River. The effects of private land salvage on Abbot Creek in the 1.5 years after the fire is not expected to cause a measurable amount of sedimentation to stream because of the flat land adjacent to the stream within the salvaged area. Other projects in the watershed are not expected to contribute to the cumulative effects to redband trout habitat because of the primary habitat is located in the upper reach of the Metolius River. Determination **-May Impact individuals or habitat but not likely to contribute to listing of interior Columbia Basin redband trout.**

3.15 Botanical Resources

Existing Condition

There are no federally listed Threatened or Endangered plant species known to exist within or nearby the project area. Currently, the Deschutes National Forest Sensitive Plant List includes 31 taxa, either known or suspected to exist on the Forest. Three of these taxa have occurrences within the project area. Another 13 are known from sites elsewhere on the Forest. Relevant information concerning Deschutes National Forest Sensitive Plant Species, including presence of occupied or suitable habitat within the project area, is presented in Table 3.190.

Table 3.191. Relevant information concerning Sensitive Plant Species documented or suspected to occur on Deschutes National Forest. Codes: "VP" = vascular plant; "B" = bryophyte; "L" = lichen; "F" = fungus.

R6 Sensitive Plant Species Documented or Suspected on Deschutes National Forest	Range within Pacific Northwestern United States	Habitat	Known Occupied Habitat in Project Area?/ On Forest?	Probability of Occurrence in Project Area
Agoseris elata (VP)	Cascades: Oregon, Washington, California	Somewhat diverse; typically lower elevation forest openings and alluvial terraces.	Yes	High; many occurrences within the project area.
Lobelia dortmanna (VP)	Eastern Cascades, Oregon; Washington	In water of lake, pond, slow river or stream, or wet meadow.	Yes	High; however, project site is only recently verified site in Oregon.
Penstemon peckii (VP)	Central Oregon	Ponderosa pine or mixed conifer with ponderosa pine, in openings or in relatively open stands; on recovering fluvial terraces and shallow intermittent drainages.	Yes	High; many occurrences within the project area.

As noted in Table 3.191, only 3 taxa are thought to have a High probability of occurring within the project area, while 2 taxa are believed to have a Moderate probability of occurring within this area. Only 2 Sensitive Plant Species, Peck's penstemon (*Penstemon peckii*) and tall agoseris (*Agoseris elata*), were considered likely to occur within proposed treatment units. These two species became the focal points of the 2004 field surveys within the project area. Surveys for non-vascular taxa were not systematically conducted. This was considered warranted because 1) suitable habitat is absent or only marginally present within the project area, and absent from the proposed activity areas (*Rhizomnium nudum*), 2) fire effects within the proposed activity areas have resulted in a loss of suitable habitat that was potentially present (*Schistostega pennata*, *Leptogium cyanescens*) and 3) remaining suitable habitat with proposed activity areas should be largely unaffected by the proposed treatments in those areas (*Scouleria marginata* and *Dermatocarpon luridum* are both submerged or emergent aquatics; *Ramaria amyloidea* is an ectomycorrhizal fungus associated with live host trees). Information relative to management for Pecks's penstemon and tall agoseris is presented below.

Peck's penstemon

Peck's penstemon is a central Oregon endemic, its range fully included in an area of about 325 square miles centered about Black Butte on the Sisters Ranger District. Plants are often found in swales or topographically subtle drainages where seasonal surface movement of water and soil moisture accumulation appear to promote both seed dispersal and germination. Occurrence of the species within the Metolius Basin shows a strong association with soil types 8 (bottomlands along drainages) and 30 (subject to high water tables during runoff periods) as described and mapped in Larsen and Klink (1976). The fact that the species is a native, herbaceous perennial, occupying lower elevation ponderosa pine and ponderosa pine-mixed conifer forest communities, suggests that may be well-adapted to frequent, low intensity fires. That the species is typically found in relatively open forest stands, forest openings, old clear cuts and along roadsides, further supports the understanding that it acts as an early seral species, benefiting from periodic disturbances. Field (1985) speculated that "silvicultural treatments which open closed canopies, reduce soil litter, reduce vegetative competition and retain penstemon parent plants will benefit the species in forested habitats." It is notable that periodic, low intensity fire can affect these same changes. Indeed, Field (1985) notes that fire enhances Peck's penstemon by 1) reducing canopy and increasing available sunlight, 2) reducing understory vegetation and exposing bare soil for germination and establishment and 3) increasing runoff and increasing available moisture in habitat areas.

The Species Conservation Strategy (1992) for Peck's penstemon includes all occurrences in two management categories, Protected and Managed. The Strategy identified 25 Protected populations, that should be managed "to achieve long-term species viability by maintaining existing genetic variance and promoting reproductive success." These populations were selected due to attributes such as 1) large population size and density, 2) a distinctive geographic setting, 3) relatively unfragmented structure, 4) inclusion in distinctive plant association, 5) distinctive flower color or degree of color polymorphism and 6) plant vigor. It is recommended that no permanent habitat loss be allowed at these sites, and that loss of individual plants due to active resource management not exceed 0.2% in populations greater than 2000 individuals and 0% in populations less than 2000 individuals. Populations not given Protected status automatically assume the status of Managed populations. These populations are to be managed for the enhancement of Peck's penstemon habitat with existing or experimental forest management tools suspected to be of benefit to the species. Loss of more than 20% of a population that exceeds 500 individuals, or more than 10% of a population of less than 500 individuals, is not recommended.

The Metolius Watershed Update: Botany and Noxious Weeds (March 2004) notes that of the 83 total known occurrences of Peck's penstemon, 40 occur on Forest lands within the Metolius watershed. This document also provides an estimate of the extent of Peck's penstemon habitat burned in the Cache, Eyerly, Link and B&B complex fires of 2002 and 2003, as well as the severity of burn on the effected acres. This analysis indicates that 16% of all acres occupied by Peck's penstemon on Sisters Ranger District has been burned in these fires, with 36% of the effected acres experiencing Stand Replacement burn severity, 24% Mixed Severity, and 41 % Underburned.

Tall agoseris

Tall agoseris is western endemic, thought to extend along the Cascades from southern Washington into the Sierra Nevada of California. Although historically identified in several locations on the Sisters District, expertise in the identification of this species has only recently been developed within the Sisters District Botany Program. Because of this, active collection of distributional and ecological information for this species, on the District, has been underway only a few years. At present, this information suggests that tall agoseris, much like Peck's penstemon, acts as an early seral species that favors settings with ample light and benefits from periodic, canopy-reducing disturbances such as fire. Related to dandelions, tall agoseris has dandelion-like fruiting heads and fruits that are well-adapted for dispersal by wind.

TES Plants - Environmental Consequences

Table 3.192. Summary of determinations of short-term effects for Sensitive Plant Species within the B&B Fire Recovery Project. "VP" = Vascular Plant; "B" = Bryophyte; "L" = Lichen; "F" = Fungus; "NI" = No Impact; "MIIH" = May Impact Individuals or Habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species.

Species	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**
Agoseris elata (VP)	NI	MIIH	MIIH	MIIH	MIIH
Lobelia dortmanna (VP)	NI	NI	NI	NI	NI
Penstemon peckii (VP)	NI	MIIH	MIIH	MIIH	MIIH

Prefield review and 2004 field surveys indicate that only two TES plant species, Peck's penstemon and tall agoseris, have known occurrences within or adjacent to proposed treatment units within the B&B project area. The following analysis focuses principally on Peck's penstemon. One reason for this is that occurrences of "pure" tall agoseris (not intermixed with Peck's penstemon) do not frequently exist within proposed treatment units. Of the 14 new occurrences of tall agoseris documented in the project area during 2004, only one (TES # 149) is substantially included within a proposed treatment unit (units 124 and 128). Three other of these newly documented occurrences occupy roadsides that are, in part, adjacent to proposed treatment units. Elsewhere within the project area, tall agoseris commonly co-occurs with Peck's penstemon, and can largely be included in the analysis for that species. Further, it seems reasonable to speculate that with its wind-borne fruits and apparently broader habitat amplitude, tall agoseris is likely to be more resilient to the effects associated with salvage treatments. Finally, management recommendations for Peck's penstemon existing within its Species Conservation Strategy need to be addressed.

In analyzing possible effects of salvage harvest to Peck's penstemon, it is useful to understand that the various proposed treatment units within the project area include some portion of what are now defined as 6 occurrences of the species. The amount of included occupied habitat varies between occurrences and Alternatives. Table 3.193 summarizes this information.

Table 3.193. Per cent of total area of Peck's penstemon occurrences included within proposed treatment units, by Alternative. "P" = Protected; "M" = Managed.

Occurrence	Mgt. Status	Total Acres	Alternative 1 (No Action)	Alternative 2	Alternative 3	Alternative 4	Alternative 5
#29	P	63.4	0.0%	38.5%	0.0%	0.0%	12.5%
New #1	M	286	0.0%	30.6%	0.0%	0.0%	30.6%
New #2	M	150	0.0%	39.5%	31.4%	39.5%	39.5%
New #3	P	85.7	0.0%	14.3%	14.3%	14.3%	14.3%
#43	P	72.0	0.0%	6.7%	10.3%	10.3%	6.7%
#75 (in part)	M	21.3	0.0%	7.8%	7.8%	0.0%	0.0%

Two different perspectives appear to be important when considering salvage treatment effects of Peck's penstemon: short-term mortality of established plants and long-term viability of currently occupied sites.

<u>Short-term Mortality</u>

As noted by Field (1985), it is evident that Peck's penstemon benefits from periodic disturbances. In the absence of commercial forest management practices, these disturbances have probably been largely associated with fire. The types of disturbance resulting from the B&B fires that are believed to be beneficial to Peck’s penstemon (Field 1985) include 1) opening the forest canopy, 2) reducing soil litter, 3) reducing vegetative competition and 4) retention of parent plants. It is reasonable to speculate that the additional disturbances associated with salvage harvesting in units including Peck's penstemon will do little, if anything, to augment fire-related benefits described in 1-3 above. On the other hand, it is also reasonable to speculate that the heavy mechanical activity associated with salvage harvesting, especially the dragging, whether individually or bunched, of cut trees, will, through soil-gouging, result in significant loss of established individuals of Peck's penstemon. Even when measures are taken to reduce adverse soil impacts to no more than 20% of a treatment unit (i.e., effects are limited to skid trails), the dragging of trees to skid trails has the potential to damage or kill Peck's penstemon plants at many points within units, outside of the skid trails. It is not currently possible to confidently predict the extent of mortality associated with conventional ground-based harvesting methods (machine-felling and bunching) relative to that associated with modified ground-based harvesting systems (hand-felling and single tree dragging). Casual field observations at sites already salvaged within the B&B project area suggest that the proposed ground-based systems, when imposed on the frequently “patchy” distribution of Peck’s penstemon, have the potential to cause an immediate mortality rate of 30-50%. Additionally, the mechanical entries associated with salvage harvesting provide opportunities for the introduction, spread, and establishment of noxious weeds and other undesirable non-native species. If this understanding is correct, the short-term effects of salvage harvesting on established Peck's penstemon will be negative, and the Alternatives will rank, from most negative effects to least negative effects, in direct relation to the number of salvage acres proposed within occupied habitat. Relevant information is provided in Table 3.1944.

Table 3.194. Acres of occupied Peck's penstemon habitat included within the various proposed treatment units, by Alternative.

Alternative	Management Status of Peck's penstemon in Proposed Treatment Units	Number of Acres of Included Peck's penstemon
1 (No Action)	Not Applicable	**0.0**
2	Protected	41.4
	Managed	148.4
	Total	**189.8**
3	Protected	19.6
	Managed	48.7
	Total	**68.3**
4	Protected	19.6

	Managed	59.3
	Total	**78.9**
5	Protected	24.9
	Managed	146.8
	Total	**171.7**

Long-term Viability

In the forested communities of the Metolius Basin, long-term viability of Peck's penstemon sites appears to depend on periodic disturbances that, as noted above, contribute to relatively open or patchy tree canopies, reductions of soil litter and vegetative competition. During the next century and beyond, as the forest communities within the B&B project recover from the 2003 fires, the conditions that benefit Peck's penstemon will, in the absence of further activities or disturbances, steadily decline. At many of the occupied sites, shade and litter generated by shrubs will eventually give way to shade and litter principally generated by trees. The ability to implement forest management-related treatments that would likely benefit Peck's penstemon during this recovery period, treatments such as non-commercial/commercial thinning, mowing, and prescribed fire, appear to vary according to proposed treatment unit and by Alternative. Future Vegetation Simulations (FVS), a computer-assisted forest management modeling tool, indicates that under the No Action Alternative, several treatment units that include portions of a Peck's penstemon occurrence, will have fuel loadings that preclude the use of prescribed burning during significant portions of the current century. These same loadings would, presumably, also preclude the use of mowing as a means of altering vegetative structure for the benefit of Peck's penstemon. Hence, in some units, while salvage harvest actions may directly and immediately result in some level of mortality of Peck's penstemon, these same actions may be necessary to permit active management for the long-term viability of Peck’s penstemon, in portions of several of its occurrences, through the use of prescribed fire, and possibly, mowing.

Based on FVS data, thresholds of unacceptable fuels levels, and unit by unit estimates of fuels loadings between 2005 and 2100, under Alternatives 1 and 2, have been prepared (Owens, 2004). Unacceptable fuels levels are those at which it is not safe to introduce prescribed fire.

It is projected that, under the No Action Alternative, fuels levels in most of the units that include Peck's penstemon, will, for some portion of the next 95 years, exist at levels that preclude the introduction of prescribed fire. It can also be seen that Alternative 2-type salvage harvesting is projected to essentially eliminate fuels issues that would limit the use of prescribed fire during this same time period. The time period over which, under the No Action Alternative, fuels levels would preclude prescribed fire vary by unit. Time periods range from as much a 80 years to as little as zero years. In the interest of more easily managing this information, it seems sensible to place the various projected durations of fire exclusion into three classes: short, moderate and long. With the understanding that the risk to viable Peck's penstemon habitat may be directly related to the period of time it exists without experiencing fire, categories of time without fire may also be regarded as categories of risk to viable habitat. These concepts are summarized in Table 3.195 below.

Table 3.195. Periods of prescribed fire exclusion anticipated under the No Action Alternative (from Table 5, above), and resultant risk to viability of included Peck's penstemon habitat, between 2005 and 2100, by unit. Values are derived from FVS-projected fuels loadings.

Treatment Unit	Included Peck's penstemon Occurrence/ Total Acres	# of Peck's penstemon Acres Included	Period of Rx Fire Exclusion (consecutive years)	Time Period Category (subjective)	Relative risk to Peck's penstemon Habitat Viability (speculative)
#76	#29/63.4	15.4	80+	Long	High
#73	#29/63.4	1.1	50+	Long	High
#104	New #2/150	8.6	50+	Long	High
#111	New #3/85.7	9.8	40+	Long	High
#130	#43/72	2.6	30+	Moderate	Moderate
#105	New #2/150	27.4	20+	Moderate	Moderate
#74	New #1/286	95.5	20+	Moderate	Moderate
#116	#43/72	4.8	10+	Short	Low
#107	New #2/150	11.9	0	Short	Low
#109	New #2/150	12.2	0	Short	Low
#112	New #3/85.7	1.7	0	Short	Low
#124	#75/21.3	1.7	0	Short	Low

Effects Analysis by Alternative

Alternative 1 - No Action

Direct and Indirect Effects

The No Action Alternative would leave the proposed treatment areas in their post-fire condition. Activities directed by the Burned Area Emergency Recovery Plan would be completed, but activities such as salvage harvesting, post-salvage fuels treatments and reforestation, would not be undertaken. As presented in Table 4, this Alternative would have the least negative, short-term effects - mortality of established Peck's penstemon plants - of all the Alternatives. In contrast, Table 6 indicates that in the long-term, No Action poses the highest long-term risk of negative effects, with a projected 160.4 acres of currently occupied Peck's penstemon habitat. being at High to Moderate risk of lost viability. Management Recommendations (see Project Design Elements section of this document) are given in an attempt to lessen the probable negative long-term effects associated with high fuel loads projected to occur under this Alternative.

Action Alternatives

Direct and Indirect Effects

As presented in Table 3.194, the rank of the Action Alternatives, in order of least to greatest negative, short-term effects to established Peck's penstemon plants is 3 and 4, proximate on the low side of the negative effects scale, followed by 5 and 2, proximate to one another on the high side of the negative effects scale. The long-term viability of Peck's penstemon included within the proposed treatment units, each Action Alternative poses a similarly low risk: all are projected to lower fuels levels to an extent that allows use of prescribed fire on any schedule necessary for the maintenance of viable Peck's penstemon habitat.

Cumulative Effects for All Alternatives

The Metolius Basin Forest Management Project (MBFMP) is now in the initial stages of implementation. This project includes approximately 12,000 acres and is centered about the Metolius River and Camp Sherman, Oregon. Project activities include extensive forest thinning and underburning, much of which can be expected to increase the availability and quality of habitat for Peck’s penstemon and tall agoseris within the Metolius Basin. In contrast, the MBFMP can be expected, along with the B&B fires, to further diminish the availability and quality of habitat for TES and other uncommon bryophytes and lichens that require cool, humid settings.

Overall Ranking of Effects

Table 3.196. Summary of ranking of short-term and long-term effects associated with each Alternative.

Short-term effects, least negative to most negative	Alt. 1 (least negative effects)	Alt. 3	Alt. 4	Alt. 5	Alt. 2 (most negative effects)
Long-term effects, least negative to most negative	Alts. 2,3,4,5 (least negative effects)				Alt. 1 (most negative effects)

3.16 Noxious Weeds

Existing Condition

Deschutes National Forest manages approximately 97% of the area within the B&B Fire Recovery Project boundary. Numerous noxious weed sites were known to exist within and adjacent to the current project boundary before the Link and B&B fires of 2003. These fires combined to burn approximately 70,000 acres managed by the Forest. Many of these acres can now be considered at increased risk to the spread or introduction of noxious weeds. Factors that increase weed risk in burned forest include 1) increased availability of light and nutrients, 2) reduction of competition with native plants for subsurface resources such as mineral nutrients, water, and rooting space and 3) increased opportunities for dispersal of weed seeds, including the mechanical vectors associated with fire suppression efforts.

Noxious weeds are an undesirable presence in forest ecosystems because they tend to displace native plants, including, potentially, rare and protected species, degrade habitat for animal species, promote soil erosion, and lessen the value of recreational experiences. As chronically disturbed, often well-illuminated areas, roadsides are highly suitable habitats for many noxious weeds. Many of the weed sites within the project area are located along roadsides. Relating to this, motorized vehicles are probably the major vector for the introduction and/or spread of noxious weeds within the project area. Such vehicles may include those associated with public recreational use or harvesting of special forest products (e.g., firewood, mushrooms), or general forest management operations including inventory, monitoring, road maintenance and fire suppression. Such vehicles have the potential to transport weed seeds included in soil and muck stuck in tire treads or upon undercarriages. Also, portions of whole, seed-bearing weed plants can become wedged in bumpers and within undercarriages when vehicles drive through patches of weeds. By these means, weed seed can be imported to the project area or moved about within the project area.

Information currently in the Natural Resources Information System/Terra database documents the presence, within the B&B project boundary, of eight noxious weed species, collectively infesting 107 acres at 108 weed sites. Although numerous weed surveys had been conducted in recent years within the project area, including extensive surveys immediately following the Link and B&B fires, only 43 noxious weed sites were documented within project boundaries as of the fall of 2003. Field surveys during the 2004 field season documented the presence of 65 new weed sites within the project area.

Noxious weed surveys were performed in conjunction with Sensitive plant species surveys over approximately 5600 prioritized acres within the project area. Additionally, noxious weed surveys were conducted along about 74 miles of forest roads and approximately 8 miles of cross-country (not immediately adjacent to a forest road) dozer lines created during the 2003 fire suppression efforts.

Following are brief descriptions of the noxious weed species documented to occur within the B&B project area.

Knapweeds: There are two species of knapweed within the project area, spotted knapweed (*Centaurea biebersteinii*) and diffuse knapweed (*Centaurea diffusa*). Spotted knapweed is present at 45 sites, while diffuse knapweed occurs at another 22 sites. Combined, these two species account for a total infested area of 52.9 acres at 67 sites within the project area. The knapweeds are understood to be the most aggressive noxious weeds, in upland settings, on Deschutes National Forest. Their abundance and frequency within the project area supports this understanding. Spotted knapweed, in various literature, is often referred to as a biennial or short-lived perennial. However, observations of this species in central Oregon indicate that it rarely behaves as a biennial, and can commonly live five or more years. Flowering and fruiting generally begins in the second year of growth, with the length and total number of flower-bearing branches per plant increasing with each year of growth. Hence, individual plants typically produce significantly more seeds with each year of age. Locally, it is tentatively thought that diffuse knapweed behaves more like a true biennial. Knapweed seeds appear to have too much mass to be readily transported by air currents, but circumstantial evidence suggests that humans and their various mechanical contrivances serve as very effective vectors for knapweed seed dispersal. The knapweeds are not especially tolerant of shade, and herbicide applications on the Forest since 1999 have significantly reduced population sizes at a number of sites. Both species appear capable of spreading from disturbed sites into adjacent, relatively undisturbed and open native plant communities.

St. Johnswort: St. Johnswort (*Hypericum perforatum*) is regarded as an emerging noxious weed threat within the Metolius Basin. This species is second only to the knapweeds with regard to extent of infestation within the project area, occupying 47.5
acres at 58 sites. Notably, 41 of these sites were newly discovered in 2004. This rhizomatous species is currently causing local alarm, due to both its apparent high rate of spread and its resistance to manual, chemical and biological controls.

Bull Thistle: Bull thistle (*Cirsium vulgare*) is widespread, in generally low numbers of individuals, across the Sisters District. Local observations over the past decade have led to the understanding that this biennial species is not long persistent at specific sites. Although it may be quick to establish itself in very recently disturbed settings, it seems to be rather soon displaced by herbaceous natives. Occurrences of this species in the proximity of Sensitive plant species, or in high-use recreational areas are of concern, but occurrences elsewhere are not consistently recorded. There currently are 4 recorded sites within the project area accounting for an infested area of 1.3 acres.

Canada Thistle: Canada thistle (*Cirsium arvense*) appears to be a relative newcomer to the Sisters District. Within the project area, there are 22 documented sites with a total infested area of 4.5 acres. Only one site of this species was known within the project area prior to 2004. The capacity for this species, locally, to persist at specific sites or to act invasively, is poorly understood. As a perennial that can spread vegetatively by deep, creeping roots, the species clearly warrants early treatment efforts and monitoring.

Dalmation Toadflax: Relative little Dalmation toadflax (Linaria dalmatica) occurs on the Sisters District. Within the project area, there are 6 documented sites accounting for an infested area of 0.2 acres. The species spreads vegetatively by deep rhizomes and locally does invade relatively undisturbed and open native plant communities. Because it is resistant to manual and chemical control, the species warrants early treatment efforts and monitoring.

Tansy Ragwort: Tansy ragwort (*Senecio jacobaea*) has been present in low quantities on the Sisters District for many years. It is currently known at 1 site with an infested area of 0.5 acres. This site may have expanded somewhat between 2003 and 2004. This short-lived perennial is toxic to stock and has been historically very troublesome west of the Cascades. The species does not appear to be very competitive in the Metolius Basin, but continuing treatment and monitoring are advisable.

Scotch Broom: Scotch broom (*Cytisus scoparius*) is a shrub that is an aggressive invader of both disturbed sites and largely undisturbed native plant communities west of the Cascades. Within the project area, there are 2 sites of this species infesting a total of 0.5 acres. One of these sites was disturbed by dozer activity during fire suppression activities in 2003. Approximately 120 scotch broom seedlings were found at this site in 2004 and hand-pulled.

Dozer Lines: Noxious weeds were located on 82% of the dozer lines surveyed. Most commonly encountered was bull thistle, which when present, occurred at a rate of about 20-50 rosettes per mile. Other noxious weeds and non-native plants found in small quantities included Scotch broom, St. Johnswort, spotted knapweed, Canada thistle, cheatgrass brome (*Bromus tectorum*) and wooly mullein (*Verbascum thapsis*).

Noxious Weed Environmental Consequences

Introduction

With regard to noxious weeds, the possible negative consequences associated with any Alternative considered in this EIS largely arise from further disturbances within the project area. For the action Alternatives, activities that could result in negative consequences are principally those involving the heavy equipment used in temporary road construction, the cutting, bunching, dragging, piling, and over-road transport of salvaged trees, and any subsequent mechanical entries associated with salvage fuels management and reforestation. These activities elevate weed risk by both the physical disturbance of soil, which even two years following fire, will result in destruction of newly established competing native vegetation, and in providing vectors for the introduction and spread of noxious weeds. Mitigations are proposed to reduce weed risk, but in projects such as this, where numerous noxious weed sites exist both within the adjacent to the project area, any action alternative will unavoidably be associated with an increased potential for the introduction and spread of noxious weeds. Type of harvesting system will affect weed risk, with systems involving less mechanical travel within and around harvest units being reasonably expected to proceed with less risk. Helicopter logging, for instance, can be conducted with very low weed risk. Where harvest systems within a project are similar, weed risk can largely be equated with the number of acres of proposed harvest. Hence, an alternative proposing a conventional ground-based harvest on 1000 acres, can be reasonably expected to pose a significantly greater weed risk than an alternative proposing conventional ground-based harvest on 500 acres. Specifically, acres of commercial salvage, acres of special forest products salvage, and miles of temporary road construction will be used to compare noxious weed impacts between alternatives.

Direct and Indirect Effects

Common to all Alternatives

Weed management measures recommended in the BAER Team Botanical Report will be continued regardless of the Alternative that is selected. BAER-directed activities within the project area, including those associated with revegetation and direct actions to reduce erosion, pose a risk of introduction and spread of noxious weeds. These risks can be reduced by adherence to mitigation measures included here (see Project Design Elements). BAER-directed efforts toward revegetation and soil stabilization have the potential to indirectly affect noxious weeds by reducing the extent of disturbed, sparsely vegetated land surface while promoting vegetative competition against weeds.

Alternative 1 (No Action)

Overall, this Alternative appears to have a lower probability of introducing and/or spreading noxious weeds relative to any of the action Alternatives. Several actions generally common to the action alternatives, and causative of elevated levels of weed risk, are absent from this Alternative. These ground-disturbing and/or weed seed-vectoring actions include construction of temporary roads, salvage harvest, treatment of salvage fuels, subsequent harvest of special forest products (e.g., firewood) in units already treated by commercial harvest, and reforestation. In contrast, two actions that could reasonably be expected to reduce weed risk, road closures and reforestation, are absent from this Alternative. Reforestation activities, in the short-term, pose a risk of introduction and or spread of noxious weeds, but in the long term, especially in areas where desirable resident seeds, or local seed sources are scarce, can provide a shading canopy that will discourage the presence of noxious weeds in the underlying herbaceous community.

Alternatives 2, 3, 4 and 5 (Action Alternatives)

The level of weed risk associated with these Alternatives appears generally, to be directly correlated with the number of commercial harvest acres proposed for each. In order of increasing number of proposed acres, the rank of the Alternatives is 4, 3, 5 and 2. With regard to the expected short-term weed risk associated with reforestation activities, the rank of these Alternatives, from least risk to greatest risk, is as above: 4, 3, 5 and 2. In the long term, it is possible that higher acreages of reforestation will result in higher levels of canopy closure and stronger deterrence to the establishment of noxious weeds. Based on number of miles of proposed temporary roads associated with each Alternative, the rank of weed risk associated with the Alternatives, from least risk to greatest, is similar, but not identical to above: 4, 5, 3, and 2. With regard to weed risk associated with number of units available for special forest products harvest, the order of the Alternatives, from least weed risk to greatest risk, is 3 followed by 4, with 5 and 2 tied for greatest risk. In terms of the long-term reduction of weed risk associated with road closures, the Alternatives vary little. Alternatives 2, 3, and 4 propose identical amounts of road closures, while 5 proposes slightly more miles of closures than the other Alternatives.

Cumulative Effects

Salvage harvesting included within the B&B Fire Recovery Project will necessarily compound the risks of noxious weed introduction and spread associated with the habitat disturbances caused by both the B&B/Link fires and the efforts to suppress them. The B&B/Link fires are joined by several other large-scale projects/events, recent or planned, that will increase the risk of the spread of invasive plant species on the Sisters District. The Eyerly and Cache Mountain fires of 2002 together burned over 30,000 acres of forest that receives light to moderate recreational use and is infested to varying degrees with noxious weeds. The Metolius Basin Forest Management Project, in the initial stages of implementation in the fall of 2004, will result in extensive forest thinning, in an area of approximately 12,000 acres. This area receives intensive recreation use and includes several noxious weed sites. Numerous smaller ground-disturbing projects, including the Lower Jack and Coil Fiber timber/salvage sales, have occurred within the project area in recent years.

3.17 Insects and Disease

Introduction

After a wildfire, there is typically a large increase in the populations of certain forest insects. Recently dead wood is colonized by a wide variety of wood boring insects and bark beetles that sometimes come from great distances to take advantage of a new and abundant food source. These insects introduce various fungi into the wood that they colonize and the fungi begin the decay process that eventually leads to the recycling of the dead material and the release of nutrients back into the system. Many of the same insects, particularly the bark beetles, will also infest trees that are not yet dead but that have been sufficiently wounded by the fire to have their defense systems impaired. In subsequent years, typically two to four years after the fire, the populations of some bark beetle species (most notably those colonizing ponderosa pine and Douglas-fir) may become quite large and may move beyond the perimeter of the fire and may infest trees that did not sustain any damage in the original fire event.

Insects and Disease Existing Condition

History Relative to Insect Populations in the Area

According to the annual aerial detection survey maps, there are numerous bark beetle species that were active in 2002 in the area of the B & B Fire. These include the fir engraver (*Scolytus ventralis*), the mountain pine beetle (*Dendroctonus ponderosae*) and the western pine beetle (*D. brevicomis*). These beetle populations and others have fluctuated greatly from one year to another in response to changes in climatic factors and the activities of other disturbance agents. For example, the drought period of the early to mid-1990’s led to a substantial increase in populations of the mountain pine beetle in various pine hosts throughout the Sisters RD. At the same time, the Douglas-fir beetle, *Dendroctonus pseudotsugae*, was evident in stands that had been heavily damaged in the late 1980’s by the western spruce beetle, *Choristoneura occidentalis*. In 1997 and 1998 the mountain pine beetle became very active in lodgepole pine stands north and south of the B & B Fire area, and has continued to kill additional trees in those stands through 2004.

The B & B Fire of 2003 has provided an abundance of host material for the bark beetles that were in the area in 2002, and increases can be expected in all of the species named above for the next three to four years.

Description of Significant Insects Related to the B & B Fire

<u>Western pine beetle, *Dendroctonus brevicomis*</u>

The western pine beetle is most commonly associated with large-diameter ponderosa pine and is a primary mortality agent under the right conditions. Wildfires provide those conditions that lead to rapid population increase of these beetles. The ability to complete two generations in one year enables these beetles to take advantage quickly when a food source becomes available to them. In the first and second year after the fire, the western pine beetle will colonize trees that were killed in the fire, but that still have their cambium intact and are capable of supporting the developing beetle broods. Observations from the Hash Rock Fire (Ochoco NF, August 2000) showed that western pine beetles were strongly attracted to trees with all foliage turned brown by the fire, and with 40-50 feet of blackened bole (Eglitis, in press). In past monitoring of tree survival, large pines that lose over half of their crown in a wildfire have been found to be very likely to die from attacks by western pine beetle (Miller and Patterson 1927). In years two to four after the fire, the beetles may infest pines that were weakened but still retain some live crown, or trees that are fairly healthy outside the fire perimeter. Fire-damaged trees that are being left as part of the green-tree replacement component for wildlife purposes are very likely to be killed by the western pine beetle within three to four years after the fire. Western pine beetle populations will usually decline from that point on unless other enabling factors such as drought prevail at the time.

Mountain pine beetle, *Dendroctonus ponderosae*
The mountain pine beetle is associated with numerous species of *Pinus* including lodgepole pine, second-growth ponderosa pine, western white pine, whitebark pine and mature sugar pine. This bark beetle is commonly found on fire-damaged trees. Unlike the western pine beetle that infests trees well after a fire is over, the mountain pine beetle often responds shortly after a fire and may actually be attracted by odors emanating from burned trees (Miller and Keen 1960). The flight period of these insects (July-September) is nicely synchronized to coincide with freshly available host material provided by wildfires that tend to occur in the latter part of summer. In order to be suitable for colonization by mountain pine beetle, these damaged trees must have their cambial tissue intact. (The thickness of ponderosa pine bark usually insures that such is the case, even for trees with severe bole scorch). Infested trees are easily recognized by the thumbnail-sized globs of pitch on the bole where each point of attack has occurred.

Pine engraver, *Ips pini*
Pine engravers are also associated with lodgepole and ponderosa pines, but typically prefer trees of small diameter (4-6 inches dbh). On occasion pine engravers will infest and kill the tops of larger trees, producing a spike top. Fire-damaged trees are attractive to *I. pini* as long as there is cambial tissue present to support the developing larvae. Within the perimeter of the fire, trees having sustained a significant level of fire damage are vulnerable to infestation by pine engravers. Outbreaks have been known to occur in green stands shortly after the fire, but are usually confined to dense stands of pole-sized trees near the fire perimeter.

Red turpentine beetle, *Dendroctonus valens*
Turpentine beetles usually confine their attacks to the basal portion of the boles of host trees (pines exclusively). The presence of pitch tubes resulting from turpentine beetle attack is an indicator that the host tree has been sufficiently wounded to produce pitch flow which serves as an attractant to these bark beetles. Although not a mortality agent *per se*, the turpentine beetle is a good indicator that the host may be vulnerable for colonization by other more aggressive bark beetles.

Douglas-fir beetle, *Dendroctonus pseudotsugae*
The Douglas-fir beetle is associated with Douglas-firs of large diameter and is known for infesting trees that have sustained light levels of fire damage (Furniss 1965). Outbreak populations typically arise a few years after the fire and, in a manner similar to the western pine beetle, can spread well beyond the perimeter of the fire.

Fir engraver, *Scolytus ventralis*
The fir engraver is best known for its dramatic population increases in response to drought. Wildfires also provide habitat for these bark beetles, and true firs sustaining even minimal fire damage (e.g., prescribed fire) may be infested afterwards by engravers (Eglitis, unpublished). However, the spread from fire-damaged trees to undamaged hosts is not as well-documented as it is for Douglas-fir beetle and western pine beetle.

Ambrosia beetles, *Trypodendron* sp. and *Gnathotrichus* sp.
These small insects are closely related to bark beetles but occupy a different niche in the host tree. They burrow directly into the sapwood of recently dead tress and introduce fungi that will serve as food for their developing broods. Although most conifers can be colonized by these insects, the vast majority of ambrosia beetles found in the B & B Fire have been in white fir. Ambrosia beetles occurring in the Pacific Northwest do not colonize live tree tissue.

Wood borers, Coleoptera: Cerambycidae and Buprestidae; Hymenoptera: Siricidae

There are three important families of wood boring insects that use recently dead wood as their food source. These include the two beetle families *Buprestidae* (flat-headed or metallic wood borers) and *Cerambycidae* (round-headed or longhorned wood borers), and the wasp family *Siricidae* (woodwasps or horntails). Most of these wood-boring insects are fairly large, measuring about one inch in length in their adult stage (beetle or wasp), with larval stages that can be considerably larger. Most of them have a one-year life cycle that begins with the adult stage in the spring or summer. Eggs are laid within the bark (beetles) or within the sapwood (woodwasps) and larvae feed for nearly a year as they grow from a small egg to a fairly large-sized grub at maturity. Both of the beetle families feed on the cambial tissue between the bark and the wood before they enter the sapwood (the woodwasps do not). The majority of wood borers infest trees that are recently dead, usually within the first year after death. Any dead tree is likely to be utilized by wood borers, but as a general rule, trees killed by fires will have a higher proportion of these insects than trees dying of other causes.

Given their roles as primary decomposers, the wood boring insects are the primary reason for the sense of urgency that accompanies the salvage of fire-killed wood. All wood borers appear to have a strong association with fungi. Some of these associations may be passive (insects creating holes for fungi to enter the wood) while others are active (vectoring of a symbiotic fungus into the wood). These associated fungi are ones that produce stains and decays. It has been recognized that wood infested by woodborers decays considerably faster than uninfested wood.

The wood-boring insects are also the main reason that woodpecker populations increase dramatically in a forest after a wildfire occurs. The larvae of all wood borers are a highly prized food source for woodpeckers; their feeding can be a diagnostic tool for recognizing infested wood. *It is important to note that the woodborers arriving shortly after a wildfire are a very ephemeral food source and that their populations decrease dramatically in two or three years after the freshly dead wood is no longer available.*

Relationship Between Insects and Fire Intensity

A key factor in the habitat requirements for most bark and wood-infesting insects is that the host trees have their cambial tissue intact. This substrate is essential for the development of bark beetles, and is important in the early stages of larval development for the two beetle families of woodborers (Cerambycidae and Buprestidae). As such, the areas of “moderate burn intensity” should provide the best habitat for these insects. Where needle desiccation (rather than consumption) has occurred, the bole scorch is generally superficial and the cambial tissue has not been damaged. Most trees within the “moderate” intensity would likely be colonized at least by woodborers and possibly by bark beetles. In area of “high burn intensity”, there is greater likelihood that bole scorch has been more severe and that the cambium in the lower bole in some trees has been damaged to the point where woodborers and bark beetles might not be able to establish broods. Miller and Patterson (1927) found that ponderosa pines with heavy fire damage (all foliage consumed and “sour sap” beneath the bark) were far less attractive to bark beetles than were trees with “light to medium” fire injury where crowns were either brown or had some level of needle scorch and the associated cambial layer intact. Requirements for wood boring beetles would be similar. Thus, the trees within the “high burn severity” may or may not be suitable for subcortical feeders depending on the level of damage to the cambium.

Desired Conditions for Insect Populations

Many of the forest insects such as wood borers and bark beetles are important agents in the forest environment. They are involved in nutrient cycling, in producing the disturbances that are critical to the diversity of the forest, and in providing a food source for other organisms. As such, it is important to achieve a balance that allows for these ecological processes to continue, but that still limits insect populations to endemic levels. The populations of all of these insects are ultimately regulated by the amount of habitat (food source) that is available to them, and <u>not</u> by the organisms that feed on them.

Opportunities and Objectives Regarding Insect Populations

A large-scale disturbance such as a 90,000-acre wildfire temporarily disrupts the balance of insect populations in the forest and can lead to even greater imbalance without some directed effort at reducing current and potential insect habitat. Salvage harvest of recently dead and dying trees can reduce insect habitat, and to some extent the insect populations themselves, by targeting those trees that are infested at the time of the harvest, and those that would likely be the next to be colonized. However, it is important to note that we do not have the ability to entirely eliminate the possibility of insect outbreaks through salvage activity because timing is critical and large areas of potential bark beetle habitat remain untreated in any project.

Insects and Disease Environmental Consequences

Even though the land manager has limited ability to avoid outbreak populations of bark beetles (the greatest forest insect-related concern that arises after a wildfire), there are some opportunities. The removal of infested trees and soon-to-be-infested host material helps to limit bark beetles populations to a certain degree. The greatest gains are with the largest infested trees; removal of small infested trees, or trees colonized two years previously have no relevance to reducing bark beetle populations from within the fire area.

The more aggressive the salvage alternative is, regarding the removal of currently infested or soon-to-be-infested trees, the greater will be the potential benefit to live trees in surrounding stands.

Formal monitoring will be done to determine tree survival with various levels of fire damage. District personnel and researchers have tagged a number of trees and recorded the level of crown and bole damage that these trees had sustained in the fire. The condition of these trees will be examined for the next five to eight years.

Relationship Between Insects and Environmental Components

The relationships between forest insects and the issues are described as follows:

- The effects of forest insects on soils and water are indirect. Trees that are killed by bark beetles will eventually fall over and, on steep slopes, may lead to increased soil movement and sedimentation into water sources.
- Within riparian areas, insects may be important contributors to in-stream wood by killing trees that grow under dense conditions in these corridors. In this way, the relationship between forest insects and Fish Habitat is indirect as well.
- The relationships between forest insects and wildlife habitat and ecosystem diversity are much more direct. As key disturbance agents, the bark beetles create gaps in the forest by colonizing and killing certain species, ages and sizes of trees that represent the most appropriate host for each beetle species. As such, these insects are directly responsible for snag levels within the forest and for their temporal and spatial arrangement.
- Wildlife habitat can be affected by insects in either positive or negative ways, depending on the species under consideration. The conversion of live trees to dead trees may be positive for some species (e.g., woodpeckers), but extensive mortality can lead to loss of cover and/or a reduction in the large-tree stand component that might be critical for other species such as the northern spotted owl.
- Bark beetles and wood borers introduce fungi into the wood they colonize and thus influence the rate at which dead wood decays and becomes usable by other organisms, either as food or as habitat.

Direct and Indirect Effects

In the short term, wood-boring insects will colonize most of the trees killed in the fire. In the larval form, the wood borers will provide a nutritious food source for woodpeckers that congregate in the burned area. The colonized wood will begin to decompose quickly through the action of decay fungi brought in by the woodborers. In the medium to long term, these insects will be replaced by others such as carpenter ants that utilize wood in a more advanced state of decay. In general, the significance of these wood-boring insects will be confined to *recently* dead wood and will decrease as time goes on.
The bark beetles in ponderosa pine and Douglas-fir could be important as tree mortality agents in the short to mid term, at first causing the death of trees severely damaged by the fire and then subsequently infesting trees less severely damaged. Within three to four years small infestations may develop in stands outside the perimeter of the B & B Fire if weather conditions favor the buildup of these insect populations within the fire-damaged trees. Larger trees in surrounding stands may be infested and killed if bark beetle populations reach epidemic (outbreak) levels. In the long term, populations will revert to endemic levels until the next disturbance event generates more habitat for them.

Cumulative Effects

Within Central Oregon, other wildfires have occurred recently (e.g. 18 Fire, Eyerly Fire and Davis Fire). Although many insects have dispersal capabilities of several miles, there will likely be no influence from those other fires on the area around the B & B Fire. Bark beetles come from at least three miles away to colonize trees damaged in the fire, and their broods may fly out that far next year or in coming years, so although there is a perimeter effect, it is of a local nature.

3.18 Recreation Resources

Introduction

The B and B project area provides a range of activities for recreation activities and opportunities for the visiting public. Some of which are fishing, hiking, hunting, boating, camping, horseback riding, sightseeing, mountain biking, mushroom picking, firewood collecting and off-highway vehicle (OHV) use. The Suttle Lake area of the project has developed fee sites and provides for water based recreation and overnight camping at multiple locations. The types of vegetation management activities that may affect recreation are salvage logging, slash disposal, reforestation and removal of danger trees occurring near but not in high use. Changes in road status (either development or closure) may also affect recreational activities in the B and B project area.

The majority of the recreational activities occur in lands designated for a variety of Metolius management areas (MAs) in the Deschutes Land and Resources Management Plan, except for Intensive Recreation and Eagle MAs in the Suttle Lake area. The Recreation Opportunity Spectrum (ROS) for the various Metolius MAs include Roaded Natural, Semi-primitive Non-Motorized, Semi-primitive Motorized and Semi-primitive Motorized - Winter. The ROS categories for the Intensive Recreation MA are Rural and Roaded Natural. In general, a predominately natural-appearing environment characterizes the ROS categories for the Metolius MAs with moderate evidence of the sights and sounds of humans. The exception is the Intensive Recreation area around Suttle Lake, where the environment can and does range from obvious to dominant on the landscape.

Existing Condition/Facilities

Campgrounds within the project area include Blue Bay, South Shore, Link Creek (all three on Suttle Lake), Scout Lake, Sheep Springs Horse Camp, Jack Creek, Candle Creek, Abbot Creek, and Round Lake. Day use areas include Suttle Lake Picnic, Cinder Beach (both on Suttle Lake), Scout Lake, and the Head of Jack Creek. Except for Abbot Creek and Round Lake, all of these are fee sites that are operated and maintained by Hoo Doo Corporation.

Abbot Creek and Round Lake Campgrounds are non-fee sites. Abbot Creek Campground was totally destroyed by the fire and has been permanently closed. Factors contributing to the closure included; burn severity of the surrounding forest, low historic use levels, only four sites, the cost of replacing the facilities and the lack of budget to do so. There is no accurate visitor use data for either site.

At Round Lake Campground the toilet and bulletin board were lost. The toilet has not been replaced due to unavailability of funds and the district is considering how to deal with the long-term fate of the site. For obvious sanitary concerns it would be preferable to replace the toilet, but given the current and foreseen budget situation, this may not be possible in the near future. The Recreation Facility Master Plan ranking level for the Deschutes National Forest is very low for this small campground and as such is not a high priority for expenditure of scant recreation funds.

The only campground that’s use was noticeably impacted during the 2004 season was Sheep Springs Horse Camp. Trail condition/availability from the site was poor and use dropped considerably. It is expected that use will increase to near normal levels within the next couple of years as conditions are improved.

There may have been minor effects to use levels at Candle and Jack Creek campgrounds, but it is believed that the low use reported in those sites was primarily due to the fact that they were recently converted to fee sites and some of the traditional users relocated to dispersed non-fee campsites. In general, these campgrounds are used mainly during the big game hunting seasons.

The following use data was provided by the campground concessionaire and is based on total number of sites occupied in a given season (Table 3.197).

Table 3.197: Use and Occupancy by Campground.

Campground Name	Sites Occupied by Year			% Occupancy by Year		
Blue Bay CG - 122-day season, capacity of 130 people at one time, 24 campsites, 2,928 sites available/season.	*2001*	*2003*	*2004*	*2001*	*2003*	*2004*
	1,855	1,903	1,923	63%	65%	66%
South Shore CG - 122 day season, capacity of 185 people at one time, 37 campsites, 4,514 sites available/season.	*2001*	*2003*	*2004*	*2001*	*2003*	*2004*
	2,901	2,981	3,078	64%	66%	68%
Link Creek CG - 192 day season, capacity of 175 people at one time, 33 campsites, 6,336 sites available/season.	*2001*	*2003*	*2004*	*2001*	*2003*	*2004*
	3,260	3,702	3,597	51%	58%	57%
Scout Lake Group CG - 122 day season, capacity of 125 people at one time, 10 campsites, 1,220 sites available/season.	*2001*	*2003*	*2004*	*2001*	*2003*	*2004*
	528	594	694	43%	49%	57%
Sheep Springs Horse Camp - 166 day season, capacity of 55 people at one time, 11 campsites, 1,826 sites available/season.	*2001*	*2003*	*2004*	*2001*	*2003*	*2004*
	931	952	671	51%	52%	37%
Candle Creek CG - 122 Day season, capacity of 50 people at one time, 10 campsites, 1,220 sites available/season.	*2001*	*2003*	*2004*	*2001*	*2003*	*2004*
	No data	336	302	N/A	28%	25%
Jack Creek - 122 day season, capacity of 90 people at one time, 18 campsites, 2,196 sites available/season.	*2001*	*2003*	*2004*	*2001*	*2003*	*2004*
	No data	No data	424	N/A	N/A	19%

Table 3.198 extrapolates data from Table 3.197 to determine the approximate number of overnight visitors to each campground. This was accomplished by multiplying the number of sites occupied by campground by the Oregon state average number of people per vehicle (3.1) to determine approximate total use by site. This would be a low end estimate since it is not known how many vehicles per site actually occurred. These campgrounds attract a variety of people seeking mostly water-based recreational opportunities.

Table 3.198: Approximate Amount of Use by Campground.

Campground Name	Approximate use by Year		
Blue Bay CG	*2001*	*2003*	*2004*
	5,751	5,899	5,961
South Shore CG	*2001*	*2003*	*2004*
	8,993	9,241	9,542
Link Creek CG	*2001*	*2003*	*2004*
	10,106	11,476	11,151
Scout Lake Group CG	*2001*	*2003*	*2004*
	1,637	1,841	2,151
Sheep Springs Horse Camp	*2001*	*2003*	*2004*
	2,886	2,951	2,080
Candle Creek CG	*2001*	*2003*	*2004*
	No data	1,042	936
Jack Creek	*2001*	*2003*	*2004*
	No data	No data	1,314

Comparison of 2001, 2003 and 2004 use and revenue (not displayed) data suggests that there was about a 5% increase in the 2004 operating season. There are too many variables such as weather, blue Green Algae, fee collection efficiencies, economy, etc., to accurately compare the actual effect that the fire had on use levels, but indications are that the fire will have little or no residual impact to future use levels or patterns in the developed recreation areas.

Day use areas include Suttle Lake Picnic, Cinder Beach (both at Suttle Lake), Scout Lake and the Head of Jack Creek. Visitor use data for day use areas are not available but all of these sites receive heavy recreation use during the summer months.

The level of unregulated camping with no fee (dispersed) recreation throughout the project area is considered high, especially during the summer camping season and holidays. Many sites and areas are accessed from trailheads and points within the project area, but whose destinations are outside of the project area (such as Three Sisters Wilderness). Frequently used dispersed sites are located throughout the project area, especially those adjacent to running water (i.e., Abbot Creek, First Creek, Canyon Creek, etc.).

Dispersed recreation activities make up a large portion of the recreation use in the project area. Long-time users of the area are generally made up of Sisters area residents as well as those coming from the Willamette Valley. They prefer the lack of management or facilities in the general forest areas as opposed to regimented camping found in the developed campgrounds. They favor the freedom to choose campsites and picnic areas as the mood strikes them, or they have traditional campsites or areas that they frequent off and on throughout the year. Most come to this area to camp and fish or hunt, but some come for OHV or 4 X 4 riding.

Dispersed camping is very popular in the project area, especially at sites adjacent to water. Dispersed recreation use impacts result in a loss or degradation of vegetation, soil compaction, sanitation problems (litter, water pollutants, etc.), and a change in site character (ex. crowding, scenic quality). This is caused primarily by: user-made roads and trails, pit toilet development to close to a stream or lake, use of vegetation for firewood and other camp use (construction of furniture, lean-tos, etc.), and the increase in use of the area by recreationists.

A majority of the sites are large, providing for larger families or group camping opportunities. Over the years, the popularity of these sites has increased, resulting in their vegetation and soil resources being heavily impacted, especially those in riparian areas. Recreational use has resulted in trampled vegetation associated with dispersed campsites, pull out areas, and user trails. It is likely that surface runoff is occurring at the larger, more heavily impacted sites near a water body. Though there is no hard data to detail use numbers for dispersed recreation, it’s intuitively known that use has been on the increase over the past dozen years or so. As with the developed campgrounds, the increase in dispersed camping has occurred over the years as central Oregon has become more popular as a recreation destination and as the population of the area has increased. This results in increased impacts to the riparian, water and vegetative resources. Increased use could also put at risk the solitude and quiet character of lesser-used areas.

There are a few miles of designated trails within the project area. Trail use consists of hikers, horseback riders, snowmobile and cross-country skiers throughout the year.

There are no designated OHV trails in the project area, however there are a number of user-created OHV trails within the project area or on the adjacent private lands. OHVs in the Metolius basin are only allowed on designated roads only. Due to the severity of the fire and resulting reduction of natural barriers, there is a concern about increased use of OHVs and the potential resource damage.

Within the project area, a closure order is now in effect restricting motorized use within the fire perimeter.

Special Uses
An annual operating plan provides management direction for the campgrounds and resorts under recreation special use permits. There are no non-recreation special use permits in the project area. Permits are required for the gathering of special forest products, which include firewood, cones, mushrooms, transplants, rocks/minerals and post and poles.

Several resorts and private camps are within the project area, located at Suttle Lake, Round Lake, Blue Lake and Dark Lake. Of these, the area most affected by the fire was at Round Lake where the fire was very intense and removed most of the ground and overstory vegetation. Some of the minor structures were lost at the private facilities at Dark Lake and Round Lake, but nothing that would effect the operation of these sites.

The impacts caused by the fire were:

- Round Lake Christian Camp - buildings destroyed, camp closed. Plan is to rebuild in summer 2005. Haven't operated the camp since the fire.
- Camp Tamarack - affected by closure during the fire.   No impacts directly to the camp infrastructure, other than to the scenic quality. Some impacts to off camp use - trails and camping areas in the Blue Lake area.
- Suttle Lake Methodist Camp - affected by closure during the fire, no impacts to infrastructure. Lost one teepee off the camp that was burned up.
- Suttle Lake Resort - no impacts to infrastructure - smoke damage to restaurant.   Loss of revenue due to closure and delay in construction of new facilities.
- Camp Sherman Store - income loss due to closures.

- Metolius Tract Recreation Residence - use loss due to fire closures.

Other impacts were to commercial outfitter guides in the Jefferson Wilderness, and in the Santiam Pass area. Most guides have moved their operations elsewhere.

Below are Use Numbers from permits within the fire area for 2004:

- Camp Sherman Store - 105,464 annual visits. Fire occurred during busiest months - August/September, which accounted for approximately a 20% reduction, for a total of approximately 84,371.
- Wizard Fall Fish Hatchery - 70,000 annual visits. Fire induced closure reduced the number of visitors; exact number not known.
- Recreation Residences - 24,000 visits.
- Outfitter Guides – 1,500 user days on Sisters side of Mt Jefferson Wilderness.
- Suttle Lake Methodist Camp - 20,000 visits.
- Round Lake Camp - 3,000 visits.
- Camp Tamarack - 3,000 visits.
- Redmond Saddle Club - 1230 visits.

Effects of the B & B Fire

The landscape and the recreational experience have changed and the area would not likely meet visitor's expectations for at least the next five years until vegetation begins to return and changes the landscape to a more forested/vegetated character. Many of the dispersed areas and one fee campground were burned over by high intensity fire. The fire has removed most live vegetation that provides shade and screening from the view of adjacent sites.

The fire completely burned Abbot Creek Campground, a four-site campground. This was a low use site but frequented annually by local families. All facilities were burned here and the site will be permanently closed due to lack of funds to replace the facilities, the severity of the burn in this area of the fire and the low recreation use this site received. Round Lake Campground had a toilet facility and bulletin board destroyed in the fire. This is another low use site. Visitors will likely shift their use to other places, or continue to use the area minus the facilities. Replacement of burned facilities at the above mentioned sites would be dependent on available funding to do so.

Also, the North Blowout nordic snow shelter was also destroyed. This facility is very popular and the District is planning to rebuild as soon as possible.

Environmental Consequences

Alternative 1 - No Action

Direct and Indirect Effects

Under the No Action Alternative there would be no change to the recreational opportunities that exist post fire. Custodial management such as danger tree removal along roads and in developed campgrounds and fire suppression would continue.

Access to the area would remain at its current levels, especially in areas that are not as dramatically burned or altered from the fire. These particular areas may actually see an increase in use, as they would be more appealing than those more affected by the fire. Also, the visiting public would have an elevated level of risk of hazards from falling dead trees, especially adjacent to the dispersed sites and areas, as they are not managed for danger tree removal as developed sites are.

Also, due to loss of natural barriers and unrestricted access, inappropriate OHV use is expected to continue and possibly increase (due to lack of natural barriers).

Cumulative Effects

The recreation setting around and near recreation sites has changed due to the fire. It's not expected that the loss of vegetation will deter or reduce use at the developed campgrounds and the fire did not impact resorts at Suttle Lake, as the immediate area at these recreation facilities. Also, as these sites are primarily water-based recreation oriented, the visitors would continue to frequent and use them regardless of the visual impact made by the fire on the access to these sites.

Alternatives 2, 3, 4 & 5

Direct and Indirect

Most of the effects to recreation resources would be similar by each alternative. The only difference would be in the amount of salvage, location of salvage and the location and amount of road closures that are proposed. As such, the effects are combined in this one narrative, with any marked changes between the alternatives specifically described as needed.

These alternatives would likely be most noticeable and affect those who recreate during the summer season in the first 1 to 3 years. Dependent upon the timing, if one of these alternatives were selected, dust and noise from harvest equipment would be evident to the casual visitor. Evidence of harvest operations would be noticeable for up to three summers, once implementation begins. A mitigation measure was developed that would identify how areas should look after treatment (e.g. stump heights, etc.) to reduce the overall effect in more sensitive scenic areas, such as along major travel routes or recreation sites.

For dispersed settings, hazards that would otherwise be present from falling snags in the next decade would still be present, but to a lesser degree due to salvage efforts.

There are no developed facilities that would have to be closed for harvest operations. However, forest visitors may notice limited access caused by harvest operations. For safety, many lesser roads could be temporarily closed for up to one year at a time while harvest operations are being implemented. Main access around Suttle Lake and other recreation sites and areas may also be temporarily closed or delayed during logging operations. Alternate access during the summertime months may be provided and flaggers may be present, causing a delay for some in reaching their destination. These potential delays could last for up to 30 minutes on main roads and from one to two summers on lesser-traveled routes.

Closure and restoration of user-created roads and some system roads will reduce impacts to scenery and aesthetics, restore vegetation and provide for visitor safety. It will reduce the amount of open road available to OHV enthusiasts. These recreationists will likely go to other areas to partake in this activity, or ignore restoration efforts and continue to use the closed roads, or create new trails to give them the experience they are seeking.

In general, the amount of road closures being proposed in each alternative would reduce driving opportunities for sightseeing and other activities. However, the proposed closures are proposed in a way to still provide many driving opportunities to motorists and recreationist and to provide access for fire crews. Roaded access is still available to all portions of the planning area by remaining nearby open roads, i.e., access to adjacent areas (to each proposed closure) would still be available via another open road. Even so, proposed closures would eliminate motor vehicle access to areas that were once available to the public. This is likely to result in dissatisfaction of some visitors that once used the closed roads for dispersed camping, sightseeing, big game hunting, gathering forest products and other recreational activities. Furthermore, road closures from other projects in the Metolius and surrounding areas exacerbate this concern. The overall effect to the public is that there are fewer roads to drive than there were previously.

All alternatives have treatment units adjacent to or within a mile of the Three Sisters Wilderness boundary. Though the activities would not have any direct effects on Wilderness resources, activities would have indirect effects. Logging and other treatment projects would be seen by visitors traveling to Wilderness trailheads. Sounds associated with logging activities would also be heard by visitors in areas of the Wilderness near treatment units. The effects of this would be limited to when logging activities occur and duration of project proposals. Alternative 4 would have the least amount of units (two) and as such, would have the least effect on Wilderness visitors.

Cumulative Effects

Roaded access would remain open as part of the long-term management plan. The reduction in access displayed in Table 3.199 below would likely have no measurable effect to those who drive for pleasure or need to access favorite places or areas. Though the closures will have a direct effect on access to areas/roads that were once available to the general public with motorized vehicles, the amount of remaining open roads would still provide access to similar areas for the same types of activities sought. There is relatively no difference in effect between alternatives as they propose the same type and amount of closure, except for Alternative 5.

Table 3.199: Road Closure Proposal by Alternative.

Type of Closure	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Decommission	0	51	51	51	55
Inactivate	0	20	20	20	22

3.19 Unroaded Areas

Introduction

Unroaded areas as defined in the FEIS for the Roadless Area Conservation Final Rule are "any area, without the presence of a classified road, of a size and configuration sufficient to protect the inherent characteristics associated with its roadless condition. Unroaded areas do not overlap with the inventoried roadless areas." Unroaded areas are not usually inventoried and are, therefore, separate from inventoried roadless areas. This document uses the term "unroaded area" to differentiate these areas from inventoried roadless areas. (There is a large portion of the Mount Jefferson Inventoried Roadless Area {IRA} within the B&B Fire project area. There are no treatment units proposed in any IRA.).

There are no Forest-wide or Management Area standards specific to unroaded areas in the Deschutes Forest Plan. There are limited areas in the B&B project area that are in the category of unroaded, most of which are adjacent to Wilderness or IRA, in LSR, Metolius – Special Forest and Metolius – Spotted owl management areas. As these unroaded areas are not inventoried, the acreage is not known.

Affected Environment

There are some areas of unroaded that do have treatment units proposed under this project. Specifically salvage units 44 & 47.

The effects discussion focuses on the values that may be provided by unroaded areas, including the following:

- Natural appearing landscapes for dispersed unroaded recreation opportunities such as hiking, camping, wildlife viewing, hunting, and cross-country skiing, and the solitude they can provide.
- Protection of cultural and heritage resources.
- High quality or undisturbed soil, water, and air; sources of public drinking water.
- Habitat for abundant and healthy fish and wildlife populations.
- Diversity of plant and animal communities, including areas that are relatively at less risk from noxious weeds.
- Habitat for threatened, endangered, and sensitive species.

The small unroaded areas are likely considered secondary or incidental to other recreation locations and activities in the area. Most visitors and recreationists frequent established recreation sites, whether developed, dispersed or Wilderness; though some use of the unroaded areas likely occurs. Although the unroaded areas may provide some seclusion and feelings of remoteness or solitude, it is unlikely there are strong attachments to them as there are no major viewpoints or other attractions (such as water features) to attract such use. Most visitors and recreationists utilize the Wilderness for achieving these goals.

As use increases with the influx of population and recreationists in central Oregon, demand for unroaded recreation could also increase, as would other forms of recreation (developed and dispersed, motorized and non-motorized).

Environmental Consequences

Direct and Indirect Effects

Alternative 1

There would be no direct effects from the No Action alternative on any of the unroaded areas. No activities would take place that would have any direct or indirect effects on the roadless character of the areas.

Alternatives 2, 3, 4 and 5

Natural appearing landscapes for dispersed unroaded recreation There would be some direct or indirect effects from the action alternatives to any unroaded area, but specifically to the area that encompasses portions of units 44 and 47. This would change the character of the unroaded area so as it would not be eligible for inclusion in either the existing IRA to the west or for future consideration as Wilderness. This will occur as a result primarily of temporary road building necessary for the proposed salvage logging units.

Noise created during logging operations would affect Wilderness, Roadless, unroaded recreationists while chainsaws and other equipment are in use. Temporary road construction would affect the scenic integrity of the unroaded areas while the road is in use and until it is completed. Around the fringes of the unroaded area, salvage logging would be evidenced by stumps, and by the sights and sounds of the activities during operations.

Undisturbed **or High Quality Soils, Water, Air** Impacts to soils where units overlap the unroaded area are expected to be negligible.

Habitat for Fish and Wildlife/Diversity of Plant and Animals There is no fish-bearing water bodies in any of the unroaded areas.

Protection of Cultural and Heritage Resources There would be no direct or indirect impacts to cultural resources in unroaded areas.

Noxious Weeds The risk of noxious weeds invading these areas is limited to the area of disturbance. Mitigation measures listed in Chapter 2 are expected to be effective in limiting the introduction and spread of noxious weeds in the project area.

Cumulative Effects

Road building, past harvest, and the B&B Fire have impacted the natural appearance of much of the project area. Salvage logging will take place only in high or moderate intensity, where there is complete mortality.

Based on recommendations of the Roads Analysis reasonably foreseeable future management of the transportation system includes road closures and obliteration, and re-opening of some roads. Roads to be closed around the unroaded area may increase the degree of “roadless character” on a local level.

3.20 Scenic Quality

Aesthetic Experience

The scenic quality within the project area is generally based on people's perception, including emotional and/or physical attachment to the landscape from a sensory perspective (such as sight, sound, feel, taste, and touch) and cultural value (such as attitudes and beliefs).

The existing condition decribed in this document includes "positive attributes" and "negative deviations" from the valued landscape character. Deviations from the valued landscape character often caused by human or management activities, such as impact from new facilities construction, user created patterns that disturb natural landscape character or vegetation, the increase in human interaction that socially impact quiet places or private areas (i.e. increased number of recreationists altering site and/or recreational experience, as in changes in ROS (Recreation Opportunity Spectrum) classes, as well as naturally caused disturbances (such as wildfire that destroy life and property, insect and disease in old growth stands, flooding or erosion that altered a special place etc.).

Scenic Condition Summary

The scenic conditon within the B & B Fire area often does not meet the expectations and preferences of the visitor or users due to the affects of ecological characteristics of the area including severe wildfire regimes, such as the B & B Fire of 2003 and the Spruce Bud Worm epedimic of the 90's, as well as green overstocked and high density (doghair) stands. Wildfire, which has not been allowed to ravage the area vegetation in the past, have altered the natural successional patterns within and across the landscape. As a result, this has led to the increased density of understory trees that may not have existed in the area historically. Thus, the overstocked forest environment has reduced the health and vigor of the stands, due to the lack of available moister and nutrients, and led to serious insect and disease outbreaks that have reached epidemic proportions throughout the landscape. The increase in understory vegetation also created ladder fuels that led to severe fire occurrences, such as the B & B Fire, that subsequently followed. Still, this highly valued landscape--even if not quite as in tact as it once was—continues to be valued and appreciated by the general public who passionately recreate and utilize this area for its strong "sense of place" settings.

LANDSCAPE CHARACTER DESCRIPTION

Distance Zone

There are two primary distance zones that falls within the B & B project area as viewed from a viewer location (such as a fixed viewpoint) or a scenic and travel corridor (such as from primary and secondary access and travel route, trail or trailhead). The area is primarily being viewed as a **Foreground** (0-1/2 mile) scenic corridor, such as views from along the highly valued Santiam Pass, and **Middleground** (1/2-5 miles) landscape area. Please refer to Deschutes NF LRMP **Management Area 9** map for more detail.

Santiam Pass (Hwy 20) Scenic Corridor

Posivitive Attributes:

The B & B Fire Recovery Project area encompassed a very dynamic landscape found on the foothills of the Oregon's Cascade mountain range. The Santiam Pass Scenic Corridor offers a growing number of travelers magnificent views of snow capped mountains, grassy meadows, lush-green forests, crystal clear lakes, flowing rivers, rushing streams, and gushing springs. Characterized as a "transition landscape" between the Cascade Mountain Range, the Willamette Valley, and the high desert of Central Oregon, the diversity in landscape character is what attracted visitors to this area year after year. Abundant wildlife species, majestic views and vistas, ample recreation opportunities and experiences of various kinds, have made this area a renound destination spot in the Pacific Northwest. The primary plant association in this transition landscape is a mixed variety of pine and fir forests in mid to early serial stage. This area is also characterized as the "Yellow Pumpkin" or "Yellow Belly" forest where stands of large ponderosa pine trees exist as a testiment to the productive nature of this transition landscape.

Negative Attributes:

In Central Oregon, large wildfires and other natural and man-made forest disturbance processes are especially visible and accessible to the forest visitor along major travel corridors, such as the Santiam Pass Scenic Corridor, especially within recent times. These include the B & B Complex, McCache, Link , Eyerly Fires near Sisters, and Davis Fire along Highway 46 near Crescent, Road 18 and Bessie Butte Fires along Highway 97, Skeleton Fire, and Awbrey Hall Fire on Highway 46 near Bend. Cumulatively, these large-landscape scale disturbances have directly and significantly altered the overall landscape character and scenic views, deviating from Central Oregon's characteristic landscape.

The Spruce Bud Worm infestation, which killed between 40 to 60 percent of the area's forest, have led to a massive salvage treatment of the corridor during the 1990's, generally to improve forest health, improve scenic quality, and reduce fuel loading in the severly effected area. Subsequent high mortality wildfires, including the B & B Fire of 2003, have severely damaged existing forest structure further and degraded scenic views, particularly in areas where salvage treatment was light or did not occurr. High density white fir and lodgepole pine stands still created a strong "wall effect" in some areas within the B & B Fire project area. Many of the large ponderosa pine trees have been overcrowded and hidden among these high density stands found along this highly valued travel and scenic corridor.

Suttle Lake, Blue Lake, and Round Lake Area

Positive Attributes:

The Suttle Lake, Blue Lake, and Round Lake are within close proximity of each other. These three high elevation lakes have always been very special and unique for people and wildlife alike. Since ancient times, this area has been a highly popular playground (both recreation uses and special uses) to generations of people who came to absorb and enjoy the area's natural beauty. Archaeological records have shown that the Native Americans have used this area extensively, especially in areas around Suttle Lake. Present day people, from all walks-of-life, also recognize the high value of this area for the truly unique quality and diversity of landscape character, as well as the exceptional recreational values that this area offers. From the gentle rolling hills to crystal-clear water, these lakes draw countless people who come to experience these special places for countless generations. These visitors have always been attracted to the radiant and lush-green mixed pine forest, the open-grassy meadows, the abundant fish and wildlife species, and the picturesque vistas to distance hills and snow capped peaks that provide the visitors with a sense of absolute awe. Atypical and exceptionally beautiful landscape characteristics found and valued throughout Central Oregon made these lakes prime destinations.

People have often sought and found seclusion, solitude, and being closer to nature on and around these lakes. Designated and dispersed camping, hiking, picnicing, site seeing, hunting, fishing, and special forest products collection, such as firewood and the highly prized and valuable mushroom gathering, are some of the most popular uses in this area. People just love and appreciate the sense of "visiting the woods" surrounded by beautiful scenery and varieties of outdoor recreation experience in a natural forest setting.

These highly popular lakes and nearby destination resorts, along with popular day use areas, campgrounds and boat launching facilities, are the premier centerpieces in the area. These lakes are well known to generations for a good quality fishery where the pursuit of a trout and other game fish is a sport as well as an art form. Sport fishermen (and fisherwomen) could be seen pursuing their trophy trout from their float tube and boats of various sizes and shapes. Once a fish is hooked, it assures that the fishermen (and fisherwoman) would return to the area repeatedly, year after year, which is what made these lakes unique and special.

The B & B Fire of 2003 has since altered the landscape character of the area to some extent, but its strong “sense of place” is still very much in tact.

Negative Attributes:

Although the existing burned forest condition may appear "natural" to a casual visitor, it is actually far from being "natural." The wildfire has somewhat altered the forest structure and landscape character within the surrounding area. In some areas around Suttle Lake, for instance, the forest has been lightly burned and several miles of hiking trail have been damaged by the B & B Fire. Decades of fire suppression and other human intervention, and/or lack there-of, have led to the current state of forest health conditions that favor severe fire occurrences. Such conditions do not meet social and ecological character expectations. The alteration by this fire to the natural and cultural resources, including traditional recreation values, is a very serious concern to the public.

The loss of a natural appearing forests to insect, disease, and subsequently wildfire, especially within and around developed recreational sites, increasingly adds to the negative deviation from the “natural appearing” landscape character expected by the concerned public.

Metolius Basin Area

Positive Attributes:

The B and B Fire of 2003 crossed over into part of the Metolius Basin, an important watershed area that drains into the Metolius River, a designated Wild and Scenic River system. The topography here transitioning from gentle slopes (5-20%) at the head water of the Metolius River to steeper gradients (above 20%) at the western slope of the basin where the B and B Fire burned with various intensities. Elevations here range from about 3300 to 7000 feet above sea level. Precipitation primarily occurs in the form of snow in the wintertime, and the amounts are higher based on proximity to the Cascade Mountain Range. The Landscape is dominated primarily by mixed conifer stands containing large trees and a wide variety of species (Lodgepole, incense cedar, Douglas-fir, ponderosa pine, and white fir). Major travel ways into this area are Forest Road 14 and Road 12. These access roads are the primary access into and out of the numerous recreation sites, including world class trout streams, developed campgrounds along the Metolius Wild and Scenic River, and other recreational destinations that make this area very special.

This is a landscape with features such as cinder buttes, and water bodies in the form of perennial streams, and permanent natural springs. The area contains strong line, form, color, and texture (components used to measure scenery). A diversity of large trees, including the significantly large “yellow belly” ponderosa pine and Douglas-fir trees lining the roadway.

Negative Attributes:

In the past two decades, use has increased dramatically within the Metolius Basin. Heavy summer traffic coming and going toward established resorts, and new development (such as summer homes) have altered the area from one of natural to a more rural landscape characteristic. The “essense” of this area is changing from a personal connection with nature to a large-scale social interaction recreation experience. The trend of increase human activities within the area, including recreation, special uses, and timber management, are also starting to result in soil compaction and displacement, expecially along the riparian community areas.

The B & B Fire which burned along the western fringe of the Metolius Basin has also altered the existing forest character to a degree and deviated from the naturalness or wholeness of the area’s landscape character.

EXISTING SCENIC CONDITION

Pre-fire Conditions

During the early 1980 Decade, the B & B Fire area had healthy forests with numerous trees of various age and size classes. At about the same time, one of Oregon worst drought season was looming, which lasted for several years. Serious insect and disease infestations followed that led to serious degradation on the forest structure in the late 1980 and 90’s. Much of the area’s forest has been affected by Spruce Budworm infestation, which killed many trees—as much as 60 percent mortality rate in some pockets.

Much of the affected area, including Spruce Budworm infestation areas, have subsequently been thinned (salvaged), such as along the Hwy 20 scenic corridor, during the 1990 decade. This decade saw more severe drought, which led to numerous high intensity wildfires in the area during the 2000 decade.

The 2000 decade saw forest structure within vicinity of the B & B Fire area burned up extensively by high intensity wildfires, such as the Eyerly and Cache Mountain Fire. The B & B Complex fire of summer 2003, at 92,000+ acres, represents one of the largest wildfires to have burned in the region. This wildfire alone has directly affected and altered five (5) of eleven (11) landscape areas (refer to the 1996 Metolius WSA Landscape Areas) within the watershed. As a result, it has highly altered the existing landscape character, scenic quality, and scenic integrity level within the area.

Post-fire Conditions

In Central Oregon, large wildfires and other forest disturbance processes are especially visible and accessible to the forest visitor along major travel corridors, especially within recent times. These include the B & B Fire Recovery Project Fire along Highway 20, Road 18 and Bessie Butte Fires along Highway 97 and Skeleton Fire on Highway 20 and Awbrey Hall Fire on Highway 46 near Bend, Eyerly and Cache Mountain and Link Fire along Hwy 20, and insect infestation with associated tree mortality on Santiam Pass along Highway 20 prior to the wildfires of last year. These events tend to alter the existing landscape character, scenic quality, and scenic integrity level from mostly “natural appearing” to a more “distinctive”, altering scenery to a degree that is perceived by many to deviate from the landscape character that the constituents valued for their aesthetic quality (i.e., it no longer appears as natural, or whole).

Along primary scenic corridor routes, such as Hwy 20, which is a heavily used corridor, natural disturbances such as past wildfires, insect and disease infestation, and wind damage to the forest are strongly evident. As a result of the B & B Fire, the area is characterized by a “mosaic” of burned forest conditions, ranging from unburned or low intensity fire, to stand replacement in other areas where vast pockets of stands are completely charred (please refer to fire intensity map for more detail and general location of fire intensity on forests).

The views along the scenic and travel corridors, in general, have been altered from high density foreground landscape into open vistas toward Middleground and background landscape. Along a stretch of Highway 20 scenic corridor, the views are more open where mortality was classified as mostly moderate to high. In some pockets on either end of the fire perimeter, the fire burned less intense, creating various mosaic patterns within a forest of mixed tree species. Although this fire may visually appear “natural” to some forest visitors, many perceive the landscape no longer contains the components of healthy landscape, such as lush green and healthy forests. Also, landscapes are primarily viewed by two types of constituents; casual forest visitors who mainly are from outside the central Oregon area, and local residents who tend to be more familiar with forest structure succession and processes.

The fire intensity within the Foreground and Middleground landscape designation, as viewed from a sensitive scenic corridor, such as Hwy 20, was mostly high where tree mortality is 100%. The vegetation most likely will appear blackened across much of the landscape for many years to come, although new grasses and herbaceous ground cover has naturally begun to emerge during the fall season of 2003 and spring season of 2004.

The wildfire created a landscape characterized as “unique” (Forest Service Manual 2380, Landscape Management). In areas where stand replacement occurred, the fire has created numerous views and vistas toward distant landscapes, including “filtered views” as well as “open vistas” toward distant buttes, canyon walls, and lakes. Although wildfires create openings, they also tend to highlight road building and other presence of human activities across the landscape that can transform the visitor’s encounter to less of a “high quality experience”.

CULTURAL VALUES

“Scenic attractiveness is the primary indicator of the intrinsic scenic beauty of a landscape and the positive responses it evokes in people. It helps determine landscapes that are important for scenic beauty, based on commonly held perceptions of the beauty of landform, vegetation pattern, composition, surface water characteristics, land use patterns, and cultural features” (*Landscape Aesthetics: A handbook for Scenery Management*, USDA, 1995). Scenic attractiveness is ordinarily very stable. However, in rare circumstances, scenic attractiveness may change because of natural disasters or human (cultural) alteration of the landscape. Change may increase the potential for a “typical or common” landscape to become “distinctive” (*Scenery Management System Handbook,* USDA, 1995).

The USDA Forest Service established a Handbook for Scenery Management System (SMS--USDA FS 1995) use to protect and enhance scenic resources, which may be diminished by human activities, such as vegetation management, recreation, and/or administrative facility development.

The Scenery Management System will be used in conjunction with the Deschutes National Forest Land and Resource Management Plan (LRMP 1990). The analysis will take into consideration the balance between Social and Ecological needs within the study area.

The Forest Service implementing regulations, currently establish a variety of **Scenic Quality Standards** (SQO's for MA-9). These standards include:

1. Natural Appearing Landscape with High Level Scenic Integrity (formerly Retention, SV-1 allocation),
2. Slightly Altered Landscape with Medium Level Scenic Integrity (formerly Partial Retention, SV-2 allocation),
3. Altered Landscape with Low Scenic Integrity (formerly Modification or General Forest, GFO allocation).

SCENIC VIEW ALLOCATIONS

The Deschutes National Forest Land and Resource Management Plan established a variety of Management Areas (MA) used to manage national forest land. Within the B & B Fire Recovery Project area they included: Scenic Views (MA 9, SV-1, SV-2, and SV-4) and various Metolius Scenic allocation areas (refer to LRMP map for more detail). An estimate of approximately 947 acres (or 2.4% of the total 42, 143 acres) are within various Scenic Views allocation areas, approximately 9, 861 acres (or 23.4% of total 42, 143 acres) are within the various Metolius Scenic segments (MA 21 and MA 26), approximately 1, 730 acres (or 4.1% of total 42, 143 acres) are within Metolius W & SR (MA 28), and approximately 19, 933 acres (or 47.3 acres of total 42, 143 acres) are within Metolius Special Forest (MA 22).

Highway 20, and Forest Road 14, 12, 2070, 2076, 2066 scenic corridors are the primary access routes into and out of the B & B project area. Secondary access route included Forest Road 1210, 1220, 1230, 1232, 1234, 1235, 1260, 1270, 1280, and Forest Road 1292. Highway 20 and Forest Road 14, 2070, 2076 have been allocated as Natural Appearing Landscape with High Level Scenic Integrity (formerly Retention, SV-1 allocation) within the Foreground landscape area. Forest Road 2066, 12, 1210, 1220, 1230, 1232, 1234, 1235, 1260, 1270, 1280, and Forest Road 1292 have been allocated as Slightly Altered Landscape with Medium Level Scenic Integrity (formerly Partial Retention, SV-2 allocation) within the Foreground landscape area. Please refer to the Deschutes NF LRMP MA 9, MA 21, 22, 26, and MA 28 map for more detail on scenic allocation areas and classifications.

ENVIRONMENTAL CONSEQUENCES

The proposed activities assume vegetative management and management directions that upon implementation would create an altered and different forest character than the existing condition. It is also assumed that upon implementation, the forest health is improving, fuels are reduced, and the enhancement of long-term scenery, recreational, and other experience is also expected.

The effect on scenic resources from the proposed action, specifically on landscape character, scenic quality, and scenic integrity level, can be classified into two specific categories. The first is short-term effects (within landscape terms of 0-5 years), and the other is long-term effects (from 5 years and beyond). The effect from the proposed management activities would be most evident to the visiting public within the foreground landscape (0-1/2 mile for scenic and travel corridors) and some part of the Middleground landscape (1/2 to 5 miles, mainly from viewer locations, such as from Black Butte, Highway 20 and other sensitive travel corridors.

The unit of measure for the environmental effects, specifically on scenic resources from the proposed management activities, can be categorized into two distinctive areas. They are: 1. Acre (or percentage) of improved or enhanced scenery; and 2. Acre (or percentage) of impacted on short-term scenic quality within the Foreground and Middleground landscape as viewed from a travel corridor following implementation. This effect analysis is takies into consideration both short and long-term effects.

DIRECT AND INDIRECT EFFECTS

Alternative 1: No Action

Under this alternative, the entire B & B Fire project area perimeter (est. 41,000 acres), including 10, 808 acres (or 25.6 % of total 41,000 acres) within scenic views allocation, would not be actively managed. Evidence of human activity would not be apparent, except around the developed campsites and travel ways where danger trees have been felled as part of B & B Hazard Trees Project. The successional processes, such as insects, diseases, lateral and vertical fuels build up, would continue without intervention.

The current management actions would continue as is (e.g. management of recreation use and services, fire suppression, danger trees, standard road maintenance and re-closure of breached roads, etc.). No action would be taken to reduce risk at a landscape-scale under this alternative. No action would be taken to salvage and recover valuable wood fiber to benefit social and ecological needs. Vegetation health, growth, and vigor would be at the mercy of nature with little to no human intervention.

The current dead and dying vegetation condition, whats left after the B & B Fire, would continue to degrade and this forest structure may collapse altogether. As a result, this could eventually affect long-term scenic quality, forest health, and also public safety--as related to access and travel management.

The area's landscape character, scenic quality, and scenic integrity level would remain essentially the same during the short-term period. The long-term scenic quality, scenic integrity level, and landscape character are expected to be highly altered through time as the fire damaged forest structure naturally degrade and subsequently collapses altogether.

No harvest or reforestation activities would be proposed and vegetative recovery would take place at a slower rate than if planted. This is due to a lack of seed source over large areas where successful natural regeneration would be delayed within moderate to high mortality burned areas. It may be several decades before sapling/pole size trees exist to re-establish visual components within the B & B Fire area. Achievement of the long term desired condition for Scenic Views (i.e., high quality scenery that represents the character of central Oregon forests) would be delayed for several decades. In the event of a wind storm, blow down of the standing dead trees could fall at an accelerated rate and it could lead to large areas of stacked trees on the forest floor and possibly the roadway. Also, there would be an elevated risk to visitors from falling trees and fuels build up that may lead to another severe fire occurrence.

Under this alternative, the Deschutes National Forest LRMP directions, the Desired Future Condition for Scenic Views (LRMP MA-9 as listed and described earlier under Section 4) within the B & B Fire Recovery Project is NOT expected to be met as originally intended.

Alternative 2: Proposed Action

The proposed management activities would have a direct effect on existing landscape character, scenic integrity level, and scenic quality.

These proposed treatment activities, in general, are expected to directly help enhanced long-term (5 years and beyond) scenic quality, by moving the existing burned forest toward the re-establishment of a new forest, which is also meeting the Desired Future Condition under the Deschutes National Forest's LRMP Management Area 9 (as listed and described earlier under Section 4 of the Desired Future Scenic Condition). The short-term (0-5 years) scenic integrity level, scenic quality, and landscape character, however, are expected to be noticeably altered by the proposed management activities (treatments) and practices. Such visual effects under this alternative are expected to be noticeable to the casual forest visitors during the short-term period.

The following proposed treatment units would have a direct effect on the foreground scenic resources and sensitive travel corridors, they include: unit 54 that is adjacent to Highway 20; unit 165 along Forest Road 2070; unit 169 along Forest Road 2066; unit 44, 46, 47, 56, and unit 60 along Forest Road 1210; unit 132 and unit 83 along Forest Road 1220; unit 37, 38, and unit 115 along Forest Road 1230; unit 36 and unit 88 along Forest Road 1234; unit 36, 103, and unit 111 along Forest Road 1234; unit 36 and unit 103 along Forest Road 1235; unit 105, 104, 36, 29, 30, 32, 34, unit 3, 4, 5, 7, 12, 19, and unit 69 along Forest Road 1280; unit 1, 62, 61 along Forest Road 1292.

The effect on scenic resources brought on by these proposed activities are expected to be most evident to the forest visitors (casual observers) within the immediate Foreground landscape (0-300 feet), Foreground landscape (300 feet to 1/2 mile of scenic and travel corridors), and some part of the Middleground landscape (1/2 to 5 miles zone from scenic and travel corridors and from Black Butte viewpoint).

Soil and vegetation, as well as the landscape elements of line, form, color, and texture, are the major components expected to be altered from the existing conditions during and after the proposed treatment processes. The existing burned vegetation would be treated, which is expected to alter the line elements within the foreground landscape and also the textural and color elements currently found within the Middleground landscape.

The use of ground-based logging systems are expected to have a direct effect on soil and vegetation, which could lead to soil disturbances, textural changes, and also color contrast in the foreground and Middleground landscape area. The use of helicopter system could result in the least impact on landscape character and scenic quality. The short-term cumulative effect on scenic resources from changes in vegetation texture and pattern, soil disturbance and color contrast, especially within the Middleground scenic allocation areas, could exceed the Deschutes LRMP Standards and Guidelines for Scenic Views under normal circiumstances. However, the B & B Fire have already altered those normal circomstances.

The proposed small diameter fuels reduction thinning (defensible space) of dead and down trees along scenic and travel corridors is expected to help reduce road hazards and address fuel loading concerns. Such small diameter treatment activity also expected to enhance the foreground landscape character and scenic views by reducing the dead and dying vegetation, as well as reducing stand density within the immediate foreground landscape area. As a result, a "filtered view" deep into the burned forest landscape has been established.

Post treatment activities, such as clean-up of residual slash and debris, in the foreground landscape within the proposed treatment units and landings along scenic and travel corridors frequented by the recreating public should be completed within 1 year for Retention, and 2 years for Partial Retention allocation areas as specified under Deschutes National Forest LRMP S & Gs. The effectiveness of meeting scenic views standard is expected to be between moderate to high level.

The existing landscape character, scenic quality, and scenic integrity level would be altered from the existing burned out forest to a much more opened landscape character within the proposed treatment areas (refer to the proposed treatment areas map and table under Alternative 2). With the help of effective management practices, including green tree replacement--through planting of tree seedlings and/or natural regeneration, the protection and retention of residual green and standing dead trees, effective post treatment activities, effective implementation of recommended mitigation measures, and on site monitoring, the following end result can be expected:

- The short-term effect (within landscape term of 0 to 5 years period) on landscape character, scenic quality, and scenic integrity level from the proposed actions under this alternative is expected to altere the existing burned out forest to a much more opened landscape character. Such short-term effect, from the proposed salvage and fuel treatment of burned timber, may appear to be drastic alteration to the existing landscape character to both local residents and casual visitors. The line, form, color, and texture elements within the foreground and Middleground landscape are expected to be altered under this alternative. Groundcover components are expected to return within one or two seasons, due to good growing location, and help heal the landscape and thus improve scenic quality.

- The long-term effect (within landscape term of 5 years and beyond) is expected to be of considerable enhancement and beneficial to landscape character and scenic views. The planted seedlings and/or natural regeneration are expected to help healed the burned forest and any potential scaring of the landscape from the subsequence management activities. This new forest would eventually replace the burned out one and help meet the Desired Future Scenic Conditions within the B & B Fire Recovery Project area.

- The existing burned out forest currently found throughout the scenic and travel corridors, such as along primary and secondary access roads within the B & B Fire Recovery Project area, is expected to open up much more to show the expanded views deep into the landscape, including distant buttes and ridges following the completion of salvage activities. The first immediate benefit is that visitors to this area would be much safer from the falling danger trees found throughout the B & B Fire Recovery Project area. They would be able to see the numerous open vistas and/or “filtered” views deep into the landscape that never exist previously. For instance, the small diameter fuels treatment along scenic and travel corridor would help enhance views and vistas toward natural rock outcropping found within the foreground landscape. Views toward the Middleground landscape areas could also be enhanced.

- Some residual slash, debris, and cut stumps are expected to be noticeable to the “casual visitors” along the immediate foreground (0 to 300’) of the travel route following the completion of salvage activities. Due to the scale and scope of this fire, the existing vegetation condition, and the proposed activities, this situation is unavoidable. However, with effective post treatment activities are expected to help reduce some of these visual effects.

- The proposed short temporary spur roads to provide access and landings are expected to be visible until their rehabilitation has been full and completed following salvage activities.

- Wildlife clumps and residual snags are expected to add scenic component value to the landscape.

Under this alternative, the Deschutes National Forest LRMP directions for Scenic Views (MA-9) within the B & B Fire Recovery Project would be moving a step closer toward the Desired Future Condition, while at the same time specifically addressing other issues, such as danger trees, fuels build up, wildlife habitat management, soil productivity, and forest health.

Alternative 3

The proposed management activities would have a direct effect on existing landscape character, scenic integrity level, and scenic quality.

The effect on scenic resources brought on by the proposed management activities under this alternative are expected to be minimal, compare to Alternative 2, the Proposed Action, due to its smaller scale and scope. With effective implementation of mitigation measures, the effect on scenic quality is expected to be minimal under this alternative.

The following proposed treatment units would have a direct effect on the foreground scenic resources and sensitive travel corridors, they include: unit 165 along Forest Road 2070; unit 169 along Forest Road 2066; unit 46 along Forest Road 1210; unit 83 along Forest Road 1220; unit 37, 38, and unit 115 along Forest Road 1230; unit 36 and unit 88 along Forest Road 1234; unit 36, 103, and unit 111 along Forest Road 1234; unit 36 and unit 103 along Forest Road 1235; unit 105, 104, 36, 29, 30, 32, unit 3, 4, 12, and unit 69 along Forest Road 1280; unit 1 along Forest Road 1292.

Alternative 4

The proposed management activities would have a direct effect on existing landscape character, scenic integrity level, and scenic quality.

The effect on scenic resources brought on by the proposed management activities under this alternative are expected to be very minimal, compare to Alternative 2 and 3, due to its much smaller scale and scope. With effective implementation of mitigation measures, the effect on scenic quality is expected to be very minimal under this alternative.

The following proposed treatment units would have a direct effect on the foreground scenic resources and sensitive travel corridors, they include: unit 83 along Forest Road 1220; unit 37, 38, and unit 115 along Forest Road 1230; unit 36 and unit 88 along Forest Road 1234; unit 36, 103, and unit 111 along Forest Road 1234; unit 36 and unit 103 along Forest Road 1235; unit 105, 104, 36, 29, 30, 32, and unit 34 along Forest Road 1280.

Alternative 5

The proposed management activities would have a direct effect on existing landscape character, scenic integrity level, and scenic quality.

The effect on scenic resources brought on by the proposed management activities under this alternative is expected to be similar to Alternative 3, due to its comparable scale and scope. The increase emphasis on wildlife clumps and residual snags retention is expected to add more scenic component value to the landscape. As a result, this action will lead to more rention of landscape components within the project area. With effective implementation of mitigation measures, the effect on scenic quality is expected to be minimal under this alternative.

The following proposed treatment units would have a direct effect on the foreground scenic resources and sensitive travel corridors, they include: unit 165 along Forest Road 2070; unit 169 along Forest Road 2066; unit 83 along Forest Road 1220; unit 37, 38, and unit 115 along Forest Road 1230; unit 36 and unit 88 along Forest Road 1234; unit 36, 103, and unit 111 along Forest Road 1234; unit 36 and unit 103 along Forest Road 1235; unit 105, 104, 36, 29, 30, 32, unit 3, 4, 12, and unit 69 along Forest Road 1280; and unit 1 along Forest Road 1292.

CUMULATIVE EFFECTS

Individually and cumulatively, wildfires in Central Oregon have always created a landscape characterized as “distinctive” or “unique” (in accordance with the USDA Forest Service Manual 2380, Landscape Management). These large disturbances have, in effect, deviated from the previous “natural appearing” character of Central Oregon’s characteristic landscape. In areas where stand replacement occurred, the fire has created numerous views and vistas within the foreground landscape and also toward distant landscapes, including “filtered views” as well as “open vistas” toward distant buttes and hills.

Although these wildfires naturally create such openings, they also tend to open up and highlight unsightly road building and other presence of human activities, such as past timber harvest units, can transform a visitor’s experience to less of a “high quality experience” expected within the Central Oregon’s forest landscape.

Central Oregon (Regionally)

Large wildfires and other natural and man-made forest disturbance processes are especially visible and accessible to the forest visitor along major travel corridors, especially within recent times. These include: the B & B Complex Fire, McCache Fire, Link Fire, Eyerly Fire near Sisters, and Davis Fire along Highway 46 near Crescent, Road 18 and Bessie Butte Fires along Highway 97, Skeleton Fire, and Awbrey Hall Fire on Highway 46 near Bend. Cumulatively, these large-landscape scale disturbances have significantly altered the overall landscape character and scenic views of Central Oregon from “natural appearing” to “distinctive” or “unique” characteristic.

Sisters RD (Locally)

The B and B, Eyerly, Cache Mountain and Link Fire, and insect infestation with associated tree mortality on Santiam Pass along Highway 20 prior to the wildfires, all have the most direct and significant cumulative effects on landscape character within the Sisters RD. These disturbance events tend to change the landscape character from being “natural appearing” previously to the current “distinctive”, altering scenery and landscape character to a degree that is perceived by the general public to be “deviated” from the landscape valued of their aesthetic quality (i.e., it no longer appears as natural, or whole as it once was).

The B & B Fire and Metolius Basin Site Specific

The B & B Fire has slightly altered the existing vegetation patterns and landscape elements, such as line, color, and texture, found within the Metolius Basin EIS Forest Management Project area. This alteration is considered to be minimal and insignificant to the overall landscape character, scenic integrity level, and scenic quality.

Several changes, on a landscape scale to the Metolius Watershed and B & B Fire area, included the cumulative effects brought on by natural and human caused activities, such as:

1) Wildfire suppression and BAER activities
2) B&B Hazard trees
3) Coil Fiber CE
4) Lower Jack CE
5) McCache TS

6) Eyerly salvage EIS

The implementation of these projects is expected to have additional effects on the landscape character, scenic integrity level, and altering scenic quality within the B & B Fire Recovery Project as a whole. These projects assume vegetative and fuel management direction that upon implementation would create an altered and different forest character than the existing characteristic during the short-term and long-term period.

3.21 Forest Plan Ammendment

Forest Plan Amendments

Visual Quality

A short-term, non-significant, site specific amendment of several visual quality standards and guidelines in the Deschutes National Forest Land and Resource Management Plan, is proposed to allow impacts from tree removal and prescribed burning to be visible to the "casual observer" for slightly longer periods than under the existing Standards and Guidelines. Though the current Visual Quality Standards and Guidelines would not be met in the short-term, the proposed actions are expected to better meet visual quality objectives for the long-term (over five to ten years). Following is a description of proposed changes to the existing standards and guidelines for Scenic Views (MA9), Metolius Heritage (M19), Metolius Black Butte (M21), and Metolius Special Forest (M22).

A goal for scenic views in the project area is to provide forest visitors with high quality scenery that represents the natural character of Central Oregon. The objectives call for enhancing landscapes by opening views to distant peaks, and highlighting large ponderosa pine. The scenic views allocation of "retention-foreground" and "retention-middleground" are found within the project area. Although proposed activities are intended to meet the goals and the Standards and Guidelines over the long-term (longer than 5 years), short-term visual impacts are expected from removing vegetation (slash, stumps, stacked logs, skid roads) and reducing fuels (blackened, scorched vegetation and tree trunks, piles). As such, it is recommended that the following Standards and Guidelines be amended:

<u>M9-4, M19-26 and M21-9: Ponderosa Pine Foreground, Metolius Heritage and Metolius Black Butte – Desired Visual Condition</u>

The proposed actions of salvage, fuels treatments and burning are expected to result in visible changes noticeable by the casual observer in these management areas. It is proposed that these Standards and Guidelines be amended to accept that the casual forest visitor may notice short-term changes in these allocations. These objectives would be met over the long term through re-establishment of open, park-like stands of ponderosa pine and enhancement of existing large pine trees.

<u>M9-8, M9-27, M9-44, M21-20, and M22-13: Timing of Cleanup Activities in Ponderosa Pine Foregrounds, Mixed Conifer Foregrounds, Middlegrounds and Backgrounds, and forested areas in the Metolius Black Butte and Metolius Special Forest areas.</u>

These Standards and Guidelines establish that slash, logging residue, or other results of management activities will not be obvious to the casual forest visitor one year following the activity in Retention areas, and two years following the activities in Partial Retention areas. Although the Sisters Ranger District intends to clean up the slash as soon as possible, especially along travel corridors, this project would employ prescribed burning to reduce natural fuels, and fuels created by timber harvest activities. It is recommended that these Standards and Guidelines be amended to allow visible effects of harvest cleanup and fuels reduction for approximately 5 years.

<u>M-29, M9-34 and M22-8: Openings in Mixed-Conifer Foreground, and in Metolius Special Forest.</u>

The intent of management actions in these areas is to salvage harvest, reduce fuels, and restore the next generation forest to many areas. Openings would be reforested, as needed, if insufficient natural reproduction exists. It is recommended that this Standard and Guideline be amended to allow openings to be visible for approximately 7 to 10 years, the estimated time it would take for seedlings in these openings would reach 4 ½ feet[37], depending on the site conditions.

Fuelwood Collection

A site-specific, non-significant amendment of fuelwood standard and guideline in the Deschutes National Forest Land and Resource Management Plan is proposed to allow the Forest Service to permit commercial and personal use fuelwood collection in the Metolius Heritage area.

M19-27: Fuelwood, Metolius Heritage Area.

It is assumed that this standard and guideline was initially developed to prevent impacts that could be associated with collection of fuelwood, such as user-created roads, piles of limbs and slash from wood cutting, and visible cut stumps. However, fuelwood may be a product that could be utilized as an outcome of implementing forest health and fuel reduction objectives under this project. Both commercial and personal fuelwood collectors could help accomplish these objectives by removing excess vegetation. The activity would only be permitted in specified areas and under specified terms and conditions that would mitigate potential impacts.

Effects of Proposed Forest Plan Amendments

The proposed revised Visual Quality and Fuelwood standards and guidelines would not significantly change the forest-wide impacts disclosed in the Deschutes National Forest Land and Resource Management Plan Environmental Impact Statement, based on the following factors:

Timing: The effects of the proposed revised Visual Quality standards and guidelines for implementing the B&B Fire Recovery Project are predicted to occur in the short-term (approximately 5 years) for prescribed burning and post harvest activities. Created openings from removing dead and dying trees would be visible for longer periods (7 to 10 years) but are expected to appear forested more quickly than if they were not treated (where needed, openings would be reforested).

The effects of the proposed revised Fuelwood Collection standard and guideline for implementing the B&B Fire Recovery Project are predicted to occur in the short-term (approximately 5 years) during implementation of the project.

Location and Size: The proposed revised Visual Quality standards and guidelines are site specific and would only affect the area within the B&B Fire Recovery Project area boundary. The proposed revision of the Fuelwood Collection standard and guideline would only affect the Metolius Heritage area.

Goals, Objectives and Outputs: The proposed revised Visual Quality and Fuelwood Collection standards and guidelines would not alter the long-term relationship between levels

[37] 4 ½ feet is the tree height at which "openings" are considered returned to a forested condition, Regional Guide, Pacific Northwest Region, 1984

of goods and services projected by the Land and Resource Management Plan. There would not be any significant change in timber outputs over what might be available if the project was designed without the proposed amendment. Wood material that could not be removed through the use of fuelwood permits, would be removed by other means.

Management Prescriptions: The proposed revised Visual Quality and Fuelwood Collection standards and guidelines would not change the desired future condition for land and resources from that contemplated by the existing management direction in the Land and Resource Management Plan in the short-term. It would not affect the whole Land and Resource Management Plan planning area, but only approximately 6,800 acres of National Forest System lands within the Metolius Basin project area. The proposed amendments would not change the Land and Resource Management Plan allocations or management areas.

3.22 Heritage Resources

Introduction
The scale of analysis for heritage resources within the scope of this project will consist of using the defined project analysis area. This is the only defined location that will include all areas of potential effect for planning a survey strategy to identify, delineate, and as time allows, evaluate historic properties. This is not an ecological scale, but an admistrative and procedural one as we continue to attempt to collect the field data to do the project analysis prior to determining the specific project locations and activities. As the alternatives are developed and refined; field data gathered within the analysis area will be applied to each alternative to determine the potential to affect unevaluated heritage sites and evaluated historic properties. Mitigation measures to avoid or reduce these potential effects will be developed and monitoring criteria applied.

EXISTING CONDITION

Previous Inventories

Seventy six previous projects have had heritage resource field work (mostly survey but a few testing projects (Table 3.3)) within the current project analysis area. These previous surveys varied in size from thousands of acres to less than one acre. Most of them were conducted and documented sufficiently to be used as adequate survey but ground conditions have changed significantly from the B&B fire and none of these previous surveys are considered adequate because of the drastic change in ground conditions. Total area of usable previous surveys is zero acres of the 41,000 acre project analysis area.

Current Inventories

Current survey in the summer and fall of 2004 covered most of the high probability areas and a sample of low probability areas. High probability in this project area includes approximately 10,000 acres. The remainder of the project (32,143 acres) is considered low probability for the presence of significant historic and prehistoric resources. Total new surveyed areas is approximately 10,250 acres including most of the high probability and a sample of the low probability areas.

Known Resources

Through past surveys, 90 heritage sites have been located and recorded. Current surveys located an additional 21 heritage sites and 37 heritage isolates. Sites are defined by having 10 or more artifacts or the presence of features such as a cave, rock art, fire pit remains, structure, ect. Isolates are defined as not having any features and locating less than 10 artifacts. Of the sites; 80 are prehistoric, 27 are historic, and two have both a prehistoric and historic component. Twenty three of these sites are considered significant and eligible for inclusion on the National Register of Historic Places, nine are considered not significant, and 77 remain unevaluated for significance.

The site evaluations completed were done by applying the criteria for eligibility in 36CFR60.4. For prehistoric sites, information potential was determined by assessing research value or potential as addressed in research topics presented in the Deschutes County Prehistoric Context Statement (Houser, 1996) and Management Strategy for Treatment of Lithic Scatter Sites (Keyser et al, 1988). No thematic or individual National Register nominations have been completed for any sites in this project area.

One location with known native american ceremonial use is known in the project area. A second location with past cultural use related to subsistance gathering is also present. The Warm Springs, Paiute, and Wasco Tribes from The Confederated Tribes of the Warm Springs Reservation of Oregon are the known tribes with historic associations to this area. The project area is within lands ceded to the Federal

Government by The Confederated Tribes of the Warm Springs Reservation of Oregon under treaty in 1855 and ratified by Congress in 1859.

EFFECTS

Alternative One Effects

No heritage resource site disturbance would occur from project activities. The potential for impact to heritage resources from other sources such as erosion and visitor collection would not change. If this alternative is chosen, it would have no effect on heritage resources.

Alternatives Two through Five Potential Impacting Activities

In units proposed for ground based commercial salvage, the heavy equipment, skidding of logs, intense activity at landings, and possible pile burning and subsoiling can all effect an historic property by breaking artifacts, changing their association and locations, and further damage of breakage or loss of hydration rinds from intense heat from pile burning. There are up to seven significant or unevaluated sites that could be affected by these activities if not avoided.

Units proposed for biomass product removal may include commercial harvest or posts and poles and have similar impacts. They may also be used for firewood and have little or no impact to significant and unevaluated heritage sites.

Helicopter harvest units would have minimal impact to heritage resources. Landings would be the most impactive locations, being larger than ground based landings and having more slash from removing limbs and tops to pile and more heavy equipment. This activity can cause redistribution of artifacts, breakage, and exposure through devegetation and soil compaction. The harvest unit itself will have very little potential impact to heritage resources.

Fuels reduction after harvest is proposed by machine piling and pile burning, jackpot burning (underburning in helecopter units), and hand piling with pile burning. Machine piling and burning can effect sites by dozer activity breaking and redistributing artifacts and pile burning shattering lithic artifacts and removing hydration rinds with the intense heat. Jackpot burning can affect some historic sites by damaging glass and tin artifacts in historic debris dumps or scatters and potential for damaging any remains of historic structures, corrals, and fence lines. Burning can also impact prehistoric sites by breakage or redistribution of artifacts by line construction by hand tools and dozers or mopping up.

Roads proposed for obliteration or decommissioning can affect historic properties by disturbance of the soil containing artifacts or features through subsoiling, excavation to install rocks or bollards, and construction of tank traps or waterbars. These activities can break or displace artifacts and can destroy such features as hearths, house floors, or remnant post holes. These activities can also increase long term protection of the sites by reducing or eliminating vehicle traffic and road maintenance though the site and speeding up the revegetation of the road which reduces erosion and artifact exposure or movement.

Reforestation will occur in treatment units only. Hand planting causes minimal disturbance of soils and has little potential to impact heritage resources. Machine planting can cause more soil disturbance and potentially artifact redistribution and breakage.

Danger tree removals along haul routes and at Round Lake developed recreation locations has the potential to have some but minimal impacts to heritage resources. Some individual tree skidding may occur if merchantable trees need to be removed. There is potential for some pile burning in these circumstances that could also impact resources. Potential impacts would be mostly artifact breakage and redistibution. Intense heat from pile burning can also affect hydration rinds in obsidian artifacts immediately under the burn pile.

Temporary road construction and landings can impact sites through artifact displacement and breakage during construction of these facilities, use, and restoation that may occur multiple times if needed before wet season.

All of the above effects can be avoided through modification of implemetation to avoid impacts to significant and unevaluated historic properties. These measures should be monitored as described below. No activities are proposed in the immediate vicinity of either of the Native American cultural sites within the project area so none of the alternatives will have any effects to these two resource locations.

Alternative 2 Effects

Alternative 2 has three sites in units that are proposed for salvage that may include piling and burning or subsoiling after the salvage, eight sites are in proposed road closure or obliteration locations, one in danger tree treatment, and two with both logging and road closure impact potential. A total of 14 sites will need protection from activities under this alternative.

Alternative 3 Effects

Alternative 3 has one site in units that are proposed for salvage that may include piling and burning or subsoiling after the salvage, eight sites are in proposed road closure or obliteration locations, one in danger tree treatment, and two with both logging and road closure impact potential. A total of 12 sites will need protection from activities under this alternative.

Alternative 4 Effects

Alternative 4 has no sites in unitsd that are proposed for salvage that may include piling and burning or subsoiling after the salvage, nine sites are in proposed road closure or obliteration locations, one potentially affected by danger tree treatment, and one with both hazard tree and rd closure potential impacts. A total of 11 sites will need protection from activities under this alternative.

Alternative 5 Effects

Alternative 5 has one site in units that are proposed for salvage that may include piling and burning or subsoiling after the salvage, 10 sites are in proposed road closure or obliteration locations, one in danger tree treatment, and two with both logging and road closure impact potential. A total of 14 sites will need protection from activities under this alternative.

INDIRECT EFFECTS

Indirect effects from implementatin of this project are not expected but the potential does still exist. Unevaluted sites and significant historic properties avoided by project implementation will have more people working in the vicinity of the site and potentially have surface tools or other artifacts observed and collected. Pile burning or jackpot burning can potentially escape the planned burn location and impact adjacent areas with both fire and fire control activities. Changing the vegetation patterns through salvage and planting can change how subsequent forest users recreate in the area; moving dispersed recreation use such as camping and hiking to adjacent locations avoided by this project implemention. Road closures modified to avoid impacting heritage sites may be less effective and result in the road being reopened by forest users or used extensively by OHVs or motorcycles.

CUMULATIVE EFFECTS

Under this project, any and all effects are expected to be avoided or mitigated (see mitigation and monitoring below) resulting in no cumulative effects. Past effects to heritage resources in the project area that could be identified are discussed below.

Most of these sites have been affected by the B&B fire, fire fighting efforts, post fire erosion, or increased visibility due to loss of covering vegetation and duff. Other sites in the analysis area have been identified and damaged by roads established in historic and recent times, or past vegetation management activities. Several sites have undetermined source disturbances or natural disturbances. All of the known sites have existing disturbance from one or more of these sources. Previous projects in the current project area are listed below. Expected furture potential sources of disturbance would include the Brush Creek Restoration Project, ongoing hazard tree treatment at recreation sites and along many developed roads, and ongoing road maintenance.

Avoiding project effects to heritage resources is important for this and all future projects. These resources are finite and non renewable. Our understanding of how people utilized this area in the past is very limited and our potential to learn more is very dependant on having some source of such information remain for analysis. Most of the information about much of human history is no longer directly observable. The language, artwork, political and social organizations, arts and crafts, customs and mores of past people are only indirectly visible through what written history has preserved, decendants have remembered and material bits and pieces of their lives can be found and studied.

Our knowledge of the people in this study area before the 1850s is extremely limited and our main avenue of learning more is through archaeological methods. For the passt 100 years our culture has had a drastic impact on these remaining bits and pieces of data left on the ground; as has natural processes of erosion and decay. Protecting and preserving what is left gives us the best opportunity to better understand how other people used this land, where we have come from, how we arrived to be the people we are, and potentially; where we may want to go from here. If we continue to destroy the only information we have to be able to someday understand the past, we may never have the depth of view to understand where we are heading into the future.

3.23 Air Quality

Introduction

The principle impacts of burning forest residues, whether by prescribed fire or wildfire, relate to effects on human health and temporary visibility reductions from smoke and dust. Emissions from fire (smoke) results in the release of particulates into the atmosphere, possibly affecting the health of forest workers, visitors and residents of the Metolius Basin and Northwestern Deschutes County.

Air Quality Existing Condition

Smoke

As of July 1997 the Environmental Protection Agency (EPA) revised the particulate matter standards. While particulate matter 10 micrometers (PM10) will still be monitored and regulated, particulate matter 2.5 micrometers (PM 2.5) and smaller will be also be included. With this additional parameter the effects on air quality may be significant. This change was brought about after scientific study found a link between PM 2.5 and public health problems. The constraints this may place on forest burning are unknown. The Forest Service will achieve strict compliance to all aspects of the Clean Air Act by working in conjunction with the Oregon Department of Forestry to adhere to Oregon Smoke Management Plan. Any planned variance from the daily burning instructions will be discussed and approved by the Smoke Management Duty Forecaster.

Smoke Management would be regulated by the Department of Ecology and The Oregon Department of Forestry according to the Oregon Smoke Management Plan Oregon Revised Statutes 477.013.

The policy of the plan is to improve the management of prescribed burning as a forest management and protection practice; and to minimize emissions from prescribed burning consistent with the air quality objective of the Interim Air Quality Policy on Wildland and Prescribed Fires, Federal Clean Air Act, and the State of Oregon Clean Air Act Implementation Plan developed by the Department of Environmental Quality under ORS 468A.035 [1989 c.920 s.2].

The State Forester will:

1. Coordinate the administration and operation of the plan
2. Issue additional restrictions on prescribed burning in situations where the air quality of the entire state or any part thereof is, or would likely become, adversely affected by smoke.
3. Issues daily burning instructions when needed.
4. Annually evaluates state-wide burning operations under the plan and provides copies of the summary to interested parties.

The Department of Environmental Quality will:

1. Maintain real time air quality monitoring network that is used by ODF;
2. Provide information on field burning activities;
3. Establishes criteria for air pollution emergencies and notifies ODF of episode stages such as alerts, warnings, and emergencies;
4. Regulates the emissions of air pollutants to ensure compliance with adopted standards, limits, and control strategy plans. The ODF smoke Management Plan is jointly developed plan that governs prescribed burning;

5. Notifies the Department of Forestry when the air in the entire State or portions thereof is or would likely become adversely affected by smoke.

Federal Land Management agencies (U.S.D.A., Forest Service (USFS)) are required by law to follow the directions of the Forester for the protection of air quality in conducting prescribed burning operations. They will follow the smoke management weather forecasts and smoke management instructions, as provided by the Oregon Smoke Management Plan and the Operational Guidance for the Oregon Smoke Management Program, (Directive 1-4-1-601). Agency officers in restricted area will make daily reports relating to burning operations.

The Clean Air Act, and associated measures listed above, states that federal land managers will attempt to "protect and enhance the quality of the nation's air resources so as to promote the public health and welfare..."

Air Quality Environmental Consequences

Effects Common to All Alternatives

Wildland Fire Activity

The potential for future wildland fire within the B&B Fire area exists regardless of the alternative selected, but would be greater under Alternative 1 "No Action" in the absence of fuels reduction activities. The "No Action" Alternative does not provide any opportunities to reduce existing forest fuels and the hazard they pose in the future on wildland fires. In the event of a wildfire, air quality degradation could exceed federal and state standards. Heavier fuel loading in the event of future wildland fire could result in greater smoke and debris emissions, which could adversely affect health and visibility.

Alternative 2, 3, 4 and 5 Effects

Prescribed Fire

Air quality would be affected primarily by smoke produced during pile burning proposed in Alternatives 2,3,4 and 5.

Table 3.197, below, displays the type of burning proposed and an estimate of smoke emissions using an estimate of tons per acre of fuel consumed during the burning operations. Pile and burn is the fuel treatment proposed for ground-based salvage unit, and jackpot burning is proposed for helicopter units.

Effects of the alternatives on smoke emissions are primarily related to the amount and type of fuels treatment proposed. Table 3.197 displays the estimated smoke emissions for the alternatives.

Table 3.197. Estimated Smoke Emmision by Alternative

Alternative	Acres Treated	Total Tons PM<10	Total Tons PM<2.5
Alternative 1 – No Action	0	0	0
Alternative 2 – Proposed Action	6,803	74	64
Pile and Burn (Landings Only)	516	121	109
Jackpot Burn	2,702	524	457
Machine Pile and Burn w/i (Salvage Units)			
Total	**10,021**	**719**	**630**
Alternative 3			
Pile and Burn (Landings Only)	3,762	41	35
Machine Pile and Burn w/i (Salvage Units)	1,710	332	289
Total	**5,472**	**373**	**324**
Alternative 4			
Pile and Burn (Landings Only)	1,725	19	16
Machine Pile and Burn w/i (Salvage Units)	270	54	46
Total	**1,995**	**73**	**62**
Alternative 5			
Pile and Burn (Landings Only)	4,633	50	44
Machine Pile and Burn w/i (Salvage Units)	2,091	406	354
Total	**6,724**	**456**	**398**

Emissions

All pile burning would be conducted under the State of Oregon Smoke Management System to track smoke produced and would be coordinated through Oregon Department of Forestry.
Pile burning would be conducted under favorable smoke dispersal conditions, avoiding impacts to the Class I Airsheds and urban areas. Inversion conditions, which could increase the potential for smoke pooling in the drainages and valleys, would be avoided during prescribed fire operations as much as possible to not impact surrounding areas.

Visual Effects

Class 1 Airshed

The Oregon State Smoke Management Plan requires that all prescribed burning be conducted under conditions that minimize smoke intrusions into Designated Areas and Class 1 Airsheds. Class 1 designation does not allow human-caused activities outside the wilderness to adversely affect air quality within the wilderness. The closest Class 1 Airsheds are the Three Sister Wilderness, Mt. Jefferson and Mt. Washington Wilderness Areas. The entire western boundary of the B&B, north of highway 20 is adjacent to the Mt. Jefferson Wilderness. The Mt. Washington Wilderness is about 2 ½ miles southwest and the Three Sisters Wilderness is located 6 miles south of the southern end of the fire area. These wilderness areas would be affected minimally because pile burning would be conducted under favorable weather conditions, avoiding impacts to these Class 1 airsheds and urban areas. Burning would be conducted when the prevailing wind patterns reflect a western flow which would result in minimal potential for impacts. Because of measures designed to disperse smoke during favorable conditions, implementation of action alternative are expected to protect air quality related values and have no visible impacts to the wilderness areas. Other monitoring techniques will include posting personnel as lookouts on burn days.

Dust

Dust would be created from proposed operations in all action Alternatives, such as log haul on roads and operation of machinery within treatment units. Dust abatement and signing would be conducted on haul routes to minimize effects to public safety. Dust created during operations would be short-term.

Cumulative Impacts

Deschutes National Forest policy dictates that prescribed burning be accomplished during periods of optimal smoke dispersion; however, there may still be some cumulative smoke impacts from concurrent Forest Service, and private prescribed burning operations.

The cumulative effects on air quality from the prescribed burning of landings piles are negligible. Burning of residues piles would only occur if existing and forecasted conditions assured that smoke would not enter any adjacent communities. A study of emissions in the Central Oregon area found slash burning to contribute less than 1 percent (.34 percent) of Particulate Matter (PM). The same study found that slash burning also produced less than 1 percent (.64 percent) of the carbon monoxide in Central Oregon (CAB, 1997).

3.24 Other Effects

3.24.1. Short-term Uses and Long-term Productivity

Project Interdisciplinary Team (ID Team) analysis indicates that implementation of any of the action Alternatives would create certain limited and short-term adverse effects (see the following section, Unavoidable Adverse Effects); however, long-term benefits to the production and quality of water, protection of Late-Successional Reserve values including promotion of Nesting, Roosting, Foraging habitat would result. All action Alternatives address providing defensible space to protect resources from future wildfire and promote a reduction of hazardous fuels within treatment units in order to move closer to historic fire intervals. With full implementation of Project Design Elements, all action Alternatives would provide for the maintenance of long-term soil productivity while providing for snags and down woody material required by Forest habitat. Under any of the action Alternatives, the obliteration of unneeded Forest roads would bring the road density of the Forest transportation system closer to that desired in the Land and Resource Management Plan.

With the selection of the No Action Alternative, fire hazard in defensible space areas, and the risk of large-scale stand replacing fire would be greater than it would with implementation of any one of the action Alternatives (refer to the Fire and Fuels Effects discussion, this chapter).

3.24.2. Unavoidable Adverse Effects

The implementation of any of the action Alternatives would result in some adverse effects. Most of these adverse effects can be mitigated to acceptable levels --consistent with appropriate standards and guidelines-- through implementation of Project Design Elements (Chapter 2). The unavoidable adverse effects described within this section are those that can not be mitigated, or those expected to occur after the application of Project Design Elements.

Increased Short-term Sediment Delivery: Although Project Design Elements and Best Management Practices would mitigate adverse effects and are expected to reduce the potential for accelerating sediment production to near baseline levels, there would be some minor risk of short-term indirect adverse effects to water quality as a result of implementing any one of the action Alternatives.

Compaction/Site Productivity: With implementation of any one of the action Alternatives, additional soil compaction is expected to occur as a result of the use of ground-based equipment to remove timber. Mitigation measures (outlined in Chapter 2, Project Design Elements -- Soils) would limit the compacted area, consistent with Forest Standards and Guidelines for soil protection of not more than 20% cumulative detrimental impact. Areas currently in excess of 20% detrimental impacts would not increase from current levels and are expected to be improved through rehabilitation efforts. Reference the Effects discussion in the Soils Resource section, this chapter.

Air Quality: Project Design Elements to mitigate or reduce potential air quality degradation are listed in Chapter 2, Project Design Elements – Air Quality. The potential exists for changes in atmospheric conditions that could result in the drifting of smoke and particulate matter, resulting in short-term adverse effects to air quality, primarily within the Metolius Basin area. All prescribed burning operations would be conducted in compliance with the Oregon Smoke Management Guidelines administered by the Oregon Department of Environmental Quality. For a detailed discussion of project effects on air quality, see the Air Quality discussion, this chapter.

Noxious Weeds: Under each Action alternative, conditions would be created that increase the risk of introduction and spread of noxious weeds. Project Design Elements would be implemented to mitigate or reduce the risk of introduction and spread of noxious weeds. While Project Design Elements would aid in reducing the risk of adverse effects, proposed disturbances related to temporary road construction, movement of machinery involved in timber harvest and transport, and any subsequent mechanical entries associated with fuels management would provide vectors for the introduction and spread of noxious weeds, resulting in a High weed risk rating for any action Alternative. Please refer to the Botanical Resource – Noxious Weed Environmental Consequences discussion in this chapter.

Disturbance to Residents and Visitors: Implementation of any of the action Alternative activities will result in noise and could create localized dust that would affect visitors and residents in or adjacent to the activity area. In addition, the transportation of equipment and materials along Forest roads may be a concern for recreating visitors and residents. Visitors and residents would be notified of activities that may affect them prior to implementation through local media press releases.

3.24.3. Irreversible and Irretrievable Commitment of Resources

Irreversible commitments of resources are those that cannot be regained: an example would be the extinction of a species, or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or road.

Under Alternative 1 (No Action), there would be no irreversible or irretrievable commitments of resources. The action Alternatives would include the construction of temporary roads and landings that would remove these specific sites from habitat development or timber production. Vegetation removed for construction would be an irretrievable (not irreversible) impact.

The construction and use of new roads and logging facilities is considered an irretrievable loss of soil productivity until their functions have been served and disturbed sites are returned back to a productive capacity through subsoiling (see Project Design Elements – Soil Resource Mitigation, chapter 2).

The action Alternatives include road decommissioning activities that would improve the hydrologic function on disturbed sites. There would be no irretrievable losses of soil productivity associated with watershed improvement activities that obliterate unneeded roads.

All action Alternatives would maintain current conditions or mitigate impacts at levels consistent with Land and Resource Management Plan standards and guidelines, with the exception of short-term site-specific impacts to soil and visual quality (see Project Design Elements, Chapter 2).

3.24.4. Effects on Wetlands and Floodplains

Riparian reserves, including wetlands, would only be impacted within the Round Lake lakeside riparian reserve where danger trees could be hand-felled or accessed by machinery from existing roads, and only in excess of Forest Plan downed wood requirements. Effects on, and protection of, wetlands and floodplains are described in the Hydrology Resource – Effects of Action Alternatives section, this chapter.

3.24.5. Effects on Prime Farmland, Rangeland and Forest Land

All Alternatives are consistent with the Secretary of Agriculture memorandum 1827 for the management of prime farmland. The B&B Fire Recovery Project area does not contain any prime farm land or rangelands. Prime Forest Land, as defined in the memorandum, is not applicable to lands within the National Forest System. In every Alternative, Forest System Lands would be managed with sensitivity to the effects on adjacent lands.

3.24.6. Energy Requirements of Alternatives

Under the action Alternatives, additional consumption of fossil fuels and human labor would be expended for the use of vehicles transporting Forest workers, chainsaws, heavy equipment and trucks. Fossil fuel would not be a retrievable resource. There are no irregular energy requirements involved in implementing any of the action alternatives.

3.24.7. Effects on Minorities and Women, and Environmental Justice

Among all project alternatives, there would be no discernable impacts to the Civil Rights of Native Americans, women, minorities, persons with disabilities, or any American Citizen.

Environmental Justice (Departmental Regulation 5600-2, December 15, 1997; in compliance with Executive Order 12898) provides for the pursuit of equal justice and protection under the law for all environmental statutes and regulations, without discrimination based on race, ethnicity, or socioeconomic status. The project Proposed and Action and Purpose and Need have been clearly defined and communicated to as broad and diverse an audience as possible. Project Social Analysis describes how the Proposed Action does not appear to have a disproportionately high or adverse effect on minority or low-income populations; to the contrary, culturally sensitive and language appropriate outreach has been provided to the Central Oregon community to provide tours of the area, explain special use permit requirements, and solicit public comments. Therefore, no mitigation measures to offset or ameliorate adverse affects to these populations have been identified. All interested and affected parties will continue to be incorporated within the public involvement and decision process.

For a detailed analysis of Social factors related to the project, please see the Social-Economic Resources section in this chapter.

3.24.8. Public and Worker Safety

The signing of project activity areas in addition to notification of additional project-related traffic would promote a safe environment for the recreating public during project implementation. Mitigation measures to facilitate public safety would include restricted recreation operations during specific harvest actions, and partial or complete closure of specific areas during implementation.

All project activities carried out by Forest Service and Forest Service contract employees would comply with State and Federal Occupational Safety and Health Administration (OSHA) standards. All Forest Service project operations would be consistent with Forest Service Handbook 6709.11 (Health and Safety Code).

3.24.9. Inventoried Roadless and Wilderness

Inventoried Roadless have been avoided in this project – all actions proposed would not have an effect on the qualities of inventoried roadless areas. There are no Wilderness areas directly within the project area; however, the Mt. Jefferson Wilderness which burned in the B&B Complex Fire is adjacent to the northwest section of the project area and has been considered in the Cumulative Effects analysis at the 5th Field Watershed level.

3.25 Other Disclosures

As specified in 40 CFR 1502.25(a), NEPA requires "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with… other environmental review laws and executive orders."

The Forest Service has consulted with the agencies listed below as required under the following acts and laws:

Affected Native Tribes were consulted and provided input to project proposed actions and mitigation measures, consistent with the 2003Heritage Programmatic Agreement Oregon State Historic Preservation Office (SHPO) Consultation is being conducted, regarding ground disturbing actions in historical places, in compliance with the National Historic Preservation Act (NHPA). Compliance with NHPA is expected (see Heritage Project Design Elements, Chapter 2; and Heritage Resources Effects, this chapter). Oregon SHPO findings will be disclosed in the final environmental impact statement.

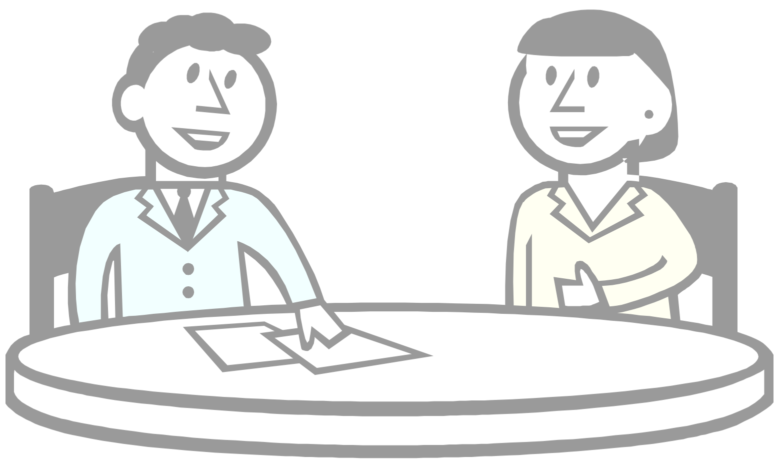
U.S.D.I. Fish and Wildlife Service and the National Marine Fisheries Service are being consulted, in accordance with Endangered Species Act (ESA) implementing regulations for projects with threatened or endangered species. Informal consultation with the U.S. Fish and Wildlife Service (USFWS) includes the review of the project Biological Assessment and effects to Federal Threatened and Endangered Species. Potential effects to Northern Bald Eagle, Northern Spotted Owl, Canada Lynx and Oregon Spotted Frog are summarized within this chapter, in the Wildlife Habitat – Effects Common to All Action Alternatives – Direct and Indirect Effects section; Greater detail is provided in the B&B Fire Recovery Project Biological Assessment for Threatened and Endangered Species. A Biological Assessment (BA) has been prepared to review findings of proposed activies for potential effects to aquatic species, required under the Magnuson-Stevens Fishery Conservation Act and consistent with Forest Service and ESA consultation guidelines. The Aquatic BA determination that the project would not likely adversely affect (NLAA) bull trout or their habitat, or redband trout and their habitat, will result in a "No Jeaporday" Biological Opinion for aquatic habitat, pending concurrence by the National Marine Fisheries Service.

The Oregon Department of Fish and Wildlife has reviewed the alternatives in regards to potential effects to wildlife.

No actions under this project propose water to be impounded or diverted; therefore, consultation with U.S. Fish and Wildlife Service under the Fish and Wildlife Coordination Act is not required.

Chapter 4

Consultation and Coordination



CONSULTATION AND COORDINATION

4.1 Preparers and Contributors

Preparers		
Name	**Position/ Contribution**	**Background (Education/ Experience)**
Todd Chaponot	Writer-Editor/ Document Editor, Admin. Support	Studied Journalism and Technical Communications at Chemeketa CC 2000-2001, Central Oregon CC 2001-2002; Military service, writing-editing regulations and standards (8 years); Defense contractor, writing lesson plans and instructing military operations, writer-editor for scientific projects, and providing website support (4 years); Oregon Department of Transportation administrative and website support for NEPA and Highway Safety Act projects (1 year); Forest Service Writer-Editor (2 years).
Rick Dewey	Botanist/ Botanical Resource Analysis	B.S. in Zoology, San Diego State U., 1969; B.S. in Natural Resources, Humboldt State U., 1975; M.A. in Biology, Humboldt State U., 1980; Ph.D. in Botany, Texas A&M U., 1986. Member of faculties of Southwest Texas State U., TX, Ft. Hays State U., KS, and Central Oregon Community College, 1988-1996. Seasonal Biological Technician on Nez Perce N.F. 1976-1978. Assistant Forest Botanist on Deschutes N.F. 1997 to present.
Andris Eglitis	Entomologist/ Insect and Decay Input	B.S. degree in Forest Management from Colorado State University, 1969. Master of Science degree in Forest Entomology from University of Washington, 1974. Doctor of Philosophy degree in Forest Entomology from University of Washington, 1980. U. S. Peace Corps volunteer in Chile from 1969 to 1973 working at the University of Chile, Santiago, teaching forest entomology and establishing a national pest detection survey system. Has over 25 years of experience in forest entomology with the U.S. Forest Service including Alaska Region (1979-1989) and Pacific Northwest Region (1989-present). Currently provides technical assistance, training and technology transfer in forest entomology to four national forests (Deschutes, Ochoco, Winema, Fremont), two Bureau of Land Management Districts (Lakeview, Prineville), Warm Springs Indian Reservation, and Crater lake National Park. Has worked extensively on wood import pest risk assessments from several countries including Mexico, Chile, Argentina, Mexico and Australia.
Maurice Evans	Fuels Planner/ Fire-Fuels Analysis, Project Design	

Preparers		
Name	**Position/ Contribution**	**Background (Education/ Experience)**
Alan Heath	Hazard Tree Analysis/ Resource Analysis	
Rodd Kubitza	Transportation Engineer/ Transportation Analysis, Data Support	
Tom Mafera	NEPA Coordinator/ Project Lead	
Erin Smith-Mateja	Forester - Forest Vegetation Simulator Group/ Forest Software Inventory & Stand Exam Data Analysis	
Cari McCown	Hydrologist/ Hydrology Analysis, Project Design	M.S. degree in Watershed Science from Colorado State University, 2001. B.A. degree in Earth Resources / Russian. USFS hydrologist from 2000 to present including assignments at the Umatilla and Deschutes National Forests. Currently serves as a Deschutes National Forest hydrologist out of the Sisters Ranger District.
Kirk Metzger	Fuels Technician/ Fuels Planning	Studied Forestry at Yavapai CC 1972-1975, Northland Pioneer CC 1979-1983, Has 33 years experience in Fire, Timber, Range, Cultural Resources, Special Forest Products, Wilderness Management, River Management and Fuels Management. Service included assignments on the Prescott National Forest, Apache-Sitgreaves NF, Mt Hood NF, Prineville BLM, and Deschutes NF. Currently serves as Fuels Planner for Central Oregon Fire Management, Cascade Division North.
Leslie Moscoso	Recreation Planner/ Recreation Analysis	
Dave Owens	Ochoco NF Fuels Planner/ Fire-Fuels Resource Input	B.S. degree in Forest Management from Utah State University, 1973. Certified Silviculturist from 1984 to 1999 after completing Silviculture Institute. Has over 30 years of experience with the Forest Service including assignments on the Cleveland, Coconino, Fremont, Umatilla and Ochoco National Forests. Fire Management Officer for Prineville Ranger District and Crooked River National Grassland from 1994 to 2000. Currently serves as Fire Planner for Central Oregon Fire Management.
Maret Pajutee	Ecologist/ Public Information	

Preparers		
Name	**Position/ Contribution**	**Background (Education/ Experience)**
Dale Putman	Transportation Engineer/ Roads and Transportation Analysis	
Brent Ralston	NEPA Coordinator/ Project Lead, Project Design	B.S., Oregon State University 1993 BLM 1992- 1999 Project Team Lead for various projects since 1999.
Mike Riehle	Fisheries Biologist/ Fisheries Analysis, Project Design	
Rob Schantz	Silviculturist/ Economic Analysis	Fisheries work with Forest Service and USGS Biological Research Lab since 1995
Peter Sussmann	Soil Scientist/ Soil Analysis, Project Design	B.S. Agronomy/Soils University of Illinois, 1986. USDA Forest Service Soil Scientist, Deschutes National Forest, 1992-1998. Field Soil Scientist, Interagency Riparian Classification, 2000-2002. Soil Scientist, Deschutes National Forest, 2002-2004.
Brian Tandy	Silviculturist/ Salvage Proposals, Unit Design, Logging Systems, Project Design	
Dorothy Thomas	GIS Coordinator/ Creation of polygon maps and data queries for project analysis & Geodatabase data.	A.A. Geogrpaphic Information Systems, Central Oregon CC, 1996. B.S. Environmental Sciences: Natural Resource Mgmt., Oregon State University, 2000. 11 years professional experience in GIS systems.
Lauri Turner	Wildlife Biologist, Project Design	B.S. Biology with a Wildlife Emphasis, Kearney State College, Kearney, NE 1989 Working as a Professional Wildlife Biologist for 13 years (Willamette and Deschutes NF's)
Ronnie Yimsuit	Landscape Architect/ Scenic Views Input	B.S. Landscape Architecture; 15 years professional experience in public practice.
Donald Zettel	Archaeologist/ Cultural Resource Input	B.A. Anthropology; 16 years professional experience; 15 years with the Forest Service.
Beckie Zimmerman	Timber Pre-sale Administrator/ Unit Layout Coordination, Project Design	

4.2 Distribution of the Environmental Impact Statement

Federal, State, Local Agencies and Individuals

The Forest Service consulted with -or received project comments from- from the following individuals, agencies, tribes, and non-Forest Service persons during the development of the draft environmental impact statement

Elected Officials
Senator Ron Wyden
Senator Gordon Smith
Representative Greg Walden

Oregon State Government
Oregon Dept. of Geology and Mineral Industries
Governor's Natural Resource Policy Director
Governor's Forest Advisor
Oregon State Economist, Executive Department
Economic and Community Development
Land Conservation and Development
Division of State Lands
Water Resources Department
Parks and Recreation Dept., Resource Management and Planning Div.
Department of Fish and Wildlife, Wildlife Division
Department of Forestry
Department of Environmental Quality, Eastern Region
Department of Transportation

Federal Agencies
Advisory Council on Historic Preservation, Western Office of Review
Environmental Protection Agency
U.S. Dept. of Agriculture
- Forest Service, Pacific Northwest Regional Office
- Forest Service, Pacific Northwest Science Lab, Northwest Offices
- Deschutes National Forest, Supervisor's Office
- Deschutes National Forest, Crescent Ranger District

U.S. Dept. of Interior
- Office of Environmental Policy and Compliance
- Bureau of Land Management, Division of Natural Resources
- U.S. Fish and Wildlife Service

Tribes

The Klamath Tribes
The Burns Paiute Tribe
The Confederated Tribes of the Warm Springs Reservation *

Others

Organizations

American Forest Resource Council
Blue Mountains Biodiversity Project
Cascadia Wildlands Project
Associated Oregon Loggers, Inc.
Bohemia Sno-Sledders
Central Oregon Fly Fishers

Forest Action-Survival Center, U of O
Forestry Action Committee
Klamath Forest Alliance
Natural Resources Defense Council
Oregon Eagle Foundation
Oregon Natural Resources Council
Pacific West Community Forestry Center
Quincy Library Group
Sunriver Owners Association
Trout Unlimited
Walker Rim Riders
Forest Conservation Council
Jefferson Center
Native Plant Society
Northwest Environmental Defense Council
Oregon Hunters
Oregon State Snowmobile Assn.
PROWL
Sierra Club, Juniper Group
The Wilderness Society
Upper Deschutes Watershed Council

Businesses

Columbia Helicopters
Crown Pacific
C & B Construction
Boise Cascade Corporation
Crescent RV Park
Central Point Lumber
Prairie Wood Products
US Timberlands Services
KTVZ
Ochoco Lumber Company
Shelter Cover Resort
Consolidated Pine
DR Johnson Lumber Co.
Erickson Air-Crane
Frontier Advertiser
Herald & News
KLE Enterprises
Superior Helicopter
The Bend Bulletin
The Nugget Newspaper
Union Pacific Railroad

Individuals

Brian Fuller
Amphone Phonngam
Bob Mullong
Danny Hughes
Deng Sandara
Fred Tanis

4.3 Glossary of Acronyms and Terms

Acronyms and Terms relevant to forest management, timber harvest and wildland fire operations found within the document are contained within this appendix

Acronyms

Acronyms provide brief multiple letter reference names to abbreviate multiple-word terms found within the document.

AMP Allotment Management Plan
ASQ Allowable Sale Quantity
ATV All Terrain Vehicle
AUM Animal Unit Month
BA Biological Assessment
BAER Burned Area Emergency Rehabilitation
BMP Best Management Practice
BO Biological Opinion
CE Categorical Exclusion
CFR Code of Federal Regulations
CFWS Confederated Tribes of Warm Springs
CVS Current Vegetation Survey
CY Calendar Year
DBH Diameter Breast Height
DFC Desired Future Condition
DNF Deschutes National Forest
DOG Designated Old Growth
DST Dead Standing Tree
EA Environmental Analysis
EIS Environmental Impact Statement
ESA Endangered Species Act
ESU Evolutionary Significant Unit
EVG Existing Vegetation
FLIR Forward-Looking Infrared Radar
FR Forest Road
FSEIS Final Supplement Environmental Impact Statement
FSH Forest Service Handbook
FSM Forest Service Manual
FSR Forest Service Representative
FY Fiscal Year
GIS Geographic Information System
GRT Green Replacement Trees
HEI Habitat Effectiveness Index
HRV Historic Range of Variability
HUC Hydrologic Unit Code
IIT Implementation Monitoring Module
IIT Interagency Implementation Team
KV Knutson-Vandenberg Act
LAC Levels of Acceptable Change
LOS Late Old Structure
LRMP Land Resource Management Plan
LWM Large Wood Material
MAL Malheur National Forest
MBF Thousand Board Feet

MEL Most Efficient Level
MIS Management Indicator Species
MMBF Million Board Feet
MMCF Million Cubic Feet
MOU Memorandum of Understanding
NEPA National Environmental Policy Act
NF National Forest
NFMA National Forest Management Act
NFMAS National Fire Management Analysis System
NMFS National Marine Fisheries Service
NOI Notice of Intent
NRIS Natural Resource Information System
ODEQ Oregon Department of Environmental Quality
ODFW Oregon Department of Fish and Wildlife
ORV Off Road Vehicle
PAOT Persons At One Time
PFC Proper Functioning Condition
PIG Columbia River Basis Anadromous Fish Policy Implementation Guide
POO Plan of Operation
PVG Potential Vegetation Group
RD Ranger District
PSCA Potential Sediment Contribution Area
RHCA Riparian Habitat Conservation Areas
RNA Research Natural Area
ROD Record of Decision
ROG Replacement Old Growth
ROS Recreation Opportunity Spectrum
RPA Forest and Rangeland Renewable Resources Planning Act
Rx Prescribed
S&G Standard and Guideline
SMO State Management Objective
SMU State Management Unit
SRD Sisters Ranger District
T/E Threatened and Endangered
TMDL Total Maximum Daily Load
TSPQ Total Sale Program Quantity
UMA Umatilla National Forest
USFS United States Forest Service
USFWS United States Fish and Wildlife Service
VQO Visual Quality Objective
WAW Wallowa-Whitman National Forest
WRS Wilderness Resource Spectrum
WTY Whole Tree Yarding

4.4 Glossary of Terms

Common terms contained throughout the document are defined within this section.

A—

Activity fuels – Fuels generated during implementation of various projects.

Age Class- A distinct group of trees recognized on the basis of age.

Allotment – Area of land on which grazing may be allowed by permit.

Allotment Management Plan – The document which contains the action program needed to manage the rangeland resource for livestock grazing with consideration given to soil, watershed, wildlife, recreation, timber, and other resources on lands within a range allotment.

Allowable Sale Quantity (ASQ) - The quantity of timber that may be sold from the area of suitable land covered by the Forest Plan for a time period specified by the plan. This allowable sale quantity (ASQ) is usually expressed on an annual basis as the "average annual allowable sale quantity" (FSM 1900). For timber resource planning purposes, the allowable sale quantity applies to each decade over the planning horizon and includes only chargeable volume. Consistent with the definition of timber production, do not include fuelwood or other non-industrial wood in the allowable sale quantity.

Anadromous Fish – Those species of fish that mature in the sea, and migrate in to streams to spawn.

Anchor Point – An advantageous location from which to start fireline construction to minimize the chance of being out flanked by the fire while the line is being built. Generally, an anchor point should be, or have immediate access to, a safety zone.

B—

Bark Beetle – An insect that bores through the bark of forest trees to eat the inner bark and lay its eggs.

Berm - A barrier, such as an earthen mound or concrete structure, placed across a road to permanently restrict the road from use by wheeled motorized vehicles.

Best Management Practices – Practice designed to prevent or reduce water pollution.

Big Game – Large mammal species (deer, elk, bear) normally managed for sport hunting.

Biological Assessment (BA) – A document prepared by a federal agency for the purpose of identifying any endangered or threatened species that is likely to be affected by and agency action. This document facilitates compliance with the Endangered Species Act.

C—

Canopy/Crown - The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees.

Capability – The potential of an area of land/or water to produce resources, supply goods and services, and allow resource uses under a specified set of management practices and at a given level of management intensity.

Catastrophic wildfire - An especially intense and widespread fire that usually, but not always, occurs in forests that are outside the historical range of variability in terms of forest structure and forest fuels due to fire suppression.

Classified Road – See Road Defininitions.

CFR - Code of Federal Regulations.

Condition Class - Condition classes are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. Current Condition Classes are defined in terms of the relative risk of losing one or more key components that define an ecological system based on five ecosystem attributes: disturbance regimes (patterns and frequency of insect, disease, fire, etc), disturbance agents, smoke production, hydrologic function (sedimentation, stream flow, etc), and vegetative attributes (composition, structure, and resilience to disturbance agents).

Condition Classes are categorized as:

Class- 1 Maintenance- Historical ecosystem attributes are largely intact and functioning as defined by the Historical Natural Fire Regime. Forested areas with an historically short fire return interval usually have frequent fires of low intensity. Areas with an historically long fire return interval have few fires.

Class- 2 Restoration- Historical ecosystem attributes have been moderately altered as defined by the Historical Natural Fire Regime. One or more fire return intervals have been missed, possibly resulting in increased fire sizes and intensities and decreased landscape mosaics and diversity.

Class- 3 Conversion- Ecosystem attributes have been significantly altered as defined by the Historical Natural Fire Regime. Multiple fire return intervals have been missed resulting in dramatic departure from historical conditions. (Hardy, et al.)

Conifer – A tree that produces cones, such as a pine, spruce or fir tree.

Consultation – A process required by Section 7 of the Endangered Species Act whereby federal agencies proposing activities in a listed species habitat confer with the U.S. Fish and Wildlife Service about the impacts of the activity on the species. Consultation may be informal, and thus advisory, or formal, and thus binding.

Crown – The part of a tree, or other woody plant, bearing live branches and foliage.

Crown Fire - A fire that advances through the crown fuel layer normally in direct conjunction with a surface fire. Three categories of crowning are recognized (passive, active, and independent); they are determined by three crown fuel properties (live crown base height, foliar moisture content and bulk density) and two characteristics of of fire behavior (spread rate and surface intensity). Alexander, Martin E. "Help With Making Crown Fire Hazard Assessments", 1987.

Cultural Resource – The physical remains (artifacts, objects, structures, etc.) of past human activities.

Cumulative Effects – The impact on the environment, which results from the incremental impact of the action when added to other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time or space.

Decommission – In terms of this document, this term means to change a road so that it no longer functions as a road or trail.

D—

Defensible Space Treatment Area – Defined by the B&B interdisciplinary team as a developed and maintained fuel break and corridor (100-500 ft. arterial or collector road) to provide an anchor point during fire suppression, and an escape route from wildfires for firefighters and the public. Small diameter fuels (<10 in.) adjacent to WUI would be less than 15 tons/acre, and understory trees may be thinned to reduce ladder fuels.

Density (Stand) – The number of trees growing in a given area usually expressed in terms of trees per acre.
Desired Future Condition – Description of what the Forest should be like, given implementation of Forest Plan direction.

Developed Recreation – Recreation that requires facilities, resulting in a concentrated use of an area. An example of a developed recreation site is a campground. Facilities might include roads, parking lots, picnic tables, toilets, drinking water, and buildings.

Diameter Breast Height (DBH) – Tree diameter, measured 4.5 feet above ground.

Direct Attack – A fire suppression strategy. Line is constructed adjacent to the fire perimeter: usually the preferred method, because of immediate access to escape routes and safety zones. Used when fire behavior, weather and fuel permit. Directly related to individual experience, escape routes and safety zones. Usually involves burnout of interior fuels as the line construction progresses or the fire is allowed to burn into the fire line.

Direct Effect – Effects on the environment that occur at the same time and place as the initial cause or action.

Dispersed Recreation – Recreation use outside developed recreation sites. Scattered, individual outdoor recreation activities. This includes activities such as scenic driving, hiking, bicycling, backpacking, hunting, fishing, snowmobiling, horseback riding, cross-country skiing, and recreation in primitive environments.

Disturbance (Ecosystem) – Refers to events (either natural or human caused) that alter the structure, composition, or function of terrestrial or aquatic habitats.

Disturbance Regime – Natural patterns of periodic disturbances, such as fire or flooding.

Diversity – The distribution and abundance of different plant and animal communities and species.

Duff – The partially decayed organic matter on the forest floor.

E—

Early Seral – A stage of development of an ecosystem from a disturbed, relatively unvegetated state, to a plant community that is up to about 30 years old. Stand structure is seedling and sapling sized.

Eastside Screens – Regional Forester's Forest Plan Amendment (June 1995) designed to maintain options for old growth related and other species.

Ecological Integrity – The quality of a natural unmanaged or managed ecosystem in which the natural ecological processes are sustained, with genetic species and ecosystem diversity assured for the future.

Ecosystem – A functional unit consisting of all the living organisms in a given area, and all of the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size, but it always functions as a whole unit.

Edge Effects – Changes in ecological communities due to the rapid creation of abrupt edges in large patches of previously undisturbed habitat.

Effects – impacts resulting from actions that may have beneficial or detrimental consequences. Effects are ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historical, cultural, economic, social, or health, whether direct, indirect, or cumulative.
Endangered species - A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

Endemic – A species whose natural occurrence is confined to a certain region and whose distribution is relatively limited.

Environmental Assessment (EA) - EAs were authorized by the National Environmental Policy Act (NEPA) of 1969. They are concise, analytical documents prepared with public participation that determine if an Environmental Impact Statement (EIS) is needed for a particular project or action. If an EA determines an EIS is not needed, the EA becomes the document allowing agency compliance with NEPA requirements.

Environmental Impact Statement (EIS) – A document prepared by a Federal agency in which anticipated environmental effects of a planned course of action or development are evaluated. A Federal statute (section 102 of the National Environmental Policy Act of 1969) requires that such statements be prepared. It is prepared first in draft or review form, and then in a final form. An impact statement includes the following points: (1) the environmental impact of the proposed action, (2) any adverse impacts which cannot be avoided by the action, (3) the alternative courses of action, (4) the relationships between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, (5) a description of the irreversible and irretrievable commitment of resources which would occur if the action were accomplished.

Escape Route - A means to access a safety zone.

Extreme Fire Behavior - "Extreme" implies a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One or more of the following is usually involved: high rate of spread, prolific crowning and/or spotting, presence of fire whirls, strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.

F—

Fine Fuels - Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter and have a time lag of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

Fire Behavior – How fire reacts to the influences of fuel, weather and topography.

Fire Intensity - A general term relating to the heat energy released by a fire.

Fire Line - A linear fire barrier that is scraped with hand tools or dug with machinery to mineral soil.

Fire Management Plan - A strategic plan that defines a program to manage wildland and prescribed fires and documents implementation strategies for the fire management program in the approved Forest Land and Resource Management plan alternative. The Fire Management Plan is supplemented by operational plans, such as preparedness, dispatch, prescribed fire and prevention plans.

Fire Regimes - The ecological effects of frequency, intensity, extent, season, and synergistic interactions with other disturbances, such as insects and disease, classified into generalized levels of fire severity.

Fire Risk – The probability or chance of fire starting determined by the presence and activities of causative agents.
Fire Severity – A relative measure of the post-fire appearance of vegetation as it relates to the intensity of the fire and the consumptive effects on vegetation.

Fire Suppression (Fire Control) - All of the work and activities connected with fire extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Firefighter Safety - A work environment where foreseeable risks have been minimized through the mitigation of known hazards associated with wildfire suppression.
Fish Habitat – The place where a population of fish species lives and the surroundings; includes the provision of life requirements such as food and cover.

Fishery – The total population of fish in a stream or body of water, and the physical, chemical and biological factors affecting that population.
Forbs - A plant with a soft, rather than permanent woody stem, that is not a grass or grass-like plant.

Forest Health – The condition in which forest ecosystems sustain their complexity, diversity, resiliency, and productivity while providing for human needs and values.

Forest Land and Resource Management Plan (FLRMP) – The Land and Resource Management Plan, which gathers and coordinates the direction to be followed in the overall management of the forest. Included in the plan are applicable national and regional management directions.

Forest Supervisor – The official who is responsible for administering the National Forest System lands in a Forest Service Administrative unit, which may consist of one or more National Forests.

Fuel(s) - Combustible material that includes vegetation such as grass, leaves, ground litter, plants, shrubs and trees. (See Surface Fuels.) Includes both living plants; dead, woody vegetative materials; and other vegetative materials which are capable of burning.

Fuel Break - A zone in which fuel quantity has been reduced or altered to provide a position for suppression forces to make a stand against wildfire. Fuel breaks are designated or constructed before the outbreak of a fire. Fuel breaks may consist of one or a combination of the following: Natural barriers, constructed fuel breaks, man-made barriers. Refer to FRZ- Fuels Reduction Zone.

Fuel Loadings - The oven dry weight of fuels in a given area, usually expressed in tons per acre. Fuel loadings may be referenced to fuel size or time lag categories; and may include surface fuels or total fuels. The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area.

Fuel Management – Manipulation or reduction of flammable matter for the purpose of reducing the intensity or rate of spread of a fire, while preserving and enhancing environmental quality.

Fuel Reduction - Manipulation, including combustion or removal of fuels, to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.

G—

Geographic Information System (GIS) – Computer software that provides database and spatial analytic capabilities.

Ground Fuels - All combustible materials below the surface litter layer. These fuels may be partially decomposed, such as forest soil organic layers (duff), dead moss and lichen layers, punky wood, and deep organic layers (peat), or may be living plant material, such as tree and shrub roots (Miller 1994).

H—

Hazard - Any real or potential condition that can cause injury, illness, or death of personnel, or damage to or loss of equipment or property.

Hazard Reduction - Any treatment of a hazard that reduces the threat of ignition and fire intensity or rate of spread.

Heavy Fuels - Fuels of large diameter such as snags, logs, large limb wood, that ignite and are consumed more slowly than light fuels.

Herbivore – An animal that feeds on plants.

Heritage Resource – Any definite location of past human activity identifiable through field survey, historical documentation or oral evidence. This includes archeological and architectural sites or structures, and place4s of traditional cultural or religious importance to specified groups whether or not represented by physical remains.

Historic Range of Variability (HRV) – The natural fluctuation of ecological and physical processes and functions that would have occurred during a specified period of time. A range of conditions and processes likely to have occurred prior to settlement of the area by Euroamericans (about the mid-1800s).

Hydrologic – Pertaining to the quantity, quality, and timing of water yield.

Hydrologic Unit Code – A coding system used to map geographic boundaries of watersheds.

I—

Indirect Effect – Secondary effects which occur in locations other than the initial action or significantly later in time.

INFISH - An inter-agency ecosystem management approach for maintaining and restoring healthy, functioning watersheds, riparian areas, and aquatic habitats within inland fishproducing watersheds in Eastern Oregon and Washington, Idaho, and portions of California.

Initial Attack – An aggressive suppression action consistent with firefighter and public safety and values to be protected.

Interdisciplinary Team (IDT) – A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one discipline is sufficiently broad enough to adequately analyze the problem and propose action.

Interior Mature and Old Growth Forest Habitat – Mature habitat where the overstory is dominated by trees 21-32 inches dbh. For the sake of this analysis, interior mature and old growth forest habitat is in patches large enough to contain at least twenty acres that are a minimum of 400 feet from other habitat types.

L—

Ladder Fuels - Fuels which provide vertical continuity between strata. Fire is able to carry from the surface fuels by convection into the crowns with relative ease.

Late Seral Stage – A later stage of development of an ecosystem. Forested stands are generally 12 to 20+ inches average DBH.

Light Fuels - Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter and have a timelag of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

Limits of Acceptable Change (LAC) – Process to provide a framework for establishing acceptable and appropriate resource and social conditions (especially the amount and type of use) in wilderness settings.

Live Fuels - Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences.

M—

Maintenance Levels (operational and objective) as defined in Forest Service Handbook 7709.58-Transportation System Maintenance:

Level 1 **-** Assigned to roads of intermittent service during the period that they are closed to vehicular traffic. The closure period must exceed one year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are “prohibit” and “eliminate”.
Roads receiving level 1 maintenance may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicular traffic, but may be open and suitable for nonmotorized uses.

Level 2 **-** Assigned to roads open for use by high-clearance vehicles. Passenger car traffic is not considered. Traffic is normally minor, consisting of one or a combination of the following: administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high-clearance vehicles.

Level 3 - Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities.
Roads at this maintenance level are typically low-speed, single-lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material. Appropriate traffic management strategies are either “encourage” or “accept”. “Discourage” or “prohibit” strategies may be employed for certain classes of vehicles or users.

Level 4 - Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated. The most appropriate traffic management strategy is “encourage”; however, the “prohibit” strategy may apply to specific classes of vehicles or users at certain times.

Level 5 - Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated. The appropriate traffic management strategy is “encourage.”

The distinction between maintenance levels is not always sharply defined. Some parameters overlap two or more different maintenance levels.

Management Action - Any activity undertaken as part of National Forest administration.

Management Area (MA) – An aggregation of capability areas that have common management direction, and may be dispersed over the Forest. Consists of a grouping of capability areas selected through evaluation procedures and used to locate decisions and resolve issues and concerns.

Management Direction – National Forest System land management and use goals and objectives, as documented in referenced management prescriptions, and standards and guidelines for attaining them.

Management Strategy (MS) – Management practices and intensities selected and scheduled for application on a management area to attain multiple use and other goals and objectives.

Monitoring – The process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned.

Mosaic – A mix of stand structure and composition caused by disturbance. In the case of wildland fire the word depicts widely varying fire effects.

Municipal Supply Watershed – A watershed that provides water for human consumption where Forest Service management could have a significant effect upon the quality of water at the intake point and that provides water used by a community, or any other public water system that regularly serves at least 25 individuals at least 60 days out of the year or that provides at least 15 service connections.

N—

National Environmental Policy Act (NEPA) of 1969 – An Act to declare a National policy which will encourage productive and enjoyable harmony between humans and the environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, to enrich the understanding of the ecological systems and natural resources important to the nation, and to establish a Council on Environmental Quality. (The Principal Laws Relating to Forest Service Activities, Agriculture Handbook NO. 453, USD, Forest Service, 359 pp.)

National Forest Management Act (NFMA) - A law passed in 1976 requiring the preparation of Regional Guides and Forest Plans and regulations to guide that development.

National Forest System – All national forest lands reserved or withdrawn from the public domain of the United States.

Native Species – Species that are indigenous to a region: not introduced or exotic.

Natural Regeneration – Renewal of a tree crop by natural seeding, sprouting, suckering, or layering.

Neotropical Migratory Birds – Migratory bird species that nest in North America and winter in Central or South America or in the Caribbean.

Notice of Intent (NOI) – A document required from any person proposing to conduct mineral related activities which might cause disturbance of surface resources.

Noxious Weed – A legal term, these are exotic plants regulated by law that are aggressive, difficult to manage, and invasive. These species may displace or significantly alter native plant communities.

O—

Old Growth Forest – The Northwest Forest Plan (USDA, USDI, 1994) defines old growth forest habitat as stands with trees greater than 32-inch dbh, and significant amounts of dead wood and trees with large limbs, cavities and mistletoe brooms.

Off Road/Highway Vehicle (ORV, OHV) – Any vehicle capable of being operated off an established road or trail.

Outsloping – pulling road fill material back onto the roadbed to create an out-slope.

Overstory - The portion of the trees that form the uppermost canopy layer in a forest of more than one story.

P—

PACFISH – An inter-agency ecosystem management approach for maintaining and restoring healthy, functioning watersheds, riparian areas, and aquatic habitats within the range of Pacific anadromous fish.

Partnership - In the context of these guidelines, partnerships are those alliances between individuals, groups and/or the Forest that enable road and trail maintenance or monitoring activities beyond those required for resource management access. Partnerships:

1. Fosters good stewardship within the land management plan;
2. Are not exclusive but serve publics at large;
3. Benefit all parties involved.

Potential Sediment Contribution Area – Defined by the B&B Interdisciplinary team as an area at higher risk to erosion from management activities as a result of the wildfires that could supply sediment to streams.

Potential Vegetation Group – Groups of potential vegetation types (vegetation that will grow on a specific site), grouped on the basis of similar general moisture or temperature environment.

Prescribed Fire - The intentional application of fire to wildland fuels in either their natural or modified state under such conditions as allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, etc.). Any fire ignited by management actions under certain, predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Prescription - Measurable criteria that define conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, and environmental, geographic, administrative, social, or legal considerations.

Project – An organized effort to achieve an objective, identified by location, activities, outputs, effects, and time-period and responsibilities for execution.

Proper Functioning Condition (PFC) – Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to allow hydrologic processes to operate to provide aquatic and terrestrial habitat.

Protocol – A widely used and accepted device or technique. An acceptable and consistent way of doing something.

Public Involvement – A Forest Service process designed to broaden the information base upon which agency decisions are made by 1. Informing the public about Forest Service activities, plans and decisions, and 2. Encouraging public understanding about and participation in the planning processes leading to final decision-making.

R—

Recontouring – pulling the excavated road back as near as possible to its original condition.

Recreation Opportunity Spectrum (ROS) - A system for planning and managing recreation resources that categorizes recreation opportunities into three classes: semi-primitive, roaded natural, and rural.

Redd – Spawning nest made by salmon or steelhead in the gravel bed of a river.

Reforestation – The renewal of forest cover by seeding, planting, and natural means.

Regeneration - The process of establishing a new tree crop on previously harvested land. The term also refers to the young crop itself.

Rehabilitation - The activities necessary to repair damage or disturbance caused by wildland fires or the fire suppression activity.

Riparian – A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it. This includes floodplains, woodlands, and all areas within a specified distance from the normal line of high water of a stream channel, or from the shoreline of a standing body of water.

Road – A motor vehicle travelway over 50 inches wide, unless designated and managed as a trail. A road may be:

Road Construction, New – Activity that results in the addition of forest classified or temporary road miles. (36 CFR 212.1)

Road Decommissioning – To remove those elements of a road that reroute hill slope drainage, and present slope stability hazards. The road is stabilized to reduce potential for storm damage, and the need for maintenance. The road is no longer suitable for travel. Decommissioning includes putting a road in storage (storm proofing with dips, berms, waterbars, etc.) for later use. In some cases the road is obliterated, restoring the hydrologic function of the ground by decompacting the road surface, removing fills and culverts, revegetating etc. to never be used again.

Road Maintenance – The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objectives. (FSM 7712.3)

Road Maintenance Levels – See *Maintenance Levels*.

Road Management Objective (RMO) – Defines purpose, use, operational and maintenance level of road based on resource management and access and travel management objectives.

Road Obliteration – Restoring the hydrologic function of the ground by decompacting the road surface, removing fills and culverts, re-vegetating, or other actions with the intent that the road will not be used again.

Road Reconstruction – Activity that results in improvement or realignment of an existing classified road.

Road Stabilization – A process to slope, dip and water bar roads thereby reducing run-off concentrations and alleviating the risk of erosion and landslides if designed drainage structures fail to carry storm runoff. This also includes grass-seeding slopes.

Road Upgrading – Includes erosion controls, road surface treatment to prevent dust and erosion, installing larger culverts and stabilizing fill slopes.

Roadless Area – A National Forest area which (1) is larger than 5000 acres, or if smaller than 5000 acres, contiguous to a designated wilderness or primitive areas; (2) contains no roads; and (3) has been inventoried by the Forest System for possible inclusion in the wilderness preservation system.

S—

Safety Zone (SZ) - SZ are areas that are fuel free zones that are incapable of burning. They afford a very high degree of firefighter safety from advancing wildfire. They can be natural or person made fire resistant areas such as lakes, dirt, gravel or asphalt parking lots, roads and areas burned to secure line.

Salvage – Harvest of trees that are dead, dying, or deteriorating due to fire, wind, insect or other damage or disease.

Scoping Process- Activities in the early stages of preparation of an environmental analysis to determine public opinion, receive comments and suggestions, and determine issues during the environmental analysis process.

Sediment – Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from the site of origin by air, water, gravity, or ice.

Sensitive Species – Species that have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species, that are on an official State list, or that are recognized by the Regional Forester as needing special management to prevent their being placed on Federal or State lists.

Seral – A transitory stage in an ecological succession.

Silviculture – Generally, the science and art of cultivating (i.e. growing and tending) forest crops based on knowledge of silvics.

Site Preparation – A general term for a variety of activities that removes competing vegetation, slash, and other debris that may inhibit the reforestation effort.

Size Class – Intervals of tree diameters used to classify timber. Size class includes: seedling/sapling, pole timber, and saw timber.

Sixth Field Subwatershed – The purpose of Sixth field subwatersheds is to create a standard set of watershed boundaries that subdivide the existing fifth field watersheds based on a common set of criteria. These watersheds are used to define unique hydrologically based land units, and generally range between 10,000 and 40,000 acres.
The sixth field lines are defined at 1:24,000 scale. Boundaries are delineated on drainage divides (ridges). Boundaries must be hydrologically based; therefore there is no isolated territory, and all areas are included.

Soil Resource Inventory (SRI) – An inventory of the soil resource based on landform, vegetative characteristics, soil characteristics, and management potentials.

Soil Productivity – The capability of a soil to produce a specific crop such as fiber and forage, under defined levels of management.

Special Use Permit – An arrangement whereby the Forest Service grants an individual, organization or agency the use of a specified area of Forest land for a water development, utility corridor, power transmission site, developed recreation site, etc.

Spotted Owl Habitat Area – An area containing the home range of one or more owl pairs established for the propagation and protection of the species in accordance with the Oregon Spotted Owl Management Plan.

Stand – A community of trees or other vegetative growth occupying a specific area, and sufficiently uniform in composition (species), age, spatial arrangement, and conditions as to be distinguishable from the other growth on adjoined lands, so forming a silvicultural or management entity.

Standards and Guidelines - Requirements found in a Forest Plan which impose limits on natural resource management activities, generally for environmental protection.

Sub-watershed – A drainage area of approximately 20,000 acres.

Summer range – Range, usually at higher elevations, used by deer and elk during the summer.

Suppression – The act of extinguishing or confining a fire.

T—

Threatened Species – A plant or animal identified and defined in accordance with the 1973 Endangered Species Act, and published in the Federal Register.

Threshold of Variability – The variation from the expected Forest Plan outputs or results that is permitted before corrective action is taken.

Winter range – Range, usually at lower elevations, used by migratory elk and deer during the winter months.

Trail – For purposes of travel by foot, stock, mechanized or motorized trail vehicle (less than 50” in width).

Trailhead – The parking, signing, and other facilities available at the start of a trail.

U—

Underburn - A fire that consumes surface fuels but not trees or shrubs. See *Surface Fuels*.

Understory - The portion of vegetation that is underneath the dominate tree canopy.

W—

Watershed – The drainage basin contributing water, organic matter, dissolved nutrients and sediments to a stream, lake or river.

Watershed Analysis (WA) – Identifies key processes, functions and conditions within a watershed and describes past and current conditions and trends. This is an analytical process, which creates a tool to help identify and prioritize actions that implement Forest plans. Watershed analysis is ecosystem analysis at the watershed scale.

Water Barring – Berm or ditch-and-berm combinations cutting across roads (and trails) at an angle such that all surface water running on the road and in the road ditch is intercepted and deposited over the outside edge of the road. These normally allow high clearance vehicles to pass.

Watershed Restoration – Improving current conditions of watersheds to restore degraded fish habitat and provide long-term protection for aquatic and riparian resources.

Wilderness – Federal land retaining its primeval character and influence without permanent improvements or human habitation as defined under the 1964 Wilderness Act. It is protected and managed so as to preserve the natural conditions, which (1) generally appear to have been affected primarily by forces of nature with the imprint of man's activity substantially absent; (2) has outstanding opportunities for solitude or a primitive and confined type of recreation; (3) has at least 5000 acres, or is of sufficient size to make practical its preservation, enjoyment, and use in an unimpaired condition, and (4) may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest.

Wildland Fire - A non-structure fire, other than prescribed fire, that occurs in the wildland. Any fire originating from an unplanned ignition.

Wildland Urban Interface (WUI) - Includes those areas of resident human population at imminent risk from wildfire, and human developments having special significance. These areas may include critical communications sites, municipal watershed, high voltage transmission lines, observatories, church camps, scout camps, research facilities, and other structures that if destroyed by fire, would result in hardships to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved.

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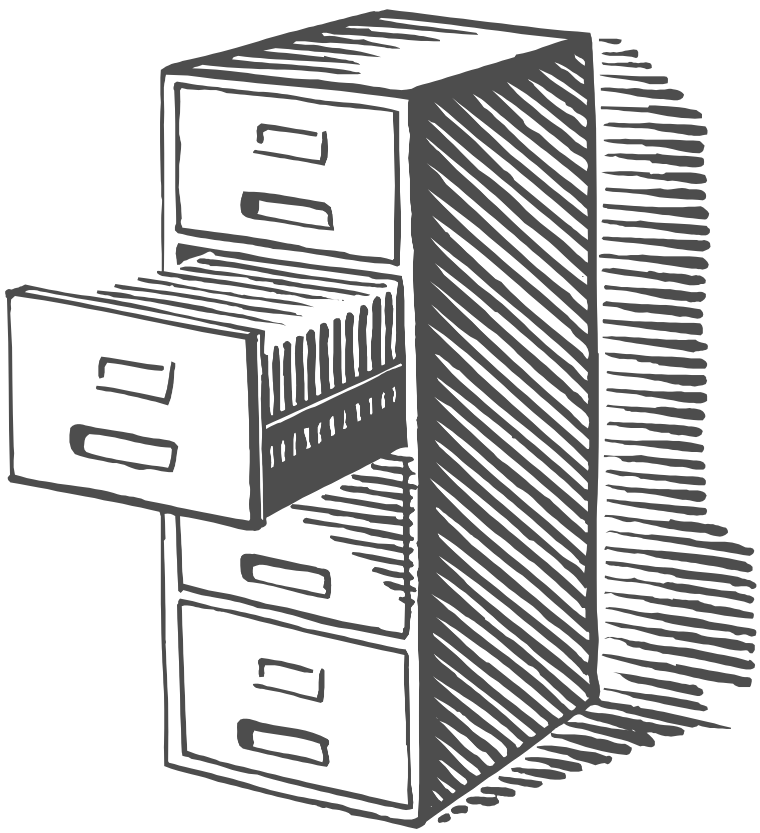
Appendix Files

Supplemental Data



Appendix A: B&B Fire and Fuels Strategy

Introduction
Fire is an important ecological process in western forest. Records of fire occurrence on the Sisters Ranger District support that fire has played a major role in shaping the forests and landscape of this area. In the 1996 Metolius Watershed Analysis, Fire Planners identified 14 trends related to fire and fuels and predicted there would be larger, higher intensity fire that would put firefighters and the public at greater risk and cost more to suppress (Metolius WA, 1996). As a result of past management practices (logging and fire exclusion), pine forest were continuing to evolve from open stands with frequent , low intensities fires to denser stands where moderate and high intensity fire were possible. The high elevation forests were nearing the natural end of their cycles and the conditions were favorable for a stand replacement fire. Fire frequency intervals ranged from 8 years in the ponderosa pine (Fire Regime I) to over 50 years in the mixed conifer (Fire Regime III, IIIa.). Fire regime IIIa typical plant communities include mixed conifer, very dry westside Douglas-fir, and grand fir. Low severity fire tends to predominant in many events. Historically, in the Metolius Watershed, the ponderosa pine and much, if not most of the mixed conifer plant association outside of the higher elevations (i.e. wilderness), burned consistent with fire regime I. A portion of the mixed conifer plant association, especially the wetter/higher sites, likely burned under fire regime III. There is no evidence that large stand replacement events occurred in this plant association historically, perhaps at the higher elevations adjacent to fire regimes IV and V. Maps produced by Langille and others (1903) also do not show evidence of large stand replacement events in the ponderosa pine or mixed conifer PAG outside of the higher elevation (i.e. , <4,500 ft.).

Objective
The fuels management strategy is based on recommendations out of the updated Metolius Watershed Analysis (MWA). The objectives of the MWA are: (1) reintroduce fire in the Metolius Basin at intervals that represent the historic range of variability (HRV) so to avoid uncharacteristic wildland fire in the future, (2) aggressively pursue options to implement fuels reduction treatments around the Wildland Urban Interface (WUI), and other developed areas to provides defensible space and increase suppression effectiveness. (3) reduce fuel loadings and crown bulk density so fire can be re-introduced in areas to help restore and maintain habitat within the HRV in fire regime III condition class I.

Fuel Loading
One objective in burned areas is to reduce fuels so that they more closely approximate historic dead and down woody fuel loads. At lower and middle elevations, this is an important ecological concept because fuels loads can significantly contribute to the effects of a fire disturbance but often exist in levels above pre-European settlement
(Brown 2000). Uncharacteristically high fuel levels create the potential for fires that are uncharacteristically intense (Franklin and Agee 2003). If lower and mid-elevation ecosystems are to experience a disturbance regime similar to that which they are adapted, the fuels must first be reduced to keep fire effects within historic range. One goal of this strategy is to manage future fuel loads and fuel arrangements to be within a manageable range for both fire control and ecosystem process.

Fuel levels and risk of damage from future wildfire is a component of the purpose and need. The fuels strategy has identified high priority areas for hazardous fuels reduction treatments based on recommendations outlined in the updated Metolius Watershed Analysis.

A) Fire Regimes (FR)
Rationale for Treatment

Ecological Role of Fire as a Disturbance Process
In April 2002, a national course-scale assessment was completed that qualifies land conditions in the conterminous United States. The analysis describes the degree of fire regime departure from historic fire cycles due to fire exclusion and other influences (Schmidt et al 2002).

This coarse-scale analysis identifies changes to key ecosystem components such as species composition, structural stage, tree or shrub stand age, and canopy closure. It characterizes the landscape by five "Fire Regimes Groups" and three "Fire Condition Classes" (USDA/USDI, 2002).

A fire regime is a generalized description of fire's role within an ecosystem, characterized by fire frequency, predictability, seasonality, intensity, duration and scale (USDA/USDI, 2002).

Fire condition class is a landscape level attribute which characterizes the degree of departure of vegetation composition and structure, and fire frequency and severity that currently exist inside fire regime.

The national fire regime scheme has been modified for use within the Pacific Northwest Area. For the MWA Fire Regimes are identified by Plant Association Group (PAG).

Fire Regimes

Fire Regime Group	Fire Frequency	Fire Severity	Plant Association Group
I	0-35 years	Low	Ponderosa Pine
II	0-35 years	Stand Replacement	Western Juniper
IIIa	<50 years	Low/Mixed	Mixed Conifer Dry
IIIb	50-100 years	Mixed	Mixed Conifer Wet
IV	35-100 years	Stand Replacement	Lodgepole
V	>200 years	Stand Replacement	Sub-Alpine Fir

Condition classes are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. Condition classes are generally equivalent to low, moderate and high departure from the natural or historical range of variability (HRV), considered a baseline for coarse-filter assessment of risks to ecosystems, habitats, and social values (Morgan et al. 1994, Hann et al. 1998, Landers et al. 1999).

- **Condition Class 1 (Low)** – Vegetation composition, structure, and fuels are similar to those of the natural regime and do not predispose the system to risk of loss of key ecosystem components. Wildland fires are characteristic of the natural fire regime behavior, severity, and patterns. Disturbance agents, native species habitat, and hydrological functions are within the HRV.

- **Condition Class 2 (Moderate)** – Vegetation composition, structure, and fuels have moderate departure from the natural regime and predisposed the system to risk of loss of key ecosystem components. Wildland fires are moderately uncharacteristic compared to the natural fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrological functions are outside the natural range of variability.

- **Condition Class 3 (High)** – Vegetation composition, structure, and fuels have high departure from the natural regime and predisposed the system to high risk of loss of key ecosystem components. Wildland fires are highly uncharacteristic compared to the natural fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrological functions are substantially outside the natural range of variability.

Condition class for the fire regimes in the MWA were subjectively determined considering information found using the Fire Regime Condition/Class guidelines above.

The following table displays the condition classes that were determined for the major fire regimes found within the MWA project area (Refer to Updated MWA Fuels Report, 2004).

MWA Fire Regimes by Condition Class Pre-fire

Fire Regime	Condition Class
I	3
IIIa	3
IIIb	3 possibly high 2
IV	1 possibly low 2
V	1 possibly low 2

Condition class was not determined using the quantitative methods described in the "Interagency Fire Regime Condition Class Guide Book", version 1.05, March 2004. This method was not used because it was felt that District was not yet prepared to conduct this level of analysis due to lack of compatible data and lack of understanding of how to use the methods.

Condition Class
Is the degree of departure from natural (historical) range of variability within a fire regime.

The exclusion of fire has altered most of the mid to low elevation Metolius Basin Forest from their historic structure, composition, and diversity. Fire regimes in ponderosa pine (FR I) and mixed conifer forest (FR III) have been significantly altered from their historical fire return interval, and the risk of losing key ecosystem components is high. These areas were most affected by the B&B fire. High elevation forests are for the most part, within their historical ranges for fire return and fire regimes. The risk of losing key ecosystem components is low. These areas will recover naturally from the B&B Fire.
Recommendations specific to Fire Regimes see Metolius Watershed Analysis Update (2004).

Vegetation Condition

Pre-Fire Condition

Fire Regime I: Fire Regime I consists of the dry and wet ponderosa pine PAG's and makes up about 16% of the B&B area. Historical ranges of variability (HRV) have been developed for the various seral/structural stages. The pre-fire conditions were characterized by a deficiency of area dominated by large –size ponderosa pine. The HRV for this structural stage is 30 – 70%, the pre-fire condition was 15%. The majority (80%) of the Fire Regime I area was dominated by pole (5 – 9" dbh) and small (9 – 20" dbh) sized stands of ponderosa pine. Departure from historical reference conditions is estimated to be about 65%.

Fire Regime IIIa: Fire Regime IIIa consists of the dry mixed conifer PAG and makes up about 42% of the B&B Area. Because the fire frequency was relatively short for this regime historical ranges for seral/structural stages are skewed toward the occurrence early seral species, such as ponderosa pine. The pre-fire condition for this regime shows a marked effect of fire exclusion with a general deficiency of area dominated by early seral species compared to historical ranges. Historically, the expected area dominated by early seral species would be from 35 – 79%. Pre-fire composition for early seral conditions was 23%. Departure from historical reference conditions is estimated to be between 33 and 67%.

Fire Regime IIIb: Fire Regime IIIb consists of the wet mixed conifer PAG and makes up about 17% of the B&B Area. Pre-fire conditions for Fire Regime IIIb were close to the HRV's for most seral/structural stages, deficiencies were apparent in areas dominated by large size trees (>20" dbh) for all seral stages. Departure from historical reference conditions is estimated to be less than 33%.

Fire Regime IV: Fire Regime IV consists of the lodgepole pine PAG and makes up about 7% of the B&B Area. Pre-fire conditions for Fire Regime IV were within the HRV's for seral/structural stages, Departure from historical reference conditions is estimated to be less than 33%.

Fire Regime V: Fire Regime V consists of the mountain hemlock PAG and makes up about 18% of the B&B Area. Pre-fire conditions for Fire Regime V were close to the HRV's for most seral/structural stages, deficiencies were apparent in areas dominated by large size trees (>20" dbh) for all seral stages. Departure from historical reference conditions is estimated to be less than 33%.

Post-Fire Conditions
In this section severity is being described in terms of tree mortality.

Fire Regime I: Effects of the B&B Fire did not substantially change the pre-fire vegetation conditions within this fire regime since most of the area burned at low intensity. The fire resulted in an increase of area dominated by early successional grass, forbs, shrub stage of about 5%. Departure from reference conditions is estimated to be about of 63%.

Fire Regime IIIa: Currently about 32% of the area within this fire regime is dominated by the grass, forbs, shrub stage, the HRV for this stage is 2 – 15%. Some of the area which was dominated by late successional stages was lost in the fire, a loss of approximately 21%. Departure from historic reference conditions is estimated to be in excess of 67%.

Fire Regime IIIb: Effects of the B&B Fire resulted in loss of much of the tree dominated area. Currently approximately 41% of area within this fire regime is dominated by early successional grass, forbs, shrub stage, the HRV for this stage is 3 – 20%. Departure from historical reference conditions is estimated to be between 33 and 67%.

Fire Regime IV: Effects of the B&B Fire resulted in loss of some of the tree dominated area. Currently approximately 46% of area within this fire regime is dominated by early successional grass, forbs, shrub stage, the HRV for this stage is 10 – 35%. Conditions within this fire regime are likely within the range expected since the fire regime is one of long-interval stand replacement fires. Departure from historical reference conditions is estimated to be less than 33%.

Fire Regime V: Effects of the B&B Fire area variable within this fire regime. Currently, approximately 18% of area within this fire regime is dominated by early successional grass, forbs, shrub stage, the HRV for this stage is 3 – 20%. Departure from historic reference conditions is estimated to be less than 33%. Except for a deficiency of large tree dominated areas the area within this fire regime supports vegetation conditions similar to that expected naturally.

Fire Frequency and Severity
Pre-Fire Condition
To better understand the pre and post fire condition below, also frequently used terms that relate to fire and the effects of fire on natural ecosystems, relevant terms are define below:
(1) *Fire Frequency* refers to the number of fires in a specified time an area.
(2) *Fire Severity* refers to the degree to which a site has been altered or the successional process disrupted by fire. Fire severity, loosely, is a product of fire intensity and residence time (DeBano et al 1998, p.11).
Pre-Fire Condition

Fire Regime I: The Deschutes National Forest maintains a historical large fire record dating back to about 1905. An analysis of this record indicates that up the occurrence of the B&B Fire about few acres had burned within the area. The historical reference fire frequency ranges from about 5 to 35 years. This short-interval fire cycle would indicate that most of the Fire Regime I area would have experienced 3 or more fire events during the last 100 years. Prior to the B&B Fire frequency of fire disturbance had departed substantially from reference conditions.
Fire Regimes IIIa and IIIb: The historical reference fire frequency ranges from 35 to 100 years. It is likely that within the B&B Fire area most of the area in these Fire Regimes had missed 1 fire cycle.

Fire Regimes IV and V: The historic reference fire frequency ranges from 100 to 200+ years. It is likely that within the B&B Fire area most of the area in these Fire Regimes had not missed a fire cycle.

The historical record contains little data on the severity of past large fires. Historically fires occurring with Fire Regime I were low intensity and had little effect on the dominant vegetation layer. Large-stand replacing fire could occur within Fire Regime I under extreme weather conditions, but were very rare events associated with exceptional droughts.

Within Fire Regimes IIIa and IIIb fires historically were of mixed intensity and had variable effects to the dominant vegetation. Large, stand replacing fire could occur but were usually rare. Fire disturbance resulted in a mix of stand ages and size classes. Historical fire severity within Fire Regime IIIa would tend to low intensity supporting and maintaining a higher percentage of early seral ponderosa pine.

Post-Fire Condition
In this section severity is being described in terms of tree mortality.

The scale, intensity and severity of the B&B Fire was characteristic compared to reference conditions within Fire Regime I. Burn severity for the B&B Fire within Fire Regime I was characteristic with about 5% of the area affected as stand replacement. The fire severity expected within Fire Regime I under historical conditions would be low severity.

Burn severity for Fire Regime IIIa was likely outside the historical range of variability, with 38% of the area affected as stand replacement. Burn severity for Fire Regime IIIb was likely within the historical range of variability, with 18% of the area affected as stand replacement.

Table A-1 summarizes the elements of vegetation condition, fire frequency and severity in the determination of condition class for the B&B Fire Area.

Table. A-1 B&B Pre- and Post-Fire Fire Regime Elements

Fire Regime	Vegetation Condition*	Fire Frequency	Fire Severity	Condition Class
I				
Pre-Fire	65%	70%	80%	3
Post-Fire	65%	60%	60%	2
IIIa				
Pre-Fire	40%	50%	50%	2
Post-Fire	70%	40%	60%	3
IIIb				
Pre-Fire	25%	40%	25%	1
Post-Fire	40%	25%	35%	2
IV				
Pre-Fire	20%	20%	20%	1
Post-Fire	20%	10%	10%	1
V				
Pre-Fire	15%	20%	10%	1
Post-Fire	20%	10%	10%	1
Note: * Departure from Reference Conditions				

Fire Regime IIIa which makes up the majority of the B&B Fire area is characterized as Condition Class 2, because of moderate departure from reference conditions for vegetation, fire frequency and intensity. Fire Regime I is characterized as being in Condition Class 3 because of a substantial amount of departure from reference conditions. Fire Regimes IV and V are shown as Condition Class 1 and essentially functioning with the ranges of historical reference conditions.

Fire Behavior

Fire Behavior is the manner in which fire reacts to topography, weather, and fuels (DeBano et al 1998 p. 11; NWCG,1998 p. G-7). These three elements comprise the fire environment, the surrounding conditions, influences, and modifying forces that determine fire behavior (NWCG, 1994 p. 8).
Modifying any one of these elements has a direct result on fire behavior, which is basically described by flame length and rate of spread. Favorable conditions for crown fires include heavy accumulations of dead and downed litter, conifer reproduction and other ladder fuels, and continuous conifer tree forest (Rothermel 1991 p.2).
The greater the fuel loading, the more intensely a fire is likely to burn (DeBano et al 1998 p.57). Conversely, a reduction in fuel loading can limit the fires intensity. Fuel characteristics affecting fire behavior are vegetative density, species composition, amount of surface fuel, arrangement of fuels and moisture content (Rothermel 1983 p.9). Fuels contribute to the rate of spread of a fire, the intensity/flame length of the fire, how long a fire is held over in an area, and the size of the burned area (Rothermel 1983 p.59).
Treatments that reduce surface fuel loads have been shown to decrease fire behavior and severity (Graham et al 1999 p.18, 20) (Pollet and Omi, 1999, p. 3). Van Wagtendonk (1996) found in fire simulations that a reduction in fuel loads decreased subsequent fire behavior, increased fire line control possibilities and decreased fire suppression costs. Fire line construction rates increase with decreased fuel loads, decreased fuel loads means a lower resistance to control.

Resistance to Control

Resistance to control is generally viewed as an estimate of the suppression force required for controlling a unit of fire perimeter. The USDA Forest Service Pacific Southwest Region (1976) developed a resistance to control ratings scheme based on difficulty of handline construction and an inventory of downed woody fuel loadings by size classes. High and extreme resistance to control ratings were reached for the following loadings in tons per acre:

High and Extreme Resistance to Control Ratings based on Loadings in Tons per Ac.

0-3 inch diameter	**3-10 inch diameter**	
	High	**Extreme**
5	25	40
10	15	25
15	5	15

The above ratings are based on the assumption that few downed pieces greater than 10-inch diameter were present. In computing the ratings, the number of large pieces (greater than 10 inches) by length class is more important than their loadings in determining resistance to control. If the number of pieces greater than a 10-inch diameter exceeds 10 to 20 per acre, depending on length, less 3-10 inch diameter material would be required to reach the high and extreme resistance to control ratings (Brown et al, 2003).

Optimum fuel loadings by plant association and harvest type(s) in Tons per Ac.

Plant Association	**Thinning**	**Partial Cut**	**Clear Cut**
PP	4.4 to 12.1	14.5	3.4
PP	4.4 to 12.1	14.5	3.4
MC-MH	4.4 to 10.5	14.5 to 28.7	26.5 to 36
MC-MH	4.4 to 10.5	14.5 to 28.7	26.5 to 36.4
LP	4.4 to 10.5	14.5	16.0

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The above tons per acre are found in Photo Series for Quantifying Forest Residues, a cooperative publication by the Pacific Northwest Forest and Range Experiment Station, USDA Forest Service, Portland Oregon. These fuels loadings will be revised when new data, methods, or research indicate that a new profile would improve resource management programs.

Optimum fuel loadings by plant association and fire regime in Tons per Ac.

Plant Association	Fire Regimes	Brown Recommended T/A	Sisters fuels Recommendation
PPD-Dry	FR I	5 to 20	7 to 10
MC-MH-Dry	FR IIIa	5 to 20	7 to 10
MC-MH-Wet	FR IIIb	10 to 30	15 to 25
LP	FR IV	10 to 30	15 to 25

Brown GTR RMRS-GTR-105, July 2003

The above ratings are recommendation and thresholds based on the amount of Coarse Woody Debris (CWD) that provides benefits, without creating an unacceptable fire hazard or potential for high fire severity reburn (Brown 2003). Also, discussion with the Fire Management Officer these are thresholds by fire regimes that are recommended in tons per acre (see Sisters Fuels).

Positives and Negatives for Coarse Woody Debris (CWD)

To summarize the positive values:

- For maintaining soil productivity the upper limit recommended is 5 to 10 tons per acre for warm dry ponderosa pine and Douglas-fir types.
- For cool (wet) Douglas-fir types, 10 to 20 tons per acre.
- For cool (wet) lodgepole and lower subalpine fir types, 8 to 24 tons per acre.

To summarize the negative values:

- Fire hazards, resistance-to-control and fire behavior reach high ratings when large fuels exceed about 25 to 30 tons per acre in combination with small woody fuels of 5 tons per acre.
- Excessive soil heating is likely at approximately 40 tons per acre and higher. Thus, generally high to extreme fire hazard potential exist when downed wood CWD exceed 30 to 40 tons per acre.

An important goal in dealing with these concerns is to manage towards quantities of accumulated downed woody material such that the risk of damage from reburn is acceptable and benefits derived from coarse woody debris can be realized (Brown et, al 2003).

B) Wildland Urban Interface (WUI)

Rationale for Treatment

1) Sisters
2) Camp Sherman
3) Suttle Lake Recreation Complex
4) Black Butte Ranch
5) Round Lake Christian Camp

In 2001, the Federal Register listed the communities at risk from wildland fire within the United States. A total of 93 communities appeared on the list in Central Oregon. After the Federal Register was published, a coalition of fire managers in Central Oregon re-evaluated this list and improved the assessment which resulted in the current list of 136 communities, i.e., Round Lake Christian Camp and Suttle Lake Recreation Complex. In Central Oregon each community was buffered by 11/2 miles to identify the Wildland Urban Interface (WUI). Central Oregon Fire Management Services (COFMS) in collaboration with local, State and private entities is in the process of developing Community Wildfire Protection Plans (CWPP) for the greater Sisters community. The protection plans will identify areas for hazardous fuels reduction and set priorities for treatment. A map has been provided to show where the wildland urban interface areas are.

One concern in the wildland urban interface areas is fire behavior and its effects. Concerns could very depending on the resources at risk (in the case WUI) and its location within the analysis area. For example, fuel loading, ground forces can use direct attack suppression tactics with flame lengths that are less than 4 feet. When flame lengths are greater than 4 feet indirect suppression tactics such as burning out from a road or dozer line construction several hundred feet away from the fire edge could be required. So by reducing the fuel loads and modifying the fuels arrangements can reduce fire behavior and fire spread.

Wildland Urban Interface Strategies:

- Modify fuels to generate low intensity wildfires (flame lengths less than 4 feet) under all weather conditions. Mechanical treatments, hand-piling and/or prescribed fire could be used to reduce fuel loadings, including ladder fuels and brush components.
- Reduce smaller diameter fuels (< 10 inches) adjacent to WUI, defensible space corridors and high use areas to less than 10 tons per acre.
- Eastside of project area look at developing fuel treatments in fire regime I (ponderosa pine) under this planning effort, which would further minimize impacts to WUI. Modify fuels to generate low intensity wildfires (flame lengths less than 4 feet). Mechanical treatments, hand-piling and/or prescribed fire could be used to reduce fuel loadings, ladder fuels and brush components. Desired future fuel loading in dry ponderosa pine (fire regime I) as recommended by Brown (2003) is 5 to10 tons/ac.
- Develop and maintain fuelbreaks to reduce the risk of high intensity wildfires moving from private lands.
- Once fuelbreaks have been developed, they must be maintained. Maintenance of fuelbreaks will be as important as developing them.

C) Defensible Space

Rationale for Treatment

1) Defensible Space

Defensible space is being defined in the strategy as a developed and/or maintained fuel break 100-500ft wide that serves as an anchor point during fire suppression and as an escape route from wildfires for firefighters and the public. It should be recognized that defensible space and distance to treat is based values at risk and management objectives. Professional judgment, experience and fire behavior modeling will vary also. However, the above definition was developed in a interdisciplinary process for the analysis area. A desired fire regime condition class for the different plant associations groups or subwatersheds for the Metolius Basin is outlined in the Updated Metolius Watershed Analysis.

Road systems allow ground suppression forces to access wildfires. When fuel conditions allow surface fire to reach the canopies of trees, torching and crowning can contribute to long range spotting and resistance to control (direct attack). The use of indirect tactics is preferred in areas of high snag densities or where firefighter safety may be jeopardized. It is acceptable to “back off” from a fire and catch it when it moves into areas with lower fuel loadings, lower snag numbers and where there are opportunities to “take a stand”.

Roads that provide defensible space provide escape routes from wildfires for firefighters and the public. The fuel strategy identified some arterial and collector roads (2 and 4 digits) for future suppression (See fuel strategy map). In the event of future fires in the Metolius Basin this strategy provides firefighters with options for suppression to minimize the impacts of wildfire.

Defensible Space Strategies:

- Develop fuelbreaks along roads identified by the fuel strategy (See Map), that can be used as anchor points during burnout operations and as a place to “take a stand” during future wildfires. The fuelbreaks should be designed to act as an anchor point and a safe location during suppression activities.
- No fuel treatments will occur inside NFR habitat at this time. The strategy for these areas will be designed to treat adjacent (buffer) to prevent wildland fire from entering those areas.

- Defensible space roads should be a minimum of 100-500ft. Site-specific locations for treatments should be based on values at risk.
- Reduce smaller diameter fuels (< 10 inches) adjacent to WUI, defensible space corridors and high use areas to less than 10 tons per acre.
- Thin understory trees to reduce ladder fuels. In heavily stocked stands, mechanical treatments will generally be required. This and all decisions must be made on the ground after visiting specific locations.
- Look at prescribed fire to manage brush along defensible space corridors versus mechanical treatments (mowing) to avoid unnecessary resource damage.
- Modify fuels to generate low intensity wildfires (flame lengths less than 4 feet) in corridors. Mechanical treatments, hand-piling and/or prescribed fire could be used to reduce fuel loadings, ladder fuels and brush components.
- Avoid leaving high snags densities along corridors used for defensible space. Recommend leaving no snags that could jeapordize firefighter safety.
- Once fuelbreaks have been developed, they must be maintained.

D) Owl Habitat

Rationale for Treatment

1) To protect existing NRF
2) Reduce risk to developing suitable habitat

- Develop and maintain fuelbreaks around "core areas", spotted owl nest sites and spotted owl nest stands identified by the wildlife biologist as important for late-successional species (Metolius LSR).
- Reducing risk to developing and existing NRF, we should look at opportunities to reduce risk within and adjacent to these stands by creating treatment buffers along existing roads which could serve as control lines and ingress/egress routes.
- In fire regime IIIa.,b., mixed conifer (across the landscape) we should avoid leaving fuel loadings above 25-30 tons per acre in combination with small woody fuels of 5 tons per acre and higher. According to scientific research, fire hazard including resistance to control reach high ratings at these levels (Brown 2003).
- Fuels that range between 0 to 3 inches in size should be targeted for removal within treatments areas to reduce and break-up continuity of these fuels across the landscape. These size classes are recognized as primary contributors to fire behavior.
- Assign a higher priority for treatments areas adjacent to WUI and NFR to reduce potential fire behavior and intensities in a timely manner. In the event of a funding issue.
- There may be a need to break-up fuel continuity if snags and tons per acre exceed a given threshold. Based on owl strategy desired future condition is this sustainable through time?

Appendix B – Management Direction and Compliance

Soils

Management Direction and Compliance

Standards and Guidelines for the soil resource within all Northwest Forest Plan or LRMP allocations are the same as those applicable for management activities in the LRMP General Forest (M8) allocation. LRMP Standards and Guidelines for management of the soil resource are intended to maintain or enhance long-term soil productivity (LRMP 4-70, SL-1, SL-3 and SL-4) and minimize erosion risks through the maintenance of effective ground cover (LRMP SL-6). Management activities proposed under the B&B project are determined to be in compliance with applicable LRMP Standards for all alternatives included in the DEIS analysis after implementation of all proposed harvest, yarding, fuels treatment and mitigation activities.

Regional Standards and Guidelines (FSM 2500, R-6 supplement 2500-98-1) describe conditions detrimental to soil productivity and outlines Soil Quality Standards to limit the extent of these conditions to less than 20% of an activity area. Detrimental soil conditions are described in the Soil Quality Standards as follows:

- Detrimental soil compaction in volcanic ash/pumice soils is an increase in soil bulk density of 20 percent or greater over the undisturbed level.
- Detrimental puddling occurs when the depth of ruts or imprints is six inches or greater.
- Detrimental displacement is the removal of more than 50 percent of the A horizon from an area greater than 100 square feet and at least 5 feet in width.
- Detrimental burn damage requires significant color change of the mineral soil surface to an oxidized reddish color, with the next one-half inch below blackened from organic matter charring as a result of heat conducted from the fire.
- Detrimental erosion requires visual evidence of surface loss over areas greater than 100 square feet, rills or gullies, and/or water quality degradation from sediment or nutrient enrichment.

The R6 Supplement also includes policy direction for designing and implementing management practices which maintain or improve soil and water quality. An emphasis is placed on protection over restoration. Deschutes National Forest direction for interpreting and implementing this policy is outlined in the document "Final Forest Plan Interpretation: Standards and Guidelines – Forest-wide SL-3 and SL-4" formulated and finalized by the Forest Interdisciplinary Team on March 15, 1996 (Herrick 1996).

Specifically, under 2520.3 – Policy, the narrative reads:

"When initiating new activities:

1. Design new activities that do not exceed detrimental soil conditions on more than 20 percent of an activity area. (This includes the permanent transportation system).
2. In areas where less than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 20 percent.

3. In areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality."

Water Quality

Management Direction

All federal land management activities must follow standards and guidelines (S&Gs) listed in the Deschutes National Forest Plan, as amended by the Northwest Forest Plan (NWFP) (USDA Forest Service and USDI Bureau of Land Management 1994), PACFISH (USDA Forest Service 1995a), and any Wild and Scenic River Plans and in accordance with Best Management Practices (WT-5; USDA Forest Service 1998a) and the Clean Water Act (WT-1). All National Forest lands in the B&B project area fall under NWFP direction and 1770 acres within the project area fall within the Metolius Wild and Scenic River corridor.

Northwest Forest Plan

The Deschutes National Forest LRMP was amended in 1994 by the Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (Northwest Forest Plan). An essential piece of the Northwest Forest Plan is the Aquatic Conservation Strategy (ACS) which "was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands." (USFS 1994, B-9). The NWFP provides standards and guidelines for Key Watersheds and Riparian Reserves (RRs) that prohibit or regulate activities that retard or prevent attainment of the ACS Objectives at the watershed scale. Key watersheds under the NWFP contribute directly to the conservation of the threatened bull trout and resident fish populations. All the subwatersheds in the B&B project boundary, except Cache Creek subwatershed, are "key watersheds" under the NWFP.

The B&B Fire Recovery Project complies with the following three requirements for projects within Riparian Reserves as directed in the ROD for "Amending Resource Management Plans for Seven Bureau of Land Management Districts and Land and Resource Management Plans for Nineteen National Forests within the Range of the Northern Spotted Owl" (March 2004; p. 10): "1) describe the existing condition, including the importation physical and biological components of the fifth-field watershed(s) in which the project area lies; 2) describe the effect of the project on the existing condition; and 3) demonstrate that in designing and assessing the project the decision maker considered and used, as appropriate, any relevant information from applicable watershed analysis" (USDA and USDI 2004). The only activities associated with the B&B Fire Recovery Project that are within Riparian Reserves are: 1) removal of hazard trees along 3.1 miles of road within the Defensible Space Strategy Area, 2) hauling and potential road improvements on 21 miles of road, and 3) decommissioning of 13.8 miles and inactivation of 3.2 miles of road[38]. The B&B Project meets the

[38] Decommissioned roads have no long term needs, are not planned to be used again and will be removed form the transportation system status. Treatment would involve "hydrologically closing" roads and could potentially include subsoiling or recontouring the road surface.

Inactivated roads are closed roads, operational maintenance level 1. While remaining on the transportation system they are managed in a storage or closed category, and only non-motorized vehicles or USFS vehicles receiving special permission are allowed. An inactivated road is "hydrologically closed," even though the landscape is not restored to near original shapes. Hydrologic closing a road is intended to leave the road in a "self-maintaining" state and would include repairing any drainage problems, potentially removing culverts from stream crossings, and installing a closure device (i.e. barricade, earth berm, logs, gates, ect).

three requirements by: 1) referencing the Metolius Watershed Analysis (1996) and the Updated Metolius Watershed Analysis (2004), which describe the existing condition for the Upper and Lower Metolius 5th field watersheds; 2) discussing the effect of the B&B project and other past, present and future foreseeable projects on the existing condition in the Cumulative Effects section of the Water Quality report; and 3) demonstrating, the use of the Metolius Watershed Analysis Update for the design and implementation of activities within the Riparian Reserves, associated with the B&B Fire Recovery Project.
All action alternatives in the B&B Fire Recovery Project comply with the Riparian Reserve and Key Watershed standards and guidelines in the NWFP. In addition, S&G regarding roads in the B&B project area have been enhanced by special design practices to make sure appropriate protection is provided (see Soil and Water Design Elements). Based on the evaluation of the short-term, long-term, and cumulative impacts, the B&B Fire Recovery Project is designed to contribute to maintaining or restoring the fifth-field watershed over the long-term."

Metolius Wild and Scenic River Plan

The Deschutes Land and Resource Management Plan identifies the Metolius River as a Wild and Scenic River and Jack Creek as an Eligible Wild and Scenic River, both of which are partially in the B&B Fire Recovery Project area. The Deschutes LRMP was amended in 1997 by the Record of Decision for Metolius Wild and Scenic River Management Plan (MWSRMP), which replaces the interim direction provided in Deschutes LRMP for Management Area MA-28 (USDA 1997).The MSRMP provides the goals, objectives, and standards and guidelines for the management of the Metolius River and Jack Creek corridors.

Metolius Wild and Scenic River

An analysis of the action alternatives under the B&B Fire Recovery Project was conducted to determine consistency with management recommendations in the Metolius Wild and Scenic River (W&S) Plan (1996). Only 1770 acres within the B&B Project boundary are in this corridor, in which 1224 acres are classified as “Recreation” and 544 acres as “Scenic” under the W&S Plan. In order to protect the scenic quality of this area and reduce further impacts to this resource the areas included as Federal Wild and Scenic Designation on the Metolius River have been excluded from salvage treatments. Some existing roads in this corridor would be used for haul and may receive some improvements. Also, approximately 4.9 miles of road in this corridor is proposed for decommissioning or inactivation under the B&B Project.

The Outstandingly Remarkable Values (ORVs), identified in the Metolius River Resource Assessment (1992), associated with the Metolius Wild and Scenic River Corridor are ecological (including vegetation), water quality, fisheries, wildlife, scenery, recreation, cultural, and geology. The road decommissioning and closure proposed under the B&B Fire Recovery Project would directly affect the ecological ORV (riparian vegetation), and all actions may indirectly affect the water quality ORVs. Consistency with the Plan was assessed in terms of whether action alternatives under the B&B Fire Recovery Project are within the standards and guidelines listed in the Metolius Wild and Scenic River Plan for the ORVs.

STANDARDS AND GUIDELINES
Following is a summary of each Standard and Guideline, and how the proposed actions in the B&B Fire Recovery Project address it.

Ecological ORV (Riparian Vegetation)

- ♦ Restore riparian vegetation in areas that are outside the range of desired conditions as defined by the limits of acceptable change (MTEV-2).

Applicable desired forest conditions include:

- Vegetation communities dominated by shrubs and trees that overhang the stream and provide shade sufficient to maintain stream temperatures
    - *Decommissioning and inactivating roads adjacent to streams would help riparian vegetation reestablish by restoring infiltration on some roads and by minimizing disturbance from use on all roads.*

Water Quality ORVs

- ♦ Water quality standards are established to maintain or improve existing water quality (MTWQ-1).

Applicable water quality parameters include:

- Turbidity – No more than 10 percent increase in natural stream turbidity as established through baseline monitoring.
    - *Sedimentation, which directly effects turbidity, from activities associated with the B&B Fire Recovery Project is predicted to be negligible due to limited activity in potential sediment contribution areas and implementation of soil and water design elements (see Chapter 3, Water Quality, Environmental Consequences, Sedimentation, Cumulative Effects).*
    - *Baseline monitoring of percent fines in the Metolius River is used in lieu of turbidity monitoring. Monitoring of percent fines would continue and if a change is detected that can be attributed to the B&B Project then project effects would be mitigated.*

Jack Creek Eligible Wild and Scenic River

An analysis of the action alternatives under the B&B Fire Recovery Project was conducted to determine consistency with management recommendations in the Metolius Wild and Scenic River Plan for Eligible Wild and Scenic Rivers (1996). Approximately 1033 acres within the B&B Project boundary are in this corridor, and are classified as “Recreation”. The Deschutes LRMP requires that all Eligible Wild and Scenic Rivers be managed in a manner that will not detract from their eligibility by protecting the outstandingly remarkable values which originally made them eligible (USDA 1990). LRMP direction for the eligible segment of Jack Crek is that it “be managed in accordance with the prescriptions found in MA28 (WS-2; USDA 1990), as amended by the Metolius Wild and Scenic River Plan (USDA 1996).

Salvage units 127, 128, and 129 are within the Jack Creek corridor, and units 122 and 124 are partially within the corridor (total of approx. 200 ac inside corridor). Some existing roads in this corridor would be used for haul and may receive some improvements. Also, approximately 2.5 miles of road in this corridor are proposed for decommissioning or inactivation under the B&B Project.

The Outstandingly Remarkable Values (ORVs), identified in the Deschutes Eligibility Study (1990), associated with the Jack Creek Eligible Wild and Scenic River Corridor are fisheries. All actions in the Jack Creek subwatershed associated with the B&B Fire Recovery may indirectly affect the fisheries ORV. Consistency with the Plan was assessed in terms of whether action alternatives under the B&B Fire Recovery Project are within the standards and guidelines listed in the Metolius Wild and Scenic River Plan for the Fisheries ORV.

STANDARDS AND GUIDELINES

Following is a summary of each Standard and Guideline, and how the proposed actions in the B&B Fire Recovery Project address it.

<u>Fisheries ORV (i.e. Bull Trout)</u>

- ♦ Wild fish populations are managed under the direction of the Upper Deschutes Basin Fish Management Plan (MTFP-1).
    - o *Effects to bull trout from the B&B Fire Recovery Project are "unlikely to adversely affect" the population (see Chapter 3- Fisheries, MSA and ESA Effects and Chapter 3-Fisheries, Effects of the Alternatives-Fisheries, Subpopulations Characteristics)*
- ♦ Restoration of fish habitat is primarily through natural processes of infall and distribution (MTFH-1).
    - o *Although approximately 200 acres of salvage units are within the Jack Creek corridor, they are all outside of debris slide areas that could reach the stream and the Jack Creek Riparian Reserve (320 ft); therefore, they would have no effect on instream wood recruitment.*

Applicable fish habitat parameters include:

- Quality and Quantity of Spawning Gravels
    - o *Sedimentation from activities associated with the B&B Fire Recovery Project is predicted to be negligible due to limited activity in potential sediment contribution areas and implementation of soil and water design elements (see Chapter 3, Water Quality, Environmental Consequences, Sedimentation).*
    - o *Monitoring of substrate composition in Jack Creek would continue and if a change is detected that can be attributed to the B&B Project then project effects would be mitigated.*
    - o *Decommissioning and inactivating 4.8 miles of roads in the Jack Creek subwatershed associated with aquatic concerns would reduce sedimentation in Jack Creek.*
- Rearing Habitat
    - o *No salvage activities would occur within Riparian Reserves.*
    - o *Decommissioning and inactivating roads adjacent to streams would help riparian vegetation reestablish by restoring infiltration on some roads and by minimizing disturbance from use on all roads.*
    - o *Baseline monitoring of rearing habitat in Jack would continue and if a change is detected that can be attributed to the B&B Project then project effects would be mitigated.*
- Fish Species Composition

- *Baseline monitoring of species composition in Jack would continue and if a change is detected that can be attributed to the B&B Project then project effects would be mitigated.*

Clean Water Act

The State of Oregon, as directed by the Clean Water Act (CWA) and the Environmental Protection Agency, is responsible for the protection of rivers and other bodies of water in the public interest. Beneficial uses as defined by the State of Oregon for the Metolius River and it's subwatersheds are listed in Table 3. 5. To show that water quality is being protected, states are required by the CWA to adopt water quality standards which must be approved by the Environmental Protection Agency. Best Management Practices (BMP) and state-wide management plans are a requirement of the CWA and are used to meet water quality standards.

Table 3. 5 Beneficial uses for Deschutes River Basin (ODEQ 2003) and water quality parameters mostly like to be influenced by the B&B Fire Recovery Project.

Beneficial Use	**Associated Water Quality Parameter**
Public Domestic Water Supply	Turbidity, Chlorophyll *a*
Private Domestic Water Supply	Turbidity, Chlorophyll *a*
Industrial Water Supply	Turbidity, Chlorophyll *a*
Irrigation	None
Livestock Watering	None
Anadromous Fish Passage	Biological Criteria, Dissolved Oxygen, pH, Sedimentation, Temperature, Total Dissolved Gas, Toxics, Turbidity
Salmonid Fish Rearing	Dissolved Oxygen, Sedimentation, Temperature
Salmonid Fish Spawning	Same as Salmonid Fish Rearing
Resident Fish and Aquatic Life	Same as Anadromous Fish Passage
Wildlife and Hunting	None
Fishing	Aquatic Weeds or Algae, Chlorophyll *a* , Nutrients
Boating	None
Water Contact Recreation	Aquatic Weeds or Algae, Bacteria, Chlorophyll *a* , Nutrients, pH
Aesthetic Quality	Aquatic Weeds or Algae, Chlorophyll *a*, Nutrients, Turbidity

The State of Oregon is required by the CWA, Section 303(d), to identify waters that do not meet water quality standards. The waterbodies in Table 3. 6 are listed on the Oregon 2002 303(d) list for water quality exceedences above the State standards established prior to 2002. A 2004 303(d) list based on the new water quality standards (ODEQ 2003) will most likely be released in 2005.

Table 3. 6 Waterbodies listed on the State of Oregon 2002 303(d) list for water quality exceedences.

Waterbodies	**Parameter**	**2002 Standard***	**2003 Standard****
Brush Creek	Temperature	Bull trout; 10° C	12° C
Canyon Creek	Temperature	Bull trout; 10° C	12° C
First Creek	Temperature	Spawning; 12.8°C	12° C
Lake Creek	Temperature	Rearing; 17.8° C	12° C
Lake Billy Chinook***	pH	6.5 to 8.5	6.5 to 8.5
Lake Billy Chinook***	Chlorophyll	15 µ/L	15 µ/L

* The 2002 water temperature standard was used for listing streams on the 2002 303(d) list and is different from the new temperature standard in the 2003 Oregon Administrative Rules ,OAR 340-041-0028, (ODEQ 2003).
** The 2003 temperature standard will be used to list streams on the 2004 303(d) list, which will not be released until 2005.
*** Lake Billy Chinook is not within the B&B project or analysis area boundary; however, it is approximately 17 miles downstream of the project.

States are required to develop Total Maximum Daily Load (TMDL) allocations, which include Water Quality Management Plans (WQMP) for 303(d) listed waters. The Upper Deschutes River Subbasin TMDL and WQMP is scheduled for completion in 2006 and covers all the subwatersheds in the B&B project boundary. A Memorandum of Understanding (MOU), signed May 2002, between Oregon Department of Environmental Quality and the USDA Forest Service, designated the Forest Service as the management agency for the State on National Forest Service lands. To meet CWA responsibilities defined in the MOU, the Forest Service is responsible for developing a Water Quality Restoration Plan (WQRP), which is now in draft form.

Forest Roads and Transportation

Management Direction

The Metolius Watershed Analysis, updated-2004; Metolius Wild and Scenic River (UDWS) Plan, 1996; Northwest Forest Plan, 1994; and the Deschutes NF Land and Resource Management Plan (Forest Plan), 1990, provide management direction for the B & B Project Area. The following are some of the primary standards and guidelines pertinent to proposed actions within the B & B project area.

Forest Plan Standards and Guidelines (for Transportation System)

The Forest Plan Goal for the transportation system is “To plan, design, operate and maintain a safe and economical transportation system providing efficient access for the movement of people and materials involved in the use and protection of National Forest Lands.”

The transportation systems will be planned to serve long-term multiple resource needs rather than individual project proposals. TS-2. Traffic will be managed as needed to control access due to structural limitations of the road, safety guidelines, or to meet resource objectives such as wildlife habitat requirements.

Adequate access to and within the forest will be provided. TS-1.

The transportation system will be managed to provide a safe and cost effective network, serving long-term multiple resource needs. TS-2.

Temporary roads may be constructed for short-term use where the risk of resource impact is low, or can be mitigated, and where analysis has shown they are cost effective. Roads proposed for inactivation, will use the most economical method that is effective in meeting the management objectives for the area. TS-5.

Some management areas include open road density guidelines. If not included in the management area direction, the deer summer range guideline of 2.5 miles per square mile, as an average over the entire implementation unit, is assumed. Guideline densities will be used as thresholds for further evaluation and will not serve as the basis for assessing conformance with the Forest Plan. TS-12

Commercial Hauling: During commercial hauling activities, public access will generally be discouraged or prohibited on single purpose local access roads (mtc lvl-2). Road Management Objectives on single purpose local access roads discourage public access. All commercial users of Forest roads will be financially responsible for maintenance activities resulting from their use of the Forest road system. TS-10

Wildlife: Provide habitat for viable populations of all vertebrate species, and maintain or enhance habitat for selected wildlife species. Road management in key areas - open road densities should not exceed an overall average between 0.5 to 1.5 miles per square mile within each key area, unless impacts on wildlife can be avoided or the proposed project would result in a net benefit to wildlife habitat. Density will be applied as an average over a key area and will be used as a threshold for further evaluation. WL-46

Riparian Areas: Emphasis is to manage riparian areas to maintain or enhance riparian dependent resources such as water quality, fish habitat, wildlife, and vegetation. Roads and trails will be at the lowest density, which meet long term resource needs. RP-17. Where existing roads or trails are inhibiting the achievement of fisheries or water quality objectives, manage roads to protect streamside habitat, eliminate and decommission roads in riparian areas, and restrict motorized traffic to the existing road prism. Routes needed for long term use can be closed to motor vehicles at the end of project.

Ensure that appropriate traffic management is established to prevent the creation of pollution-generating conditions, such as deep wheel tracks in roads during wet weather. Stabilize and re-establish vegetation on decommissioned roads.

General Forest: Long-term local roads for timber access will be planned, reconstructed, maintained and operated to be economically efficient. During commercial hauling activities, public access will be discouraged or prohibited on some roads through appropriate signing. High clearance vehicles may be accepted during post sale activities. M8-21.

Northwest Forest Plan Standards and Guidelines (Transportation System)

Road Construction and Maintenance in Late-Successional Reserves: Road maintenance may include felling danger trees along rights-of-ways. Leaving material on site should be considered if available coarse woody debris is inadequate. Topping trees should be considered as an alternative to felling. C-16.

Fell trees in Riparian Reserves when they pose a safety risk. Keep felled trees on-site when needed to meet course woody debris objectives. RA-2.

Wildlife

The Lewis' woodpecker is identified in the *Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington* as a focal species for Ponderosa Pine Forests with patches of burned old forest (Altman 2000). The biological objectives for habitat where ecologically and socially appropriate, through natural events or management, to maintain >1% of the landscape as post-fire old ponderosa pine forest habitat or >50% of the post-fire landscape as unsalvaged. Where salvage logging is occurring in post-fire old ponderosa pine forests, maintain or provide in burns greater than 100 acres, greater than 50% of the standing and down wood, and in all burns, retain all snags greater than 20 inches and >50% of those be 12-20"dbh. In addition, snags should be clumped rather than evenly spaced with both hard and soft decay classes to lengthen the period stands are considered suitable nesting habitat (Altman 2000). Where ecologically appropriate, initiate actions in old forest habitat to maintain or provide approximately 24 snags/acre >9"dbh and of these, approximately 6 snags/acre should be >20"dbh. In addition, initiate actions to provide recruitment snags particularly in areas with high risk of stand replacement fires and provide shrub understory with >13% cover (Altman 2000).

Both the white-headed woodpecker and pygmy nuthatch are identified in the *Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington* as focal species for Ponderosa Pine Forests with large patches of old forest with large snags and large trees respectively (Altman 2000). The biological objectives for habitat for both species where ecologically appropriate are to initiate actions to provide a mean of 10 trees/acre >21"dbh with at least 2 of those trees >31"dbh for foraging and replacement snags, a mean of 1.4 snags/acre >8"dbh with over half of those >25"dbh in a moderate to advanced state of decay, and a mean canopy closure of 10-40%. In addition, where ecologically appropriate, provide the before mentioned conditions to provide >350 acres in pre-dominantly old growth and in 26-75% of old growth provide >700 contiguous acres.

The Williamson's sapsucker is identified in the *Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington* as a focal species for mixed conifer late-successional forests with large snags (Altman 2000). The biological objectives for habitat where ecologically appropriate are to initiate actions in mixed conifer late-successional forests to maintain or provide greater than 1snag/acre greater than 12"dbh except ponderosa pine snags should be greater than 18"dbh and a mean canopy cover of 25-70% (Altman 2000).

The flammulated owl is identified in the *Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington* as a focal species for mixed conifer late successional forests with interspersed grassy openings and dense thickets (Altman 2000). The biological objectives for habitat where ecologically appropriate are to initiate actions in mixed conifer late-successional forests to maintain or provide habitat with greater than 10 snags/100 acres >12"dbh and 6 feet tall, greater than 8 trees/acre >21"dbh to provide recruitment snags, at least one large or two small dense, brushy thickets of sapling/pole trees for roosting habitat, and at least one large or two small grassy openings.

The black-backed woodpecker is identified in the *Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington* as a focal species for Old Growth Lodgepole Pine (Altman 2000). The biological objectives for habitat where ecologically appropriate are to initiate actions in lodgepole forests to maintain or provide large tracts (>1,000 acres) of lodgepole pine forest dominated by and managed for late successional conditions.

Consistency with Various Standards and Guidelines or Management Recommendations

Several guiding documents outline management recommendations or standards and guidelines for dead wood retention. These include the 1994 Northwest Forest Plan, the 2001 amendment for survey and manage species, the Deschutes National Forest Wildlife Tree and Log Strategy, and the Metolius Late Successional Reserve Assessment.

1994 Northwest Forest Plan – Matrix Lands

The Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (1994), standards and guidelines for matrix pages C-40 through C-42 state:

Provide specified amounts of coarse woody debris in matrix management.

> "In eastern Oregon…, a minimum of 120 linear feet of logs per acre greater than or equal to 16 inches in diameter and 16 feet long should be retained. Decay class 1 and 2 logs can be counted towards these totals."
>
> "Coarse woody debris already on the ground should be retained and protected to the greatest extent possible from disturbance during treatment (e.g., slash burning and yarding) which might otherwise destroy the integrity of the substrate."

Emphasize green-tree and snag retention in matrix management.

> "Retain at least 15 percent of the area associated with each cutting unit (stand)."
>
> "As a minimum, snags are to be retained within the harvest unit at levels sufficient to support species of cavity-nesting birds at 40 percent of potential population levels based on published guidelines and models."

2001 Survey and Manage Amendment - Northwest Forest Plan

White-headed woodpecker, Black-backed woodpecker, Pygmy nuthatch, and Flammulated Owl

The Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (January 2001) on Standards and Guidelines page 34 states:

> "Snags over 20 inches dbh may be marked for cutting only after retaining the best available snags (considering size, longevity, etc.) in sufficient numbers to meet 100 percent potential population levels of these four species."

The 2001 amendment describes those levels for white-headed woodpeckers at 0.6 snags per acre at least 15 inches dbh, and black-backed woodpeckers at 0.12 snags per acre at least 17 inches dbh. Meeting standards for the white-headed woodpecker was presumed in the amendment to provide for the pygmy nuthatch since they share the same habitat.

Flammulated owls utilize cavities occurring naturally or created by woodpeckers. The 2001 amendment assumed that standards and guidelines for snags and green tree replacements for woodpeckers and other primary cavity nesting species in existing National Land and Resource Management Plans would provide for flammulated owls. The 2001 amendment also states that snag recommendations were treated as additive: "provisions of snags for other cavity nesting species, including primary cavity nesters, must be added to the requirements for these two woodpecker species (black-backed and white-headed woodpeckers)."

Deschutes National Forest Wildlife Tree and Log Strategy

The Deschutes National Forest developed a Wildlife Tree and Log Implementation Strategy (1994c) to provide for various levels of percent population levels. It includes adding the various woodpeckers together by habitat type. These standards called for 4.05 snags per acre in mixed conifer and 3.99 snags per acre in ponderosa pine with only 0.78 snags per acre greater than 20"dbh in each habitat type. These numbers reflect the levels needed for the black-backed and white-headed woodpeckers from the 2001 amendment.

Metolius Late Successional Reserve Assessment (LSRA)

The Metolius LSRA does not describe specific snag and down woody material levels but recognizes that a range of conditions need to exist on the landscape to provide for various species needs. The following will outline the goals and objectives for the Metolius LSR.

> "Retain all down log and snag habitat components necessary to promote sustainable late-successional habitat conditions. In the long term, snags retained should have the diversity of tree species and sizes representative of the site. Maintain a variety of down wood sizes. Numbers of snags and amounts of coarse woody material necessary to provide 100"MPP will be determined at the project analysis level and should be consistent with the current peer reviewed literature." Page 66

Definitions for late-successional habitats were defined and snag levels addressed (page 52):

Fire Climax Ponderosa pine	0-2 snags per acre
Fire Climax Mixed Conifer	No snag numbers identified
Climatic Climax Ponderosa Pine	3 snags per acre
Climatic Climax Mixed Conifer	2-12 snags/acre >14"dbh

In addition, habitat characteristics for indicator species by PAG are addressed. (Appendix 2, Table 1).

PAG	Indicator Species	Size Classes	Snags per Acre	Down Logs Tons/Acre
Mountain Hemlock	American Marten Boreal Owl	>21"dbh 15-21"dbh	6 – 15 2 – 3	25-40
Mixed Conifer Wet	Pileated Woodpecker Northern Spotted Owl	9-16"dbh 16-25"dbh >25"dbh	9 – 17 1 – 2 1 – 2	25-35
Mixed Conifer Dry (Climatic Climax)	Pileated Woodpecker Great Gray Owl Northern Goshawk Bald Eagle Flammulated Owl	12-20"dbh >20"dbh	3 – 9 .75 - 2	12-24

	Black-backed Woodpecker			
Mixed Conifer Dry (Fire Climax)	Bald Eagle White-headed Woodpecker Flammulated Owl	>25”dbh	1 – 2	1-2 logs >25”
Ponderosa Pine Wet (Climatic Climax)	White-headed Woodpecker Flammulated Owl	18-28”dbh >28”dbh	.5 – 3 .25 – 1.5	12-24
Ponderosa Pine Wet (Fire Climax)	Bald Eagle White-headed Woodpecker Flammulated Owl	>25”dbh	1-5	1-2 logs >25”
Ponderosa Pine Dry (Climatic Climax)	White-headed Woodpecker Northern Goshawk	10-12”dbh 12-20”dbh 20-31”dbh >31”dbh	2.5 – 5 1 – 2.5 .25 - .75 .25 - .50	7-15
Ponderosa Pine Dry (Fire Climax)	Bald Eagle White-headed Woodpecker Flammulated Owl	>25”dbh	1 – 2	1-2 logs >25”
Lodgepole Wet (Climatic Climax)	Black-backed Woodpecker Great Gray Owl Northern Goshawk	11-20”dbh >20”dbh	3 – 8.5 1 – 3.5	12-24
Lodgepole Pine Dry (Climatic Climax – High Elevation)	Black-backed Woodpecker	>11”dbh	13 - 27	8-12

All action alternatives meet or exceed these standards. In addition, the action alternatives propose treatment to speed recovery and growth of green tree habitat and eventual snag and down woody material recruitment. See the following table outlining the source document, standard and guideline or management recommendation, whether the B&B project is meeting or exceeding these recommendations and the rationale describing why.

Table Consistency Comparison.

Source Document	Standard & Guideline or Management Recommendation	Doesn’t Meet, Meets, or Exceeds	Rationale
1994 Northwest Forest Plan – Matrix	Retain a minimum of 120 linear feet of logs/acre ≥16”dbh in decay classes 1 and 2 in Matrix Allocations		
	Retain existing down woody material in Matrix Allocations		

Lands	Retain at least 15% of the area associated with each cutting unit in Matrix		
	Retain snags at levels to meet 40% of potential populations levels for cavity nesters in Matrix		
2001 Survey and Manage Amendment - NWFP	Retain snags at levels to meet 100% of potential population levels for whwp, bbwp, pynu, and flow		
Deschutes NF LRMP – Wildlife Tree and Log Strategy	Retain snags of various sizes to meet at least 40% of potential population levels in matrix and 100% of potential population levels in LSR by PAG		
Metolius Late Successional Reserve Assessment	Retain snags and down woody material necessary to provide 100% MPP by PAG and size classes		

Consistency with the Deschutes LRMP
Wildlife standards and guidelines WL-6, WL-10, and WL-11 will be assessed. The project is consistent with the Deschutes LRMP.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-6 – Nesting habitat for at least 40 goshawk pairs will be provided in mixed conifer, mtn. hemlock, and ponderosa pine forests outside wilderness.	Meets	
WL-10 – Locating new roads within nest site stands will be avoided.	Not Applicable	No new road construction is proposed for this project.
WL-11 – Nests will be protected within ¼ mile from disturbing activities.	Meets	Mitigation measures are in place for seasonal restriction around known nest sites and in the event a new nest site is found.

Consistency with the Deschutes LRMP
Wildlife standards and guidelines WL-13, WL-18, WL-19, WL-21, WL-27 and WL-28 will be assessed. The project is consistent with the Deschutes LRMP.

Standard and Guideline	Do Not Meet, Meets, Not	Rationale

	Applicable	
WL-13/21 – Nesting habitat for at least 60 pairs of Coopers hawks and 60 pairs of sharp-shinned hawks will be provided in mixed conifer and ponderosa pine forests outside wilderness.	Meets	
WL-18/27 – Locating new roads within nest site stands will be avoided.	Not Applicable	No new road construction is proposed for this project.
WL-19/28 – Nests will be protected within ¼ mile from disturbing activities.	Meets	Mitigation measures are in place for seasonal restrictions around known nest sites and in the event a new nest site is found.

Consistency with the Deschutes LRMP
Wildlife standards and guidelines WL-30 through WL-33 will be assessed. The project is consistent with the Deschutes LRMP.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-30 – Habitat suitable for 8 great gray owl nesting pairs will be provided.	Meets	The project area contains 5 known nests alone. Suitable habitat exists outside the project area as well as other areas on the Forest to provide for 3 additional pairs.
WL-31 – Active nest sites will be protected by maintaining at least 30 acres surrounding nest.	Meets	A ¼ mile protection zone will be placed around known nest sites for green forested stands.
WL-32 – Selectively harvest at least 1/3 of the forested strip around meadows to maintain overhead cover and facilitate the natural regeneration process.	Not Applicable	There are no meadows with green forested stands within the project area proposed for treatment.
WL-33 – Nests will be protected within ¼ mile from disturbing activities.	Meets	Mitigation measures require seasonal restrictions for known nest sites.

Consistency with the Deschutes LRMP
Wildlife standards and guidelines WL-35 and WL-36 will be assessed. The project is consistent with the Deschutes LRMP.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-35 – Vegetative characteristics of rookeries will be protected.	Not Applicable	No known rookeries exist within project area.
WL-35 - Seasonal restrictions will be in effect for disturbing activities.	Meets	If new nest trees or rookeries are located, seasonal restrictions will be

		placed on disturbance activities.
WL-36 – Future nesting trees will be provided. Emphasis will be placed on providing large, mature, and over-mature ponderosa pine.	Meets	Planting of desired tree species will occur in areas of treatment within the riparian reserves.

Consistency with the Deschutes LRMP
Wildlife standard and guideline WL-39 will be assessed. This project is consistent with the Deschutes LRMP.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-39 – Waterfowl production will be increased where possible with appropriate habitat enhancement.	Meets	This project does not specifically implement habitat enhancement projects for waterfowl. However, the B&B nest box project enhanced approximately 165 acres for waterfowl.

Consistency with the Deschutes LRMP
Wildlife standard and guidelines WL-2 and WL-3 will be assessed. The project is consistent with the Deschutes LRMP.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-2 – Maintain forested character at least 300 feet surrounding active nest sites.	Meets	There are no known nests within the project area. If a nest is located, measures will be incorporated to meet this standard.
WL-2 – While timber management may occur, maintain at least 4 dominant overstory trees per acre suitable for nest and perch trees, favoring ponderosa pine.	Meets	Snag retention guidelines will be in place to provide for large snag structure. Large green trees expected to live will not be removed with this project.
WL-3 – Seasonal restrictions will be in effect for disturbing activities within ¼ mile of active nests.	Meets	Mitigation measures are in place in the event a nest site is found.

Consistency with the Deschutes LRMP
Wildlife standard and guidelines WL-2 and WL-3 will be assessed. The project is consistent with the Deschutes LRMP.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-2 – Maintain forested character		Dead trees do not contribute to the forested character for osprey habitat. No green trees will be removed

at least 300 feet surrounding active nest sites.	Meets	within 300 feet of nest sites. If a new nest is found, an evaluation will be conducted to determine the appropriate action.
WL-2 – While timber management may occur, maintain at least 4 dominant overstory trees per acre suitable for nest and perch trees, favoring ponderosa pine.	Not Applicable	This standard refers to green trees. Harvest of dead trees will not impact this standard however, snag retention is prescribed for all alternatives focusing on large snag retention.
WL-3 – Seasonal restrictions will be in effect for disturbing activities within ¼ mile of active nests.	Meets	Mitigation measures are in place for all known nest sites and in the event a new site is found.

Consistency with Landbird Strategy and BCR
Biological objectives for chipping sparrow habitat in open understory ponderosa pine with regenerating pines will be assessed. The project is consistent with the Conservation Strategy for Landbirds on the East-Slope of the Cascade Mountains in Oregon and Washington.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Where ecologically appropriate initiate action in ponderosa pine forests to maintain or provide: interspersion of herbaceous ground cover with shrub and regenerating pine patches	Meets	Fuels treatments within harvest units will provide for herbaceous growth while untreated areas will provide for shrub growth.
Where ecologically appropriate… maintain or provide: 20-60% cover in the shrub layer	Meets	Stand replacement areas with little to no conifer seed source is likely to produce shrub dominated areas.
Where ecologically appropriate… maintain or provide: >20% of shrub layer in regenerating sapling conifers especially pines	Meets	Reforestation will occur within harvest units providing regenerating ponderosa pine.
Where ecologically appropriate… maintain or provide: 10-30% mean canopy cover	Meets	Only 54 acres of mixed mortality ponderosa pine are proposed for treatment and no green trees expected to live will be harvested.
Where ecologically appropriate at the landscape level maintain or provide: a mix of understory conditions such that 10-30% of the landscape meets site-level conditions mentioned above	Meets	Approximately 99% of mature ponderosa pine forests remain on the district.

Consistency with Landbird Strategy
Biological objectives for olive-sided flycatcher habitat in mixed conifer stands with edges and openings created by wildfire will be assessed. The project is consistent with the exception of one guideline with the Conservation Strategy for Landbirds on the East-Slope of the Cascade Mountains in Oregon and Washington.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Where ecologically appropriate in mixed conifer through natural events or management maintain: >2% of landscape as post-fire habitat	Exceeds	Approximately 37% (15,800 acres) of the mixed conifer PAGs within the project area burned stand replacement which is considered post-fire habitat.
Where ecologically appropriate in mixed conifer through natural events or management maintain: >40% of the post fire landscape as unsalvaged.	Meets	Approximately 68% of the mixed conifer stand replacement area within the project area will remain unsalvaged.
Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: in burns >100 acres, salvage <50% of standing dead and down	Meets	Untreated areas for the B&B Fire Recovery project range from 83% in Alternative 2 to 96% in Alternative 4.
Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: retain all trees/snags >20"dbh and >50% of those 12-20"dbh	Does not meet	Not all >20"dbh snags will be retained in ponderosa pine harvest units with the implementation of Alternatives 2-4. Alternative 5 will meet this.
Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: patches with a mix of live and dead trees/snags to provide potential nesting trees in context of potential foraging and perch trees	Meets	Very little mixed mortality or underburned ponderosa pine stands are proposed for treatment (~54 acres). A mix of live and dead trees will be present after harvest as snag retention guidelines will be prescribed for all harvest units to ensure large dead tree habitat is retained.

Consistency with Landbird Strategy

Biological objectives for brown creeper habitat in mixed conifer stands with large trees will be assessed. The project is consistent with the Conservation Strategy for Landbirds on the East-Slope of the Cascade Mountains in Oregon and Washington.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Where ecologically appropriate initiate actions in mixed conifer forests to maintain or provide: blocks of late-successional habitat >75 acres	Not Applicable	The project focuses on the removal of dead and dying trees.
Where ecologically appropriate initiate actions in mixed conifer forests to maintain or provide: >4 trees/acre >18"dbh with at least 2 trees >24"dbh	Not Applicable	The project focuses on the removal of dead and dying trees.

Consistency with Landbird Strategy
Biological objectives for hermit thrush habitat in mixed conifer stands that are multi-layered, have dense canopy and vertical cover will be assessed. The project is consistent with the Conservation Strategy for Landbirds on the East-Slope of the Cascade Mountains in Oregon and Washington.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Where ecologically appropriate initiate actions in mixed conifer to maintain or provide: patches of forest with multi-layered structure and a dense understory shrub layer	Not Applicable	The B&B Fire Recovery project is not proposing to enter into stands possessing these attributes. Even underburned stands in the project area experienced loss of ground vegetation.

Consistency with Landbird Strategy and BCR
Biological objectives for sandhill crane habitat in wet/dry meadows will be assessed. The project is consistent with the Conservation Strategy for Landbirds on the East-Slope of the Cascade Mountains in Oregon and Washington.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Where ecologically appropriate initiate actions in wet/dry meadows to maintain or provide: tracts of suitable habitat >300 acres where both wet and dry meadows are components of a meadow complex	Not Applicable	The B&B project does not have any activities planned within meadow habitat.
Where ecologically appropriate initiate actions in wet/dry meadows to maintain or provide: where only wet meadow habitat is present, maintain >20 acres if dry meadow habitat is present within 0.3 miles	Not Applicable	The B&B project does not have any activities planned within meadow habitat.

Consistency with Landbird Strategy
Biological objectives for red-naped sapsucker habitat in aspen stands with large trees and snags will be assessed. The project is consistent with the Conservation Strategy for Landbirds on the East-Slope of the Cascade Mountains in Oregon and Washington.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Where ecologically appropriate initiate actions in aspen habitat to maintain or provide: >10% cover of saplings in the understory to provide for replacement	Not Applicable	The B&B project does not enter aspen habitat.
Where ecologically appropriate		

initiate actions in aspen habitat to maintain or provide: >4 trees/acre and 1.5 snags/acre >39 feet in height and 10"dbh	Not Applicable	The B&B project does not enter aspen habitat.
Where ecologically appropriate initiate actions in aspen habitat to maintain or provide: mean canopy cover of 40-80%	Not Applicable	The B&B project does not enter aspen habitat.
Where ecologically appropriate at the landscape level initiate actions in aspen habitat to maintain or provide areas with natural (fire) or mechanical disturbance regimes to ensure proper successional development	Meets	Aspen impacted by fire will be allowed to regenerate naturally with no entry.

Consistency with Landbird Strategy
Biological objectives for blue grouse habitat in subalpine fir will be assessed. The project is consistent with the Conservation Strategy for Landbirds on the East-Slope of the Cascade Mountains in Oregon and Washington.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Where ecologically appropriate initiate actions in subalpine forests to maintain or provide: patches of subalpine forest with multi-layered structure	Not Applicable	The B&B project does not propose actions within subalpine fir forests.
Where ecologically appropriate initiate actions in subalpine forests to maintain or provide: coniferous or aspen tree cover 15-55%	Not Applicable	The B&B project does not propose actions within subalpine fir forests.
Where ecologically appropriate initiate actions in subalpine forests to maintain or provide: shrub cover 10-40% and mean height >16"	Not Applicable	The B&B project does not propose actions within subalpine fir forests.
Where ecologically appropriate initiate actions in subalpine forests to maintain or provide: herbaceous cover 35-80% and mean height 6-22"	Not Applicable	The B&B project does not propose actions within subalpine fir forests.

Consistency with NWFP and Deschutes LRMP
Wildlife standard and guidelines WL-64 and WL-71 will be assessed. The project is consistent with the Deschutes LRMP. In addition, provisions listed in the Northwest Forest Plan for bats will be addressed.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale

WL-64 thru WL-71 – These standards and guidelines address Townsend's big-eared bat habitat at or around caves.	Not Applicable	There are no known caves within the project area.
Provide additional protection for caves, mines, and abandoned wooden bridges and buildings that are used as roost sites for bats.	Not Applicable	There are no known caves, mines, or abandoned wooden bridges or buildings within the project area.

Consistency with the Deschutes LRMP
Wildlife standard and guidelines WL-61 and WL-63 will be assessed. The project is consistent with the Deschutes LRMP.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-61 – Marten prefer extensive stands of dense lodgepole, mixed conifer, or mountain hemlock forest containing abundant dead woody material as habitat for rodent prey.	Not Applicable	There is no proposed harvest of potentially suitable marten habitat.
WL-63 – In preferred forest types, concentrations of down woody material will be left at an average of approx. one per acre after any timber harvest. Concentrations incorporating high tree stumps, logs, or snags are especially desirable.	Not Applicable	There is no proposed harvest of potentially suitable marten habitat.

Consistency with the Deschutes LRMP
Wildlife standard and guidelines WL-43 through WL-50 will be assessed for elk. Wildlife standard and guidelines WL-52 through WL-59 will be assessed for deer. The project is consistent with the Deschutes LRMP.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
ELK		
WL-43 –Within key elk areas, provide conditions needed to support at least 1500 summering elk and 240 wintering elk.	Meets	
WL-44 – Incorporate elk calving needs in the management of riparian reserves to the extent they do not conflict with the objectives of riparian management.	Not Applicable	Riparian reserves will not be treated with the exception of Round Lake.
WL-45 – Facilities will not be developed nor activities promoted which encourage public use during	Not Applicable	There are no facilities proposed under this project and public use will be restricted to open roads during the

the winter. Motorized traffic will be limited to designated routes.		winter months.
WL-46 – Open road densities for the key elk area should not exceed an overall average of 0.5 to 1.5 miles per square mile.	Does not Meet	Resulting open road densities are still above the recommended densities. However, this project will help in reducing densities to help meet the target of 0.5 to 1.5 miles per square mile.
WL-47 – Hiding areas must be present over at least 30% of National Forest land in each key elk area.	Meets	Approximately 39% of the KEHA within the project area meets the definition for hiding cover.
WL-48 – Travel corridors may be provided by linking stands (to assist in meeting hiding cover needs).	Not Applicable	This project focuses on the removal of dead material and will not reduce hiding cover.
WL-49 – Hiding areas will be dispersed throughout the key elk area.	Not Applicable	The fire reduced hiding cover and remaining cover will be left untreated.
WL-50 – Thermal cover must be present over at least 20% of National Forest land in each key elk area.	Meets	Approximately 26% of the KEHA within the project area meets the definition for thermal cover.
DEER		
WL-52 – Provide conditions to support at least 6200 deer within the Metolius winter range.	Meets	
WL-53 – Target open road densities are 2.5 miles per square mile to achieve deer summer range habitat effectiveness targets.	Does not Meet	Resulting open road densities are still above the recommended densities. However, this project will help in reducing densities to help meet the target of 2.5 miles per square mile.
WL-54 – Hiding areas must be present over at least 30% of National Forest land in each implementation unit.	Not Applicable	Treatment will occur within stand replacement areas primarily which will not alter hiding cover.
WL-55 – Hiding areas will be dispersed throughout the implementation unit.	Not Applicable	The fire reduced hiding cover and remaining cover will be left untreated.
WL-56 - Travel corridors will be provided by linking stands (to assist in meeting hiding cover needs).	Not Applicable	This project focuses on the removal of dead material and will not reduce hiding cover.
WL-57 – Hiding areas are assumed to provide suitable thermal cover conditions on summer range.	Meets	
WL-58 – If possible, a narrow strip of trees should be left along roads to reduce view distances.	Not Applicable	Green trees are not being treated especially along roads. Hazard trees will be removed but do not meet conditions needed for screening.
WL-59 – Approximately 10% of treated black bark pine stands will be in clumps that will provide visual screening throughout the area.	Meets	

Fire and Fuels

Deschutes Land and Resource Management Plan (Forest Plan). The Deschutes Forest Plan was completed in 1990. Goals, objectives and standards and guidelines related to fire and fuels management are described in the Forest Plan. However, plan amendments and shifts in fire management policy have modified management direction for fire and fuels management. Recent science also is considered when planning activities on national forest lands.

The Northwest Forest Plan (NFP), 1994, amended the Deschutes Forest Plan with direction including standards and guidelines for management of habitat for late-successional and old growth forest related species within the range of the northern spotted owl. The entire B and B planning area is covered by the NWFP.

As required under the NFP, a management assessment of the Metolius Late Successional reserve was completed in 1996, and documented in the Metolius Late Successional Reserve Assessment (MLSRA). The MLSRA provides a framework and context for projects and activities within the Metolius LSR.

Also required by the NFP for Key Watersheds, the Sisters Ranger District completed the Metolius Watershed Analysis in 1996. The purpose of the Metolius Warershed Analysis is to provide and understanding of the watershed that is essential to guide subsequent project planning. Recommendations made in the analysis are general in nature, and any site-specific recommendations will undergo analysis at the project level. Since several recent fires have occurred within the Metolius Watershed, an update of the Watershed Analysis was completed in 2004.

The National Fire Plan provides national direction for hazardous fuel reduction, restoration, rehabilitation, monitoring, applied research and technology transfer. In August 2000 President Clinton asked the Secretaries of Interior and Agriculture to recommend how best to respond to the recent fire events, reduce the impacts of wildland fires on rural communities, and ensure sufficient firefighting resources in the future. The President also asked what actions federal agencies, in cooperation with states and local communities, could take to reduce immediate hazards to communities in the wildland/urban interface, and to ensure that fire management planning and firefighting personnel and resources are prepared for extreme wildland fires in the future (USDA 2000, p. 1).

The Forest Service and Department of Interior co-authored a response in October 2000, with the report “Managing Impacts of Wildfires on Communities and Environment” (USDA 2000), known as the “National Fire Plan”. In the report, the Chief of the Forest Service outlined operating principles including: firefighting readiness, prevention through education, rehabilitation, hazardous fuel reduction, restoration, collaborative stewardship, monitoring, jobs, and applied research and technology transfer. The B & B Fire Recovery Project responds to the rehabilitation, hazardous fuel reduction, and restoration elements of the National Fire Plan.

- Restoration – Restore healthy, diverse, and resilient ecological systems to minimize uncharacteristically intense fires on a priority watershed basis. Methods will include removal of excess vegetation and dead fuels through thinning, prescribed fire, and other treatments.

- Rehabilitation – Focus rehabilitation efforts on restoring watershed function, including protection of soil and water resources, biological communities, and prevention of invasive weeds.
- Hazardous Fuels Reduction – Assign highest priority for hazardous fuels reduction to: communities at risk, readily accessible municipal watersheds, threatened and endangered species habitat, and other important local features where conditions favor uncharacteristically intense fires.

Fisheries

MANAGEMENT DIRECTION

The project area includes areas in Jefferson County, Oregon, on the Sisters Ranger District of the Deschutes National Forest. The project area is within the management direction of the Northwest Forest Plan (USDA and USDI 1994), in addition to the Deschutes Land Resource Management Plan (USDA 1990). The NWFP Standards and Guidelines and the Joint Aquatic and Terrestrial Programmatic Biological Assessment April 2001 – April 2003 (USDA and USDI 2003) Project Design Criteria (PDCs) have been used to determine the project effects to bull trout.

The Metolius Wild and Scenic River Plan includes the Resource Assessment that identifies the Outstanding Remarkable Values for the river. The following have been identified as outstandingly remarkable values: geology, fisheries, hydrology, ecology, wildlife, scenic, cultural resources, recreation. These values need to be maintained and protected. Jack Creek is designed eligible as a Wild and Scenic River. Management actions must protect those values of the river that make it eligible for designation.

The Northwest Forest Plan (NWFP) has identified most subwatersheds in the Upper Metolius watershed as a part of the Key Watershed (Tier 1) based on the contribution of water quality to the Deschutes River and the health of the bull trout population. Within the watershed analysis, the riparian reserves were modified to 320ft for fish bearing streams, both sides, and 160ft for non-fish bearing streams on both sides of stream, and wetlands. Additional streams were identified through field surveys after the watershed analysis was completed and added to the Forest stream database. The Key watershed excludes the Cache Creek subwatershed but the watershed analysis did include the Cache Creek subwatershed.

The Deschutes Land and Resource Managament Plan identifies riparian areas to be managed for riparian dependent species (p 4-61). The area of riparian protection was generally 100ft each side or as defined by riparian plant associations. These areas are to be protected and managed only for the benefit of riparian dependent species and not for timber production. Watershed protection areas based on the use of best management practices to protect water quality and water related resources.

RECOMMENDATIONS FROM WATERSHED ANALYSIS

Aquatic trends identified in the watershed analysis (USDA 2004a, pEX-26) applicable to the project included: 1)increased bank instability and soil erosion risk post fire, 2)possible temperature increases due to the loss of shade, 3)short term nutrient increases post fire, 4)risk of sediment delivery from roads, soil compaction and stream crossings. These trends are assessed in the EIS in the Hydrology sectiion.

Recommendations from the Watershed Analysis Update included (USDA 2004a, pEX-36): 1) Reduce road densities, especially in riparian reserves and where roads cross streams. Focus on high and moderate priority subwatersheds. 2) Consider expanded buffers for activities in riparian reserves in burned and unburned areas, 3) Increase capacity of culverts for increased water flow and debris after the fire, 4) Recover shade and large wood recruitment post fire by planting in high risk watersheds, 5) Prepare for salmon reintroduction in the Metolius River and Suttle Lake.

Reducing road densities, especially those roads leading to increased sedimentation to streams were assessed through roads analysis and given a high priority for decommissioning and inactivation proposed in the action alternatives in this EIS. These roads were selected for treatment to reduce the road effects on stream habitat because of concentration of flow and potential for runoff and eroded fine sediment that could reach the stream. Stream crossings are proposed for decommissioning and inactivation. This work has been proposed in subwatersheds in the project area that were considered high risk to fish habitat after the fire (Candle Creek, Canyon Creek(including Brush Creek), and Headwaters of the Metolius). Reduction of roads and stream crossings were also identified as a recommendation in the Abbot subwatershed.

The potential sediment contribution areas (PSCA) were evaluated in the analysis of the project because much of the riparian reserve network was burned in the high priority watersheds (39 percent, USDA 2004a). Because of the loss of ground vegetation and filtering capacity of the riparian reserves, areas were identified that could contribute some added runoff or fine sediment to streams in the burned condition (Hydrology Section). These are not landslide prone areas and were not consider unstable or potentially unstable, and therefore were not considered to be an expansion of the riparian reserve network. The PSCA are proposed for no treatment in Alternative 3 and limited treatments under alternatives 2, 4 and 5 (Chapter 2). Soil and Water Design Criteria for potential sediment contribution areas (PSCA) were developed to minimize the effects of salvage and haul road use in these areas.

In each of the action alternatives, decommissioning and inactivation of roads, road drainage improvements, and the removal of some drainage culverts are proposed (Hydrology section, pp). These road projects are proposed in the high priority subwatersheds listed as opportunities in the Watershed Analysis Update (Abbot, Candle, Canyon, First and Lower Lake) (USDA 2004a, p72-75). Priorities were given to roads for decommissioning that affected aquatic habitat in these subwatersheds during the roads analysis during an individual road-by-road analysis. The decommissioning of roads at stream crossings will, in some cases, remove culverts. See Hydrology section (p) for a summary of culverts that were assessed for undersized capacity There are two crossings of small springs but these streams are upstream of known fish distribution. Another three culverts proposed to be removed are within the upper Link Creek watershed in small streams that are fishless or have introduced brook trout.

Under Burned Area Emergency Response, (BAER) post fire, 12 major culverts were replaced in the project area for increased flow capacity and these culverts and bridges were installed to pass fish. Two additional culverts are being evaluated for replacement at Roaring Creek at the 1260rd and Bear Valley Creek at the 1230500 rd under a separate analysis (see future and foreseeable projects list Table 3.3).

Another concurrent project will address the watershed analysis recommendations for recovering shade and large wood recruitment by planting trees in the riparian reserves of high risk subwatersheds. In 2004, 108ac of riparian reserves were planted with fire resistant conifers at low densities along Abbot Creek, Candle Creek, and upper Brush Creek. Another 200 ac are planned in 2005 as a separate project from the B&B Fire Recovery Project (see future and foreseeable projects).

All these improvements to subwatershed health will aid in the preparation for the reintroduction of Chinook and sockeye salmon into the watershed with renewed fish passage at Pelton Round Butte Dams. Additional work to improve the instream wood densities in the Metolius River is being done on an annual basis but at a slow pace (see list of concurrent actions).

Many of the Opportunities listed in the Watershed Analysis Update (p72-75) are being addressed (USDA 2004a). Culverts that were undersized have been replaced under BAER or proposed to be removed in this project in the road decommissioning/inactivation and road drainage improvements. Stream surveys have been conducted post fire to assess instream wood and morphological changes to streams (Brush and Abbot Creek). Recreation impacts are being reduced through the Bull Trout Streamside Protection Project (see list of concurrent actions). Abbot Creek Campground was closed after the fire. Water quality is being monitored in the Metolius River and Lake Creek (Cotter and Riehle 2002). Trees are being planted in plantations and along high priority streams. Road closure and drainage repair work in riparian reserves have been proposed in this project and upland soil compaction is being limited to meet forest plan standards (see Soil section).

Botany

Direction to conserve plant species on Deschutes National Forest is found in several sources. Direction for the conservation of Threatened, Endangered and Sensitive (TES) plant species is found in the Forest Service Manual (FSM Sections 2670.5 and 2672.4), the Endangered Species Act of 1973 Subpart B; 402.12, Section 7, Consultation), and the Deschutes National Forest Land and Resource Management Plan (4-60 and 4-61). The FSM states that habitats for all existing native and desired non-native plants, fish and wildlife should be managed, at minimum, to maintain viable populations for each species. The FSM and the LRMP each direct that habitat for sensitive plant and animal species be managed to ensure that these species not trend toward being listed as federal Endangered and Threatened species. The LRMP also directs that Conservation Strategies for sensitive species be developed and used. One such document, a Species Conservation Strategy for Peck's penstemon (1992) provides important guidance for management of this locally endemic species on the Sisters District.

This project complies with the Record of Decision to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines in Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (March 2004).

Noxious Weeds

National Direction

Sources of national direction for noxious weed management include the Noxious Weed Management Act (1974) and an Executive Order on Invasive Species (1999). The Forest Service Manual (FSM) requires that Noxious Weed Risk Assessments be prepared for any project that includes ground-disturbing activities. For projects anticipated to have a moderate to high risk of introducing or spreading noxious weeds, decision documents must identify noxious weed management measures that will be undertaken during project implementation (FSM 2081.03, November 1995). A Guide to Noxious Weed Prevention Practices (2001) presents a large number of desirable weed prevention actions that should be evaluated for efficacy, and compatibility with project objectives, during the process of project planning. A USDA Forest Service National Strategy and Implementation Plan for Invasive Species Management was developed in 2004.

Regional Direction

A Region 6 Forest Service Final EIS for Managing Competing and Unwanted Vegetation (1988; amended in 1992) was subject to a Mediated Agreement (1989). This Agreement requires that six question be addressed when planning the weed prevention practices to be conducted during the implementation of any project that involves vegetation management. A Region 6 USFS Invasive Species Environmental Impact Statement (EIS) is scheduled for decision sometime in 2005. This EIS has forest-level significance as noted below.

Forest Direction

The Deschutes National Forest Land and Resource Management Plan (1990) includes limited general and specific directives regarding noxious weed management. The 1998 Deschutes National Forest Noxious Weed Control Environmental Assessment (EA) includes a Noxious Weed List, a supplemental Integrated Weed Management Plan (IWMP), and direction and authority for management of noxious weeds This EA and IWMP identify and promote specific actions to be associated the general weed management practices of prevention, early treatment, maintenance, and education. Associated products of this EA and IWMP included a formalized weed risk analysis process to be utilized during project planning, and a cooperative agreement with the Oregon Department of Agriculture for the application of herbicides at selected sites on Deschutes National Forest. A joint-forest, Ochoco/Deschutes National Forest noxious weed EIS is scheduled for completion in 2005. This EIS, which will be tiered to the Regional Invasive Species EIS, will increase the number of treatment options for noxious weeds within the B&B Fire Recovery Project area, relative to those presently available.

SCENERY GOAL AND OBJECTIVE

Landscape Character Goal

The landscape Character goal for B & B Fire Recovery Project is to achieve a natural appearing landscape, such as open park-like stands, where management directions, the desired future conditions, social and ecological framework of the Management Area are met (LRMP MA-9 and MA-19 through MA-28).

Scenic Quality Objective

Scenic quality for the B & B Fire Recovery Project would be natural appearing character where various line, form, color, and texture elements can be found within the landscape. Human alterations, in general, would be subordinate and conform to natural appearing landscape characteristics. Character trees, snags, and small openings, to highlight special features within the landscape, are desirable and encouraged. Where biologically feasible, diversity in vegetation species, age and size classes would be encouraged (Deschutes NF LRMP MA-9).

Scenic Integrity Objective (LRMP MA-9 Standard and Guideline).

Ponderosa Pine-Foreground

Ponderosa pine in Foreground Scenic Views will be managed to maintain or create a visual mosaic of numerous, large diameter, yellow-barked trees with stands of younger trees offering scenic diversity as seen from sensitive viewer locations, such as from a travel corridor. A mosaic of even-aged and uneven-aged stands and small natural-appearing openings of various sizes (less than ½ acre) are desirable.

Mixed Conifers-Foreground

Mixed conifer stands in the Foreground landscape will be managed to maintain or create a mosaic of stands with essentially continuous tree canopies with scenic diversity provided by natural-appearing openings, which resemble those found within the natural landscape. Species and size class diversity is also an essential part of this viewing distance.

Lodgepole Pine-Foreground

Lodgepole pine in Foreground landscape management emphasis will NOT be to produce large diameter, older trees. Instead, the emphasis will be on managing healthier, fuller crowned, younger trees. A mosaic of even-aged stands and natural-appearing openings of various sizes (2 acres or less) are desirable.

Ponderosa Pine-Middleground

Ponderosa pine viewed as Middleground will be managed so that they provide a strong textural element. The presence of a few individual large trees with full crowns is an important part of this landscape element. Immature stands are also an essential component in the landscape because they help provided a strong color contrast, and they eventually become the replacements for the larger, old growth trees that perpetuate the desired coarsely textured character.

Visible untimbered openings are desirable where the natural landscape contains similar openings, or where natural-appearing openings can provide additional diversity in the landscape where it is lacking.

Lodgepole Pine-Middleground

Lodgepole pine in the Middleground viewing distances provides a primarily textural landscape element. The constant and often uniform texture and color the trees provide is more important than individual trees and size of trees. For this reason, the mosaic of relatively uniform textures created by maintaining tree canopy closure is an essential part that provides quality scenery. Natural appearing openings are desirable as long as their shape and size do not dominate the landscape with soil color contrasts.

Mixed Conifers-Middleground

Mixed conifer stands view as Middleground will be managed to maintain or create a mosaic of stands with essentially continuous tree canopies with scenic diversity provided by natural-appearing openings, which resemble those found within the natural landscape. The emphasis will be to maintain continuous, similar textural and color patterns. Species and size class diversity is also an essential part of this viewing distance.

Heritage Resources

MANAGEMENT DIRECTION

Management direction for heritage resources is found in the Deschutes National Forest Resource Management Plan, in the Forest Service Manual section 2360, in federal regulations 36CFR64 and 36CFR800, and in various federal laws including the National Historic Preservation Act of 1966 (as amended), the National Environmental Policy Act, and the National Forest Management Act. In general, the existing management direction asks the Forest to consider the effects on heritage resources when considering projects that fall within the Forest's jurisdiction. Further direction indicates that the Forest will determine what heritage resources are present on the forest, evaluate each resource for eligibility to the National Register of Historic Places (Register) and protect or mitigate effects to resources that are eligible.

Relevant Forest Plan Standards and guides include:

CR-2 which states that cultural resource properties located during inventory will be evaluated for eligibility to the Register.

CR-3 states that in concert with inventories and evaluations the Forest will develop thematic Register nominations and management plans for various classes of cultural resources.

CR-4 indicates that project level inventories or the intent to conduct such shall be documented through environmental analysis for the project.

We are doing a poor job in meeting the CR-2 standard as post project, only 38 of the 111 sites known (34%) have been evaluated for National Register eligibility. We are doing an even worse job of meeting CR-3 as no thematic nominations or management plans have been considered or completed. Standard CR-4 has been met as project level inventories have been conducted and documented and are being consulted on with the Oregon State Historic Preservation Office in conjunction with the environmental analysis.

Air Quality

Management Direction

The Clean Air Act

The 1990 Clean Air Act (CAA) is an amended federal law first passed in 1970. Under this law, the Environmental Protection Agency (EPA) protects and enhances the quality of the nation's air resources by setting limits on how much of a pollutant can be in the air. A State Implementation Plan (SIP) considers local geography and industry to further define how provisions of the CAA will be implemented. The Oregon Clean Air Act Implementation Plan was developed by the Department of Environmental Quality in 1989 under ORS 468A.035. Further delineated, pollution prevention measures are implemented under 40 CFR § 81.219 Central Oregon Air Quality Control Region (as defined in section 302(f) of the Clean Air Act, 42 U.S.C.1857h(f).

Appendix C – Alternative Tables

Alternative Tables – Treatment & Soil Disturbance by Unit

This appendix displays tables for each of the action alternatives, displayed by unit. Each table includes the following information for each salvage unit.

The following is a key to the information contained in each table:

- **Unit** #
- **Allocation** – Land Allocation
  - ***LSR*** – Late-Successional Reserves
  - ***MAT*** – Matrix
  - ***AWD*** – Administratively Withdrawn
- **Rx** – Prescription
  - ***HSV-M*** – Salvage Harvest in Moderate Severity
  - ***HSV-M-WF*** – White Fir Salvage Harvest in Moderate Severity
  - ***HSV-SR*** - Salvage Harvest in Stand-Replacement Severity
  - ***HSV-UB-WF*** – White Fire Salvage Harvest in Underburned Severity
  - ***SFP-M*** – Special Forest Products in Moderate Severity
  - ***SFP-SR*** – Special Forest Products in Stand Replacement Severity
- **Acres** – Number of acres in each Unit, and Total

Harvest – Activities associated with logging in units.

- **Log_Sys** – Logging Systems
  - ***G*** – Ground-based logging: A system consisting of track-mounted knuckle-boom (16 ft. reach) feller-bunchers for cutting and pre-bunching trees, and rubber-tired grapple skidders for skidding trees to landings located on system roads or temporary roads where they are processed into logs and loaded on trucks.
  - ***G-Mod*** – Modified ground-based logging: Same as above, except trees would be hand-felled and pulled to skid trails with a cable winch. This eliminates the soil disturbance from the feller-buncher machines, although there may be some soil gouging from dragging logs to the skid trails with the winch. Costs for this system are expected to be about 15 percent higher than the standard ground-based. Ground-based systems would be used on slopes ranging from 0-30 percent, with the allowance for occasional steeper pitches.
  - ***H*** – Helicopters would be used to yard logs on slopes generally greater than 30 percent, or where road access does not exist and temporary road construction was not deemed feasible or cost-effective.
- **Vol_per_acre** – Volume per acre, in Thousands of Board Feet per Acre (MBF/ac)
- **Tot_Vol** – Total volume, in Thousands of Board Feet (MBF) for each unit, and Total

Activity Fuels Treatment – Treatment of potentially hazardous fuels (consistent with project Fuels Strategy, see *Appendix C*)

- **Treatment** – Fuels treatment type
  - ***JPB*** – Jackpot Burn (Burning high fuels concentrations)
  - ***MP*** – Machine Pile (Piling harvest slash and small logs with grapple or similar machinery from existing skid trails)
  - ***WTY/PB*** – Whole-tree Yard with Pile Burn of landings (Yarding entire trees or leaving the tops attached to the last log with pile burning of log landings)
- **Fuel Load <3 (tons/acre**) – Fuel Load, less than 3 inches, in tons per acre.

- **Fuel Load >3 (tons/acre)** – Fuel Load, greater than 3 inches, in tons per acre.
- **Total Fuel Load (tons/acre)** – Total Fuel Load in tons per acre.

Existing & Predicted Soil Disturbance – Current and estimated impacted soil conditions

Exist. Detr. Soil (%) – Field measured percentage of unit considered detrimental prior to implementation including system roads.

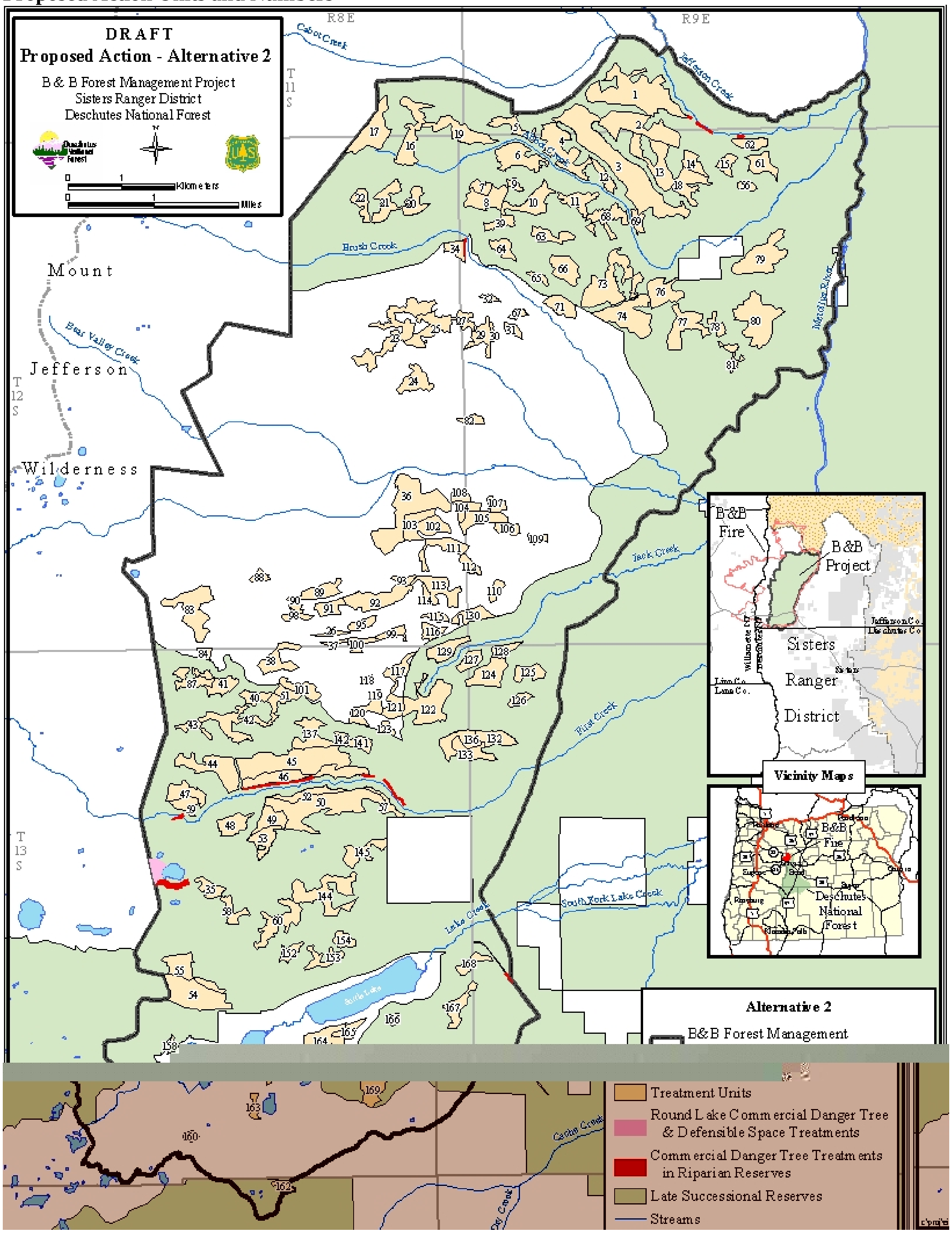
Est. Detr. Soil (%) – Estimated percentage of unit considered detrimental following salvage and fuels treatment operations, including temporary roads.

Acres subsoiled to meet LRMP standard for soil productivity – Minimum acres predicted to be subsoiled within unit to reduce detrimental soil conditions to 20% of the unit area and meet LRMP standard SL-3 under direction of LRMP standard SL-4.

Add'l Acres Detrimental following all activities and mitigations – Additional acres considered detrimental within unit following proposed activities and all minimum LRMP mitigation measures.

Temp Road Constr. (miles/ac) – Miles of temporary road construction for access to or within unit in order to implement proposed salvage activities. "New access" roads cover previously un-impacted ground and "access" roads cover either existing user or decommissioned road surfaces, some of which have been subsoiled. Miles of temporary road were converted to acres using an average 12 foot width. Acres of temporary roads within proposed unit boundaries are included in estimated detrimental condition totals prior to mitigation. All temporary road acres are prioritized for subsoiling following the completion of their use.

Proposed Action Units and Numbers



Alternatives 2, 4, 5																
					Harvest			Activity Fuels Treatment				Existing&Predicted Soil Disturb.				
Applicable Alternative(s)	UNIT	Allocation	Rx	Acres	Log_Sys	Vol_per_acre	Tot_Vol	Treatment	Fuel Load <3 (tons/ac)	Fuel Load >3 (tons/ac)	Total Fuel Load (tons/ac	Exist. detr. Soil (%)	Est. Detr. Soil (%) prior to mitigation	Acres subsoiled to meet LRMP standard for soil productivity	Add'l acres Detrimental following all activities and mitigations	Temp Road Constr. (miles/ac)
2,5	1	LSR	HSV-SR	216	G	4	864	WTY/PB,MP	14.2	5	19.3	11	25	10.8	30.24	
2	2	LSR	HSV-SR	124	H	5	619	WTY/PB	5.7	5	10.7	5	10		6.2	at .107/.15
2,5	3	LSR	HSV-SR	297	G	7	2081	WTY/PB,MP	16.3	5	21.3	8	20		35.64	at .35/.5
2,5	4	LSR	HSV-SR	101	G	3	303	WTY/PB	7.3	5	12.3	7	20		13.13	
2	5	LSR	HSV-SR	36	G	4	144	WTY/PB,MP	12.7	5	17.7	10	25	1.8	5.4	aw .123/.17
2	6	LSR	HSV-SR	79	G-Mod	3	237	WTY/PB,MP	16.9	5	21.9	5	20		11.85	
2	7	LSR	HSV-SR	19	G	4	77	WTY/PB	7.1	5	12.1	6	20		2.66	
2	8	LSR	HSV-SR	60	H	6	363	WTY/PB	4.2	5	9.2	7	20		7.8	
2	9	LSR	HSV-SR	10	G	3	31	WTY/PB	7.5	5	12.5	6	20		1.4	
2,5	10	LSR	HSV-SR	61	G	3	184	WTY/PB	7.2	5	12.2	8	20		7.32	at .335/.48
2,5	11	LSR	HSV-SR	40	G	4	160	WTY/PB,MP	10	5	15	12	25	2	5.2	
2,5	12	LSR	HSV-SR	25	G	5	123	WTY/PB,MP	19.3	5	24.3	11	25	1.25	3.5	
2,5	13	LSR	HSV-SR	89	G	5	446	WTY/PB,MP	11.4	5	16.4	5	20		13.35	aw .88/1.28
2,5	14	LSR	HSV-SR	27	G	5	137	WTY/PB,MP	19.6	5	24.6	7	20		3.51	
2	15	LSR	HSV-SR	23	G	5	117	WTY/PB	7.5	5	12.5	8	20		2.76	at .182/.26
2	16	LSR	HSV-SR	81	G	5	403	WTY/PB,MP	13.4	5	18.4	3	20		13.77	
2	17	LSR	HSV-SR	89	G	4	355	WTY/PB,MP	12.19	5.75	17.9	3	20		15.13	
2	18	LSR	HSV-SR	59	G	3	177	WTY/PB	7.3	5	12.3	8	20		7.08	
2	19	LSR	HSV-SR	69	G	5	345	WTY/PB	6.71	5.39	12.1	10	25	3.45	10.35	
2	20	LSR	HSV-SR	36	G	4	144	WTY/PB,MP	14.84	5.06	19.9	5	20		5.4	
2,5	21	LSR	HSV-SR	52	G	4	209	WTY/PB,MP	17.59	5.81	23.4	3	20		8.84	

2,5	22	LSR	HSV-SR	30	G	5	152	WTY/PB,MP	14.67	6.83	21.5	5	20		4.5	
2,4,5	23	MAT	HSV-SR	132	G	4	530	WTY/PB,MP	11.7	5	16.7	10	25	6.6	19.8	at .134/.19
2,4,5	24	MAT	HSV-M	49	G	4	196	WTY/PB	7.5	5	12.5	10	20		4.9	aw .067/.09
2,4,5	25	MAT	HSV-SR	64	G	4	256	WTY/PB	7.5	5	12.5	7	20		8.32	
2,4	26	MAT	HSV-M-WF	10	G-Mod	4	38	WTY/PB	5.5	5.5	11	8	20		1.2	
2,4,5	27	MAT	HSV-SR	21	G	5	104	WTY/PB,MP	10.2	5	15.2	3	20		3.57	
2,4,5	29	MAT	HSV-SR	38	G	4	150	WTY/PB	2.7	5	7.7	10	25	1.9	5.7	aw .055/.08
2,4,5	30	MAT	HSV-SR	9	G	5	46	WTY/PB,MP	12.5	5.2	17.7	12	25	0.45	1.17	
2,4,5	31	MAT	HSV-SR	14	G	5	71	WTY/PB,MP	10.8	5	15.8	14	25	0.7	1.54	
2,4,5	32	MAT	HSV-SR	8	G	5	40	WTY/PB	7.5	5	12.5	7	20		1.04	at.076/.1 & .06/.08
2,4	34	MAT	HSV-SR	22	G-Mod	4	88	WTY/PB,MP	10.1	5	15.1	1	20		4.18	
2,5	35	LSR	SFP-SR	29	G	1	29	WTY/PB	8.1	5	13.1	11	25	1.45	4.06	
2,4,5	36	MAT	HSV-M-WF	189	G	4	756	WTY/PB	7.7	5	12.7	11	25	9.45	26.46	
2,4,5	37	MAT	HSV-M-WF	10	G	4	42	WTY/PB	6.5	5	11.5	6	20		1.4	
2,4,5	38	MAT	HSV-SR	54	G	4	214	WTY/PB	2.9	5	7.9	5	20		8.1	aw .167/.24
2	39	LSR	HSV-SR	23	G	5	116	WTY/PB	7.9	5	12.9	6	20		3.22	
2,5	40	LSR	HSV-SR	26	G	5	130	WTY/PB	8.6	5	13.6	10	25	1.3	3.9	
2,5	41	LSR	HSV-SR	45	G	5	227	WTY/PB,MP	9.8	5.5	15.3	7	20		5.85	
2,5	42	LSR	HSV-SR	93	G	6	557	WTY/PB,MP	12.69	5.51	18.2	3	20		15.81	
2,5	43	LSR	HSV-SR	18	G	4	73	WTY/PB,MP	12.9	7.5	20.4	5	20		2.7	
2	44	LSR	HSV-SR	98	H	6	588	PB,WF,JPB	17.1	5.9	23	5	10		4.9	
2	45	LSR	HSV-SR	199	H	5	993	PB,WF,JPB	14.7	5.2	19.9	5	10		9.95	
2	46	LSR	HSV-SR	99	G-Mod	5	497	WTY/PB	7.9	5	12.9	5	20		14.85	
2	47	LSR	HSV-SR	47	H	6	281	PB,WF,JPB	13.2	7.7	20.9	10	15		2.35	
2,5	48	LSR	HSV-SR	44	G	4	178	WTY/PB	6.3	6.6	12.9	6	20		6.16	
2,5	49	LSR	HSV-SR	44	G	4	176	WTY/PB,MP	12.1	5	17.1	8	20		5.28	
2	50	LSR	HSV-SR	195	H	6	1170	WTY/PB	8.1	5.2	13.3	5	10		9.75	
2,5	51	LSR	HSV-M-WF	21	G	4	84	WTY/PB,MP	12	5.2	17.2	6	20		2.94	
2	52	LSR	HSV-SR	36	H	6	219	WTY/PB	8	5	13	5	10		1.8	
2,5	53	LSR	HSV-SR	43	G	4	170	WTY/PB,MP	13.3	2.6	15.9	12	25	2.15	5.59	
2	54	LSR	HSV-SR	126	H	6	758	PB,WF,JPB	11.5	5	16.5	5	10		6.3	
2,5	55	LSR	HSV-SR	66	G	4	266	WTY/PB	6.9	10	16.9	12	25	3.3	8.58	
2	56	LSR	HSV-SR	12	G	5	60	WTY/PB,MP	10.6	5	15.6	5	20		1.8	
2	57	LSR	HSV-SR	22	H	6	135	WTY/PB	2.5	6.8	9.3	5	10		1.1	

2,5	58	LSR	SFP-SR	28	G	1	28	WTY/PB	7.2	7.4	14.6	11	25	1.4	3.92	
2,5	59	LSR	HSV-SR	26	G	5	131	WTY/PB	6.1	6.1	12.2	4	20		4.16	
2	60	LSR	HSV-SR	76	G	3	227	WTY/PB	7.2	5	12.2	10	25	3.8	11.4	
2	61	LSR	HSV-SR	40	G	5	201	WTY/PB	6.1	5	11.1	17	25	2	3.2	aw .284/.41
2	62	LSR	HSV-SR	29	G	5	143	WTY/PB,MP	15.7	5	20.7	6	20		4.06	
2,5	63	LSR	HSV-SR	36	G	4	145	WTY/PB,MP	15.2	5	20.2	2	20		6.48	
2,5	64	LSR	HSV-SR	27	G	4	109	WTY/PB,MP	13.6	5	18.6	3	20		4.59	
2	65	LSR	HSV-SR	11	G	4	43	WTY/PB,MP	17.5	5	22.5	3	20		1.87	
2,5	66	LSR	HSV-SR	53	G	4	211	WTY/PB,MP	12.4	5	17.4	7	20		6.89	
2,4,5	67	MAT	HSV-SR	9	G	5	44	WTY/PB,MP	11.9	5	16.9	5	20		1.35	
2,5	68	LSR	HSV-SR	54	G	6	323	WTY/PB,MP	11.5	5	16.5	6	20		7.56	
2,5	69	LSR	HSV-SR	18	G	5	92	WTY/PB	7.5	5	12.5	5	20		2.7	
2,4,5	71	MAT	HSV-SR	40	G	5	201	WTY/PB	9.1	5	14.1	2	20		7.2	
2	73	LSR	HSV-SR	140	G	4	559	WTY/PB,MP	12.4	5	17.4	10	25	7	21	atw .09/.13& .397/.57
2,5	74	LSR	HSV-M-WF	114	G	4	457	WTY/PB,MP	11.6	5.4	17	12	25	5.7	14.82	
2	76	LSR	HSV-SR	61	G	3	182	WTY/PB	8.1	5	13.1	7	20		7.93	
2,5	77	LSR	SFP-SR	75	G	1	75	WTY/PB	8.2	5	13.2	6	20		10.5	
2,5	78	LSR	HSV-SR	19	G	4	74	WTY/PB	9.6	5	14.6	9	20		2.09	
2	79	LSR	HSV-SR	108	G	3	323	WTY/PB,MP	11.1	5	16.1	11	25	5.4	15.12	
2,5	80	LSR	SFP-SR	126	G	1	126	WTY/PB,MP	10.3	5	15.3	7	20		16.38	
2	81	LSR	HSV-SR	20	G	3	60	WTY/PB	7.5	5	12.5	11	25	1	2.8	
2,4,5	82	MAT	HSV-SR	16	G	4	65	WTY/PB,MP	10	5	15	5	20		2.4	
2,4,5	83	MAT	HSV-SR	108	G	5	541	WTY/PB	9.3	5.6	14.9	12	25	5.4	14.04	
2,4,5	84	MAT	HSV-M-WF	12	G	4	50	WTY/PB	2.5	5	7.5	10	25	0.6	1.8	
2,5	87	LSR	HSV-SR	37	G	4	148	WTY/PB,MP	12.9	5	17.9	11	25	1.85	5.18	
2,4,5	88	MAT	HSV-SR	13	G	4	52	WTY/PB	7.5	5	12.5	11	25	0.65	1.82	
2,4,5	89	MAT	HSV-M-WF	45	G	4	181	WTY/PB	2.5	5.7	8.2	13	25	2.25	5.4	
2,4,5	90	MAT	HSV-M-WF	6	G	3	18	WTY/PB	2.5	5	7.5	6	20		0.84	
2,4,5	91	MAT	HSV-M-WF	29	G	5	147	WTY/PB	7.5	5	12.5	15	25	1.45	2.9	
2,4,5	92	MAT	HSV-M-WF	84	G	5	418	WTY/PB	4.1	5	9.1	12	25	4.2	10.92	at .548/.79
2,4,5	93	MAT	SFP-SR	11	G	1	11	WTY/PB	7.5	5	12.5	12	25	0.55	1.43	
2,4,5	95	MAT	HSV-M-WF	21	G	4	83	WTY/PB	7.5	5	12.5	9	20		2.31	
2,4,5	98	MAT	HSV-M-WF	18	G	4	72	WTY/PB	7	5	12	4	20		2.88	
2,4,5	99	MAT	HSV-SR	21	G	5	105	WTY/PB	6.6	5	11.6	13	25	1.05	2.52	at .06/.09 & .20/.29)

2,4,5	100	MAT	HSV-M-WF	20	G	4	79	WTY/PB	7.7	5	12.7	10	25	1	3	
2,4,5	101	MAT	HSV-M-WF	37	G	4	148	WTY/PB,MP	12.1	5	17.1	9	25	1.85	5.92	
2,4,5	102	MAT	HSV-SR	39	G	4	156	WTY/PB	2.5	5	7.5	9	20		4.29	
2,4,5	103	MAT	HSV-UB-WF	46	G	4	185	WTY/PB	4.6	5	9.6	10	20		4.6	
2,4,5	104	MAT	HSV-UB-WF	28	G	2	55	WTY/PB	2.5	5	7.5	15	25	1.4	1.4	
2,4,5	105	MAT	HSV-SR	50	G	7	352	WTY/PB	4.2	5	8.2	6	20		7	
2,4,5	106	MAT	HSV-M	21	G	4	83	WTY/PB	7	5	12	11	25	1.05	2.94	
2,4,5	107	MAT	HSV-UB-WF	20	G	2	39	WTY/PB	2.5	5	7.5	8	20		2.4	
2,4,5	108	MAT	HSV-M	17	G	4	69	WTY/PB	2.5	5	7.5	9	20		1.87	
2,4,5	109	MAT	SFP-SR	12	G	1	12	WTY/PB	2.5	5	7.5	7	20		1.56	
2,4,5	110	MAT	HSV-SR	17	G	4	69	WTY/PB	2.5	5	7.5	5	20		2.55	
2,4,5	111	MAT	HSV-SR	46	G	5	228	WTY/PB	3.9	5	8.9	6	20		6.44	
2,4,5	112	MAT	HSV-M	22	G	7	151	WTY/PB	8.6	5	13.6	11	25	1.1	3.08	
2,4,5	113	MAT	HSV-SR	63	G	6	379	WTY/PB	6.3	5	11.3	5	20		9.45	aw .091/.13
2,4,5	114	MAT	HSV-M-WF	13	G	4	50	WTY/PB	3.8	5	8.8	13	25	0.65	1.56	
2,4,5	115	MAT	HSV-SR	15	G	5	74	WTY/PB	7.1	5	12.1	20	25	0.75	0.75	
2,4,5	116	MAT	HSV-SR	23	G	5	114	WTY/PB	9	5	14	17	25	1.15	1.84	
2,4,5	117	MAT	HSV-SR	34	G	5	172	WTY/PB	3.2	5	8.2	15	25	1.7	3.4	
2,4,5	118	MAT	HSV-SR	5	G	5	25	WTY/PB	2.5	5	7.5	12	25	0.25	0.65	
2,4,5	119	MAT	HSV-SR	7	G	6	44	WTY/PB	2.5	5	7.5	20	25	0.35	0.35	
2,4,5	120	MAT	HSV-M-WF	38	G	3	114	WTY/PB	2.6	5	7.6	7	20		4.9	
2,4,5	121	MAT	HSV-M-WF	33	G	5	167	WTY/PB	2.5	5	7.5	9	20		3.6	
2,5	122	LSR	HSV-SR	115	G	5	577	WTY/PB	4.1	5	9.1	9	20		12.65	aw .185/.27
2,4,5	123	MAT	HSV-UB-WF	12	G	4	49	WTY/PB	7.5	5	7.5	5	20		1.8	
2,5	124	LSR	HSV-SR	67	G	6	400	WTY/PB	6.5	5	11.5	5	20		10.05	
2,5	125	LSR	HSV-M-WF	34	G	5	170	WTY/PB	2.5	5	7.5	10	20		3.4	
2,5	126	LSR	HSV-M-WF	18	G	6	109	WTY/PB	7.9	5	7.9	7	20		2.34	
2,5	127	LSR	HSV-UB-WF	30	G	4	119	WTY/PB	3.6	5	8.6	8	20		3.6	
2,5	128	LSR	HSV-M-WF	24	G	3	73	WTY/PB	2.5	5	7.5	11	25	1.2	3.36	
2,5	129	LSR	HSV-UB-WF	46	G	4	186	WTY/PB	2.6	5	7.6	7	20		5.98	
2,4,5	130	MAT	HSV-UB-WF	36	G	4	146	WTY/PB	2.6	5	7.6	11	25	1.8	5.04	
2	132	LSR	HSV-SR	41	G	4	166	WTY/PB	5.6	5	10.6	11	25	2.05	5.74	
2,5	133	LSR	HSV-UB-WF	42	G	4	166	WTY/PB	2.5	5	7.5	5	20		6.3	
2,5	136	LSR	HSV-M-WF	52	G	4	209	WTY/PB	1.8	5	6.8	6	20		7.28	
2,5	137	LSR	HSV-SR	61	G	4	246	WTY/PB	8.7	5.3	14	9	20		6.71	
2,5	141	LSR	HSV-M-WF	23	G	4	91	WTY/PB	7.1	5	12.1	10	25	1.15	3.45	
2,5	142	LSR	HSV-M-WF	15	G	4	60	WTY/PB	3.1	6.7	9.8	7	20		1.95	
2,5	144	LSR	HSV-SR	114	G	4	454	WTY/PB,MP	10	5	15	10	25	5.7	17.1	
2	145	LSR	HSV-SR	47	H	6	279	PB,WF,JPB	11.2	5.2	16.4	5	10		2.35	

2,5	152	LSR	SFP-SR	21	G	1	21	WTY/PB	7.5	5	12.5	11	25	1.05	2.94	
2,5	153	LSR	SFP-M	31	G	1	31	WTY/PB	7.3	5	12.3	6	20		4.34	
2	154	LSR	HSV-SR	24	G	4	96	WTY/PB	4.1	5	9.1	7	20		3.12	at .229/.33
2,5	158	MAT	SFP-SR	8	G	1	8	WTY/PB	7.5	5	12.5	10	25	0.4	1.2	
2,5	160	MAT	SFP-SR	9	G	1	9	WTY/PB,MP	12.5	5	17.5	12	25	0.45	1.17	
2,5	162	LSR	SFP-SR	14	G	1	14	WTY/PB	7.5	5	12.5	9	20		1.54	
2,5	163	AWD	HSV-SR	15	G	4	60	WTY/PB,MP	17.5	5	22.5	4	20		2.4	at .22/.32
2,5	164	AWD	HSV-SR	78	G	3	235	WTY/PB,MP	10.1	5.1	15.2	3	20		13.26	aw .073/.11
2,5	165	AWD	HSV-SR	24	G	4	95	WTY/PB,MP	9.8	5.1	14.9	1	20		4.56	
2,5	166	LSR	HSV-SR	11	G	4	42	WTY/PB	7.9	5	12.9	1	20		2.09	
2	167	LSR	SFP-SR	43	G	1	43	WTY/PB,MP	14.2	5	19.2	9	20		4.73	
2	168	LSR	SFP-SR	26	G	1	26	WTY/PB	2.5	5	7.5	8	20		3.12	
2	169	LSR	HSV-SR	51	G	4	205	WTY/PB,MP	12.9	5	17.9	10	25	2.55	7.65	
2	**Total**			**6803**			**29699**									
4	**Total**			**1725**			**7496**									
5	**Total**			**4633**			**13317**									

Alternative 3															
				Harvest			Activity Fuels Treatment				Existing&Predicted Soil Disturb.				
UNIT	Allocation	Rx	Acres	Log_Sys	Vol_per_acre	Tot_Vol	Treatment	Fuel Load <3 (tons/ac)	Fuel Load >3 (tons/ac)	Total Fuel Load (tons/ac	Exist. Detr. Soil (%)	Est. Detr. Soil (%) prior to mitigation	Acres subsoiled to meet LRMP standard for soil productivity	Add'l acres Detrimental following all activities and mitigations	Temp Road Constr. (miles/ac)
1	LSR	HSV-SR	216	G	4	864	WTY/PB,MP	14.2	5	19.3	11	25	10.8	30.24	
3	LSR	HSV-SR	297	G	7	2081	WTY/PB,MP	16.3	5	21.3	8	20		35.64	at .35/.5
4	LSR	HSV-SR	101	G	3	303	WTY/PB	7.3	5	12.3	7	20		13.13	
10	LSR	HSV-SR	61	G	3	184	WTY/PB	7.2	5	12.2	8	20		7.32	at .335/.48
11	LSR	HSV-SR	40	G	4	160	WTY/PB,MP	10	5	15	12	25	2	5.2	
12	LSR	HSV-SR	25	G	5	123	WTY/PB,MP	19.3	5	24.3	11	25	1.25	3.5	
13	LSR	HSV-SR	89	G	5	446	WTY/PB,MP	11.4	5	16.4	5	20		13.35	aw .88/1.28
14	LSR	HSV-SR	27	G	5	137	WTY/PB,MP	19.6	5	24.6	7	20		3.51	
21	LSR	HSV-SR	52	G	4	209	WTY/PB,MP	17.59	5.81	23.4	3	20		8.84	
22	LSR	HSV-SR	30	G	5	152	WTY/PB,MP	14.67	6.83	21.5	5	20		4.5	
23	MAT	HSV-SR	132	G	4	530	WTY/PB,MP	11.7	5	16.7	10	25	6.6	19.8	at .134/.19
24	MAT	HSV-M	49	G	4	196	WTY/PB	7.5	5	12.5	10	20		4.9	aw .067/.09
25	MAT	HSV-SR	64	G	4	256	WTY/PB	7.5	5	12.5	7	20		8.32	
27	MAT	HSV-SR	21	G	5	104	WTY/PB,MP	10.2	5	15.2	3	20		3.57	
29	MAT	HSV-SR	38	G	4	150	WTY/PB	2.7	5	7.7	10	25	1.9	5.7	aw .055/.08
30	MAT	HSV-SR	9	G	5	46	WTY/PB,MP	12.5	5.2	17.7	12	25	0.45	1.17	
31	MAT	HSV-SR	14	G	5	71	WTY/PB,MP	10.8	5	15.8	14	25	0.7	1.54	
32	MAT	HSV-SR	8	G	5	40	WTY/PB	7.5	5	12.5	7	20		1.04	at.076/.1 & .06/.08

36	MAT	HSV-M-WF	189	G	4	756	WTY/PB	7.7	5	12.7	11	25	9.45	26.46	
37	MAT	HSV-M-WF	10	G	4	42	WTY/PB	6.5	5	11.5	6	20		1.4	
38	MAT	HSV-SR	54	G	4	214	WTY/PB	2.9	5	7.9	5	20		8.1	aw .167/.24
40	LSR	HSV-SR	26	G	5	130	WTY/PB	8.6	5	13.6	10	25	1.3	3.9	
41	LSR	HSV-SR	45	G	5	227	WTY/PB,MP	9.8	5.5	15.3	7	20		5.85	
42	LSR	HSV-SR	93	G	6	557	WTY/PB,MP	12.69	5.51	18.2	3	20		15.81	
43	LSR	HSV-SR	18	G	4	73	WTY/PB,MP	12.9	7.5	20.4	5	20		2.7	
46	LSR	HSV-SR	99	G	5	497	WTY/PB	7.9	5	12.9	5	20		14.85	
48	LSR	HSV-SR	44	G	4	178	WTY/PB	6.3	6.6	12.9	6	20		6.16	
49	LSR	HSV-SR	44	G	4	176	WTY/PB,MP	12.1	5	17.1	8	20		5.28	
53	LSR	HSV-SR	43	G	4	170	WTY/PB,MP	13.3	2.6	15.9	12	25	2.15	5.59	
55	LSR	HSV-SR	66	G	4	266	WTY/PB	6.9	10	16.9	12	25	3.3	8.58	
59	LSR	HSV-SR	26	G	5	131	WTY/PB	6.1	6.1	12.2	4	20		4.16	
63	LSR	HSV-SR	36	G	4	145	WTY/PB,MP	15.2	5	20.2	2	20		6.48	
64	LSR	HSV-SR	27	G	4	109	WTY/PB,MP	13.6	5	18.6	3	20		4.59	
66	LSR	HSV-SR	53	G	4	211	WTY/PB,MP	12.4	5	17.4	7	20		6.89	
67	MAT	HSV-SR	9	G	5	44	WTY/PB,MP	11.9	5	16.9	5	20		1.35	
68	LSR	HSV-SR	54	G	6	323	WTY/PB,MP	11.5	5	16.5	6	20		7.56	
69	LSR	HSV-SR	18	G	5	92	WTY/PB	7.5	5	12.5	5	20		2.7	
71	MAT	HSV-SR	40	G	5	201	WTY/PB	9.1	5	14.1	2	20		7.2	
82	MAT	HSV-SR	16	G	4	65	WTY/PB,MP	10	5	15	5	20		2.4	
83	MAT	HSV-SR	108	G	5	541	WTY/PB	9.3	5.6	14.9	12	25	5.4	14.04	
84	MAT	HSV-M-WF	12	G	4	50	WTY/PB	2.5	5	7.5	10	25	0.6	1.8	
87	LSR	HSV-SR	37	G	4	148	WTY/PB,MP	12.9	5	17.9	11	25	1.85	5.18	
88	MAT	HSV-SR	13	G	4	52	WTY/PB	7.5	5	12.5	11	25	0.65	1.82	
89	MAT	HSV-M-WF	45	G	4	181	WTY/PB	2.5	5.7	8.2	13	25	2.25	5.4	
90	MAT	HSV-M-WF	6	G	3	18	WTY/PB	2.5	5	7.5	6	20		0.84	
91	MAT	HSV-M-WF	29	G	5	147	WTY/PB	7.5	5	12.5	15	25	1.45	2.9	
92	MAT	HSV-M-WF	84	G	5	418	WTY/PB	4.1	5	9.1	12	25	4.2	10.92	at .548/.79
95	MAT	HSV-M-WF	21	G	4	83	WTY/PB	7.5	5	12.5	9	20		2.31	
98	MAT	HSV-M-WF	18	G	4	72	WTY/PB	7	5	12	4	20		2.88	
99	MAT	HSV-SR	21	G	5	105	WTY/PB	6.6	5	11.6	13	25	1.05	2.52	at .06/.09 & .20/.29)
100	MAT	HSV-M-WF	20	G	4	79	WTY/PB	7.7	5	12.7	10	25	1	3	
101	MAT	HSV-M-WF	37	G	4	148	WTY/PB,MP	12.1	5	17.1	9	25	1.85	5.92	
102	MAT	HSV-SR	39	G	4	156	WTY/PB	2.5	5	7.5	9	20		4.29	
103	MAT	HSV-UB-WF	46	G	4	185	WTY/PB	4.6	5	9.6	10	20		4.6	

104	MAT	HSV-UB-WF	28	G	2	55	WTY/PB	2.5	5	7.5	15	25	1.4	1.4	
105	MAT	HSV-SR	50	G	7	352	WTY/PB	4.2	5	8.2	6	20		7	
106	MAT	HSV-M	21	G	4	83	WTY/PB	7	5	12	11	25	1.05	2.94	
107	MAT	HSV-UB-WF	20	G	2	39	WTY/PB	2.5	5	7.5	8	20		2.4	
108	MAT	HSV-M	17	G	4	69	WTY/PB	2.5	5	7.5	9	20		1.87	
110	MAT	HSV-SR	17	G	4	69	WTY/PB	2.5	5	7.5	5	20		2.55	
111	MAT	HSV-SR	46	G	5	228	WTY/PB	3.9	5	8.9	6	20		6.44	
112	MAT	HSV-M	22	G	7	151	WTY/PB	8.6	5	13.6	11	25	1.1	3.08	
113	MAT	HSV-SR	63	G	6	379	WTY/PB	6.3	5	11.3	5	20		9.45	aw .091/.13
114	MAT	HSV-M-WF	13	G	4	50	WTY/PB	3.8	5	8.8	13	25	0.65	1.56	
115	MAT	HSV-SR	15	G	5	74	WTY/PB	7.1	5	12.1	20	25	0.75	0.75	
116	MAT	HSV-SR	23	G	5	114	WTY/PB	9	5	14	17	25	1.15	1.84	
117	MAT	HSV-SR	34	G	5	172	WTY/PB	3.2	5	8.2	15	25	1.7	3.4	
118	MAT	HSV-SR	5	G	5	25	WTY/PB	2.5	5	7.5	12	25	0.25	0.65	
119	MAT	HSV-SR	7	G	6	44	WTY/PB	2.5	5	7.5	20	25	0.35	0.35	
120	MAT	HSV-M-WF	38	G	3	114	WTY/PB	2.6	5	7.6	7	20		4.9	
121	MAT	HSV-M-WF	33	G	5	167	WTY/PB	2.5	5	7.5	9	20		3.6	
122	LSR	HSV-SR	115	G	5	577	WTY/PB	4.1	5	9.1	9	20		12.65	aw .185/.27
123	MAT	HSV-UB-WF	12	G	4	49	WTY/PB	7.5	5	7.5	5	20		1.8	
124	LSR	HSV-SR	67	G	6	400	WTY/PB	6.5	5	11.5	5	20		10.05	
130	MAT	HSV-UB-WF	36	G	4	146	WTY/PB	2.6	5	7.6	11	25	1.8	5.04	
137	LSR	HSV-SR	61	G	4	246	WTY/PB	8.7	5.3	14	9	20		6.71	
144	LSR	HSV-SR	114	G	4	454	WTY/PB,MP	10	5	15	10	25	5.7	17.1	
154	LSR	HSV-SR	24	G	4	96	WTY/PB	4.1	5	9.1	7	20		3.12	at .229/.33
163	AWD	HSV-SR	15	G	4	60	WTY/PB,MP	17.5	5	22.5	4	20		2.4	at .22/.32
164	AWD	HSV-SR	78	G	3	235	WTY/PB,MP	10.1	5.1	15.2	3	20		13.26	aw .073/.11
165	AWD	HSV-SR	24	G	4	95	WTY/PB,MP	9.8	5.1	14.9	1	20		4.56	
166	LSR	HSV-SR	11	G	4	42	WTY/PB	7.9	5	12.9	1	20		2.09	
169	LSR	HSV-SR	51	G	4	205	WTY/PB,MP	12.9	5	17.9	10	25	2.55	7.65	
3	**Total**		**3762**			**14031**									

Common To All Alternatives

Riparian Reserve Danger Tree Commercial Utilization Areas

Riparian Reserve Location	Pod Number	Miles of danger tree removal along roads	Volume MBF estimate for dangers removed >16 inch	Alternative
Round Lake	1	0.14**	14.0[a]	2, 3, 4, 5
Round Lake	2	0.21	19.2[b]	2, 3, 4, 5
First Creek	5	0.12	7.8[c]	2, 3, 5
First Creek	6	0.82	34.2 [c]	2, 3, 5
First Creek	7	0.16	6.9 [c]	2, 3, 5
First Creek	8	0.39	16.5 [c]	2, 3, 5
Brush Creek (unit 34)	9	0.20	5.4 [b]	2, 3, 4, 5
Candle Creek	11	0.04	1 [b]	2, 3, 5
Candle Creek	12	0.22	6.2 [b]	2, 3, 5
Candle Creek	13	0.07	2.2 [b]	2, 3, 5
Hwy 20	15	0.12	1.5[a]	2, 3, 4, 5
TOTAL		2.49	126.1	

a - 1 MBF/ac; b- 2 MBF/ac; c- 3 MBF/ac; ** - along one side of road

Table 5. Round Lake danger tree removal areas.

Location	Treatment Area Number	Acres of danger tree removal along roads	Miles of danger trees removed along roads	Volume MBF estimate for dangers removed >16 inch dbh	Alternatives
Round Lake *	3	9.6	0.23**	20.2 [b]	2, 3, 4, 5
Round Lake	4	10.1	0.23**	14.6 [b]	2, 3, 4, 5
TOTAL		19.7	0.23	34.8	

* within Riparian Reserve; ** along one side of road; b- 2 MBF/ac

Table 12. Roads restricted from haul during times when streams are flowing at crossings without culverts/bridges (i.e. fords). Other roads fitting this restriction may be identified during haul.

Road	Channel Type	Units Affected
1200850	Ephemeral	73,74
1200901	Ephemeral	74,73
1210100	Intermittent	144,145
1210330	Intermittent	144
1210340	Intermittent	144
1210400	Intermittent	55,54
1220493	Intermittent	99,100
1220650	Intermittent	40,41
1220700	Intermittent	42,43,87,41
1220744	Intermittent	87,41
1230520	Ephemeral	24
1230860	Intermittent	20
1237650	Ephemeral	23
1280100	Intermittent	3
1280200	Intermittent	4, 6, 10
1280250	Ephemeral	10
1280300	Intermittent	13,14,18
1280650	Intermittent	9,10,39
1280750	Intermittent	19
1290100	Intermittent	2
1292600	Ephemeral	1,3
1292620	Ephemeral	1
1292640	Ephemeral	1

Table 13. Logging units that are restricted to dry season operations due to high water table soils, stream crossings, temporary road miles and low elevation with intermittent snow conditions.

Unit ID	High seasonal or perched water table	Number of ephemeral draws	Number of stream road crossings	Temporary Road (miles)	Low elevation
Hazard Pod 6	Rip Reserve		1		3600
Hazard pod 11	Rip Reserve				3100
Hazard pod 12	perched		1		3100
Unit 1		5	10		3200
Unit 10		1	4	0.34	3500
Unit 25	high				4000
Unit 26	high				3400
Unit 27	high				4000
Unit 31	high	1			3300
Unit 32	high			0.14	3200
Unit 34*					4000
Unit 37	high		1		3400
Unit 67	high				3300
Unit 71	high	1	1		3300
Unit 73	high		3		3100
Unit 74	high		3	4.77	3100

Unit 76	high	1	1		3000
Unit 82	high				3200
Unit 93	high				3200
Unit 99	high		1	0.64	3400
Unit 100	high		1	0.10	3400
Unit 113	high		2	0.1	3200
Unit 112	high				3100
Unit 122	high		1	0.19	3200

* has a landing in PSCA

Table 6. Outlets of haul road waterbars, dips, and relief culverts that would be armoured because they are within 320 ft of a stream and have slopes below the outlet that are >20%.

ROAD #	Estimated # of outlets to be armoured			
	Alt 2	Alt 3	Alt 4	Alt 5
1200000	2	2	0	2
1200800	10	10	10	10
1200860	3	3	0	3
1210000	40	40	0	40
1210100	1	1	0	1
1210150	1	1	0	1
1210300	2	2	0	2
1220000	5	5	5	5
1220650	1	0	0	0
1220700	10	10	0	10
1220720	1	0	0	0
1230000	5	2	2	2
1230860	10	0	0	0
1230890	1	0	0	0
1230900	2	2	0	2
1230910	2	2	0	2
1230940	6	2	0	2
1232000	2	2	2	2
1234000	5	5	5	5
1234013	1	1	1	1
1237000	3	3	3	3
1270000	4	0	0	0
1270720	2	0	0	0
1280000	17	6	0	6
1280200	6	3	0	3
1280400	1	1	0	1
1280600	1	0	0	0
1280700	5	0	0	0
1292600	5	5	0	5
1292620	1	1	0	1
Total	**155**	**109**	**28**	**109**

Table 7. Additional relief culverts or waterbars that would be installed160 ft before stream crossings downstream of hydraulically connected road segments below proposed units.

ROAD #	TYPE	# of additional drainage structures			
		Alt 2	**Alt 3**	**Alt 4**	**Alt 5**
1210000	CMP	1	1	0	1
1220650	CMP	1	1	0	1
1220700	CMP	1	1	0	1
1230000	CMP	1	1	1	1
1230880	CMP	1	0	0	0
1230890	CMP	1	0	0	0
1230900	CMP	1	1	0	1
1230900	CMP	2	2	0	2
1234000	CMP	2	2	2	2
1280000	CMP	1	1	0	1
1280200	CMP	1	1	0	1
1280220	CMP	1	1	0	1
1280300	CMP	1	1	0	1
1280400	CMP	1	1	0	1
1290000	CMP	1	1	0	1
1292000	CMP	1	1	0	1
1210150	WATERBAR	1	1	0	1
1210300	WATERBAR	2	2	0	2
1210420	WATERBAR	1	0	0	0
1210870	WATERBAR	1	1	0	1
1230330	WATERBAR	1	1	1	1
1230910	WATERBAR	2	2	0	2
1230930	WATERBAR	1	1	0	1
1230940	WATERBAR	1	1	0	1
1230940	WATERBAR	2	2	0	2
1232310	WATERBAR	1	1	1	1
1234013	WATERBAR	1	1	1	1
1237000	WATERBAR	2	2	2	2
1237620	WATERBAR	1	1	1	1
1237650	WATERBAR	1	1	1	1
1280700	WATERBAR	2	0	0	0
1280750	WATERBAR	1	0	0	0
1290100	WATERBAR	2	0	0	0
1200860	WATERBAR	1	0	0	0
1230860	WATERBAR	1	1	0	1
1230860	WATERBAR	2	0	0	0
1280600	WATERBAR	1	1	0	1
1292600	WATERBAR	1	1	0	1
1292600	WATERBAR	2	0	0	2
1292620	WATERBAR	1	1	0	1
Total Structures Needed		**50**	**37**	**10**	**39**

Table 8. Roads restricted from haul during times when streams are flowing at crossings without culverts/bridges (i.e. fords). Other roads fitting this restriction may be identified during haul.

Road	Channel Type	Units Affected
1200850	Ephemeral	73,74
1200901	Ephemeral	74,73
1210100	Intermittent	144,145
1210330	Intermittent	144
1210340	Intermittent	144
1210400	Intermittent	55,54
1220493	Intermittent	99,100
1220650	Intermittent	40,41
1220700	Intermittent	42,43,87,41
1220744	Intermittent	87,41
1230520	Ephemeral	24
1230860	Intermittent	20
1237650	Ephemeral	23
1280100	Intermittent	3
1280200	Intermittent	4, 6, 10
1280250	Ephemeral	10
1280300	Intermittent	13,14,18
1280650	Intermittent	9,10,39
1280750	Intermittent	19
1290100	Intermittent	2
1292600	Ephemeral	1,3
1292620	Ephemeral	1
1292640	Ephemeral	1

Alternative 2

Table 2-4. Biomass Product Units

SFP UNIT	Rx	Acres	Allocation	Species
56	SFP-SR	29	LSR	WF
58	SFP-SR	28	LSR	
77	SFP-SR	75	LSR	DF/WF
78	SFP-SR	19	LSR	DF/PP
80	SFP-SR	126	LSR	DF/PP
93	SFP-SR	11	MAT	WF/DF
109	SFP-SR	12	MAT	PP/DF/WF
152	SFP-SR	21	LSR	WF/DF
153	SFP-M	31	LSR	WF/DF
158	SFP-SR	8	MAT	WF/DF
160	SFP-SR	9	MAT	WF/DF
162	SFP-SR	14	LSR	WF/DF
167	SFP-SR	43	LSR	WF/DF
168	SFP-SR	26	LSR	WF/DF
Note: Prescription(Rx)- SFP-SR(Special Forest Products-Stand Replacement); SFP-M(Special Forest Products-Mixed Mortality); Allocation- AWD(Administratively Withdrawn); LSR(Late Successional Reserve); MAT(Matrix); Species- DF(Douglas Fir); LP(Lodgepole Pine); PP(Ponderosa Pine); WF(White Fir)				

Table 2-7. Outlets to be Armoured by Road Level

B & B ROADS ALTERNATIVE 2					
ESTIMATED # OF OUTLETS NEEDING ARMOR	**ROAD_NO_**	**LEVEL 1 (CLOSE)**	**LEVEL 2 OPEN**	**LEVEL 3 OPEN**	**TOTAL $ NEED**
2	1200000			$200	***$200***
10	1200800		$1,000		***$1,000***
3	1200860		$300		***$300***
40	1210000		$300	$3,700	***$4,000***
1	1210100		$100		***$100***
1	1210150		$100		***$100***
2	1210300		$200		***$200***
5	1220000		$500		***$500***
1	1220650		$100		***$100***
10	1220700		$1,000		***$1,000***
1	1220720		$100		***$100***
5	1230000		$500		***$500***
10	1230860		$1,000		***$1,000***
1	1230890		$100		***$100***
2	1230900		$200		***$200***
2	1230910	$200			***$200***
6	1230940		$600		***$600***

B & B ROADS ALTERNATIVE 2					
ESTIMATED # OF OUTLETS NEEDING ARMOR	ROAD_NO_	LEVEL 1 (CLOSE)	LEVEL 2 OPEN	LEVEL 3 OPEN	TOTAL $ NEED
2	1232000		$200		***$200***
5	1234000			$500	***$500***
1	1234013	$100			***$100***
3	1237000		$300		***$300***
4	1270000		$400		***$400***
2	1270720		$200		***$200***
17	1280000		$1,700		***$1,700***
6	1280200		$600		***$600***
1	1280400		$100		***$100***
1	1280600		$100		***$100***
5	1280700		$500		***$500***
5	1292600		$500		***$500***
1	1292620	$100			***$100***
TOTAL	**155**				
ARMOUR OUTLEST TOTAL ALT 2		***$400***	***$10,700***	***$4,400***	***$15,500***
Note: Armor outlets of road waterbars, dips, and relief culverts that are within 320 ft of a stream and have slopes below the outlet that are >20%.					

Table 2-8. Relief Culverts by Road Number

B & B ATERNATIVE 2 RELIEF CULVERTS			
ROAD #	**TYPE**	**NUMBER**	**Expense**
1210000	CMP	1	$3,600
1220650	CMP	1	$1,200
1220700	CMP	1	$1,200
1230000	CMP	1	$7,200
1230880	CMP	1	$1,360
1230890	CMP	1	$80
1230900	CMP	1	$2,480
1230900	CMP	2	$80
1234000	CMP	2	$2,400
1280000	CMP	1	$1,200
1280200	CMP	1	$2,400
1280220	CMP	1	$80
1280300	CMP	1	$1,200
1280400	CMP	1	$1,200
1290000	CMP	1	$1,200
1292000	CMP	1	$2,400
TOTAL CMPS NEEDED		**18**	**$29,280**
Note: Install additional relief culverts 160 ft before stream crossings that are downstream of hydrologically connected road segments below proposed units.			

Table 2-9. Waterbars by Road Number

B & B ATERNATIVE 2 WATERBARS			
ROAD #	**TYPE**	**NUMBER**	**Expense**
1210150	WATERBAR	1	$80
1210300	WATERBAR	2	$160
1210420	WATERBAR	1	$80
1210870	WATERBAR	1	$80
1230330	WATERBAR	1	$80
1230910	WATERBAR	2	$160
1230930	WATERBAR	1	$80
1230940	WATERBAR	1	$320
1230940	WATERBAR	2	$80
1232310	WATERBAR	1	$80
1234013	WATERBAR	1	$80
1237000	WATERBAR	2	$160
1237620	WATERBAR	1	$80
1237650	WATERBAR	1	$80
1280700	WATERBAR	2	$80
1280750	WATERBAR	1	$80
1290100	WATERBAR	2	$160
1200860	WATERBAR	1	$80
1230860	WATERBAR	1	$80
1230860	WATERBAR	2	$160
1280600	WATERBAR	1	$80
1292600	WATERBAR	1	$320
1292600	WATERBAR	2	$160
1292620	WATERBAR	1	$160
TOTAL WATERBAR NEED		**32**	**$2,960**
Note: Install additional waterbars 160 ft before stream crossings that are downstream of hydrologically connected road segments below proposed units.			

Table 2-10. Roads Proposed for Decommissioning and Inactivation

B & B ATERNATIVE 2 ROAD DECOMISSIONING			
Road Number	**Activity**	**Sub-soil Priority**	**Miles**
1200040	Inactivate	L	0.122
1200050	Decommission	N	0.902
1200177	Decommission	L	0.119
1200178	Decommission	H	0.076
1200285	Inactivate	L	0.238
1200299	Inactivate	L	0.246
1200420	Decommission	L	0.18
1200518	Decommission	N	0.195
1200520	Decommission	N	0.236
1200530	Decommission	N	0.38
1200540	Decommission	N	0.464
1200542	Decommission	N	0.073

B & B ATERNATIVE 2 ROAD DECOMISSIONING			
Road Number	Activity	Sub-soil Priority	Miles
1200547	Decommission	H	0.617
1200548	Decommission	N	0.238
1200554	Decommission	L	0.639
1200556	Inactivate	N	0.321
1200557	Inactivate	N	0.285
1200559	Decommission	H	0.611
1200650	Decommission	L	0.374
1200822	Decommission	N	0.394
1200828	Decommission	H	0.297
1200828	Decommission	L	0.113
1200842	Decommission	L	0.138
1200849	Decommission	L	0.309
1200850	Decommission	N	0.305
1200854	Decommission	L	0.239
1200868	Inactivate	L	0.134
1200900	Decommission	H	0.373
1200901	Decommission	L	0.415
1200905	Decommission	L	0.175
1200920	Decommission	M	1.016
1200983	Decommission	H	0.412
1200989	Inactivate	L	0.252
1200996	Decommission	L	0.231
1210130	Decommission	H	0.592
1210300	Decommission	H	0.264
1210300	Inactivate	L	0.443
1210300	Inactivate	L	0.032
1210320	Decommission - Convert to Trail	L	0.27
1210400	Inactivate	L	0.414
1210480	Inactivate	L	1.326
1210484	Inactivate	L	0.117
1210486	Inactivate	L	0.122
1210490	Decommission	H	0.318
1210500	Decommission	H	0.728
1210535	Decommission	H	0.111
1210535	Decommission	L	0.41
1210570	Decommission	H	0.132
1210680	Decommission	H	0.123
1210810	Decommission	L	0.19
1210820	Decommission	H	0.199
1210870	Decommission	H	1.814
1210900	Decommission	L	0.426
1210910	Decommission	H	0.454
1210950	Decommission	H	2.229
1220100	Inactivate	L	0.712
1220120	Inactivate	L	0.707
1220125	Decommission	H	0.369

B & B ATERNATIVE 2 ROAD DECOMISSIONING			
Road Number	Activity	Sub-soil Priority	Miles
1220430	Decommission	L	0.547
1220445	Decommission	N	0.199
1220490	Decommission	L	0.382
1220493	Decommission	H	0.53
1220496	Inactivate	L	0.416
1220510	Inactivate	L	0.173
1220620	Decommission	L	0.459
1220655	Decommission	L	0.567
1220656	Decommission	L	0.268
1220725	Inactivate	L	0.125
1220744	Decommission	L	0.02
1230010	Decommission	N	0.257
1230108	Decommission	L	0.35
1230110	Inactivate	L	1.288
1230120	Inactivate	L	0.221
1230213	Inactivate	L	0.479
1230216	Decommission	M	0.099
1230216	Decommission	M	0.782
1230220	Decommission	N	1.009
1230225	Decommission	N	1.082
1230231	Inactivate	L	0.173
1230238	Decommission	N	0.131
1230240	Decommission - Convert to Trail	L	0.267
1230247	Decommission	N	0.324
1230250	Decommission	N	0.407
1230290	Decommission	N	0.346
1230320	Inactivate	L	0.438
1230338	Decommission	L	0.486
1230340	Decommission	M	0.323
1230451	Decommission	N	0.397
1230452	Decommission	N	0.242
1230455	Decommission	N	0.231
1230520	Decommission - Convert to Trail	L	0.907
1230521	Decommission	L	0.26
1230525	Decommission	N	0.266
1230550	Decommission - Convert to Trail	N	0.214
1230580	Inactivate	L	0.356
1230585	Inactivate	L	0.223
1230710	Decommission	H	0.152
1230730	Decommission	L	0.284
1230790	Decommission	H	1.087
1230865	Inactivate	L	0.209
1230900	Decommission	N	1.821
1230910	Inactivate	L	0.397
1230913	Decommission	L	0.313
1230920	Decommission	L	0.399

B & B ATERNATIVE 2 ROAD DECOMISSIONING			
Road Number	Activity	Sub-soil Priority	Miles
1230930	Inactivate	L	0.265
1230948	Decommission	L	0.595
1232263	Inactivate	L	0.665
1234022	Decommission	H	0.164
1234022	Inactivate	L	0.341
1234114	Inactivate	L	0.779
1235090	Decommission	M	1.187
1235198	Decommission	L	0.429
1235199	Decommission	L	0.125
1235270	Inactivate	L	0.127
1237200	Decommission	L	0.303
1237623	Decommission	L	0.22
1237630	Decommission	L	0.162
1237700	Decommission	L	0.281
1237850	Decommission	L	0.524
1237860	Decommission	L	0.662
1237867	Decommission	L	0.214
1260201	Decommission	N	0.185
1260235	Decommission	L	0.21
1260240	Decommission - Convert to Trail	N	0.81
1260243	Decommission	N	0.103
1260247	Decommission	L	0.154
1260260	Decommission	L	0.196
1260280	Decommission - Convert to Trail	N	0.101
1260292	Inactivate	L	0.384
1260294	Decommission	M	0.347
1260295	Decommission	L	0.37
1260590	Decommission	H	0.128
1260710	Decommission	M	0.299
1260730	Decommission	M	0.399
1260760	Decommission	H	0.455
1260765	Inactivate	L	0.495
1270610	Inactivate	L	0.272
1270615	Decommission	H	0.091
1270616	Inactivate	L	0.204
1270617	Decommission	L	0.165
1270618	Decommission	L	0.13
1270619	Decommission	L	0.129
1270715	Decommission	L	0.073
1270726	Decommission	L	0.13
1270800	Decommission	L	0.186
1270806	Decommission	L	0.13
1270810	Inactivate	L	0.628
1270832	Inactivate	L	0.171
1270833	Inactivate	L	0.146
1270850	Inactivate	L	0.354

B & B ATERNATIVE 2 ROAD DECOMISSIONING			
Road Number	**Activity**	**Sub-soil Priority**	**Miles**
1270910	Decommission	L	0.112
1270995	Inactivate	L	0.189
1280050	Decommission	L	0.327
1280100	Decommission	N	0.092
1280160	Decommission	L	0.236
1280224	Decommission	N	0.105
1280225	Decommission	H	0.317
1280430	Decommission	L	0.108
1280500	Decommission	H	0.198
1280500	Inactivate	N	0.186
1280650	Decommission	L	0.414
1280710	Inactivate	L	0.508
1290090	Inactivate	L	0.355
1290190	Inactivate	L	0.443
1290220	Inactivate	L	0.717
1290300	Inactivate	L	0.284
1292015	Inactivate	L	0.234
1292500	Decommission	H	0.984
1292640	Decommission	N	0.126
1292660	Decommission	L	0.159
2066050	Decommission - Convert to Trail	N	0.149
2066094	Decommission	N	0.066
2066118	Decommission - Convert to Trail	N	0.209
2066120	Decommission	N	0.155
2066155	Decommission	N	0.175
2066810	Inactivate	L	0.439
2067150	Inactivate	N	0.452
2068036	Inactivate	N	0.183
2068410	Decommission	H	0.398
2068412	Decommission	M	0.242
2070020	Inactivate	L	0.698
2070024	Decommission	N	0.163
2070101	Decommission	N	0.186
2070104	Decommission	N	0.388
2070110	Decommission	L	0.231
2076210	Decommission	H	0.288
2076240	Decommission	H	0.156
2076245	Decommission	H	0.151
2076250	Decommission	H	0.636
2076258	Decommission	L	0.26
2076270	Decommission	N	0.343
2076659	Inactivate	L	0.186
Note: Sub-soil priority: H-high, M-medium, L-low, N-none			

Alternative 3

Table 2-16. Outlets to be Armoured by Road Level

B & B ROADS ALTERNATIVE 3					
ESTIMATED # OF OUTLETS NEEDING ARMOR	**ROAD_NO_**	**LEVEL 1 (CLOSE)**	**LEVEL 2 OPEN**	**LEVEL 3 OPEN**	**TOTAL $ NEED**
2	1200000			$200	***$200***
10	1200800		$1,000		***$1,000***
3	1200860		$300		***$300***
40	1210000		$300	$3,700	***$4,000***
1	1210100		$100		***$100***
1	1210150		$100		***$100***
2	1210300		$200		***$200***
5	1220000		$500		***$500***
10	1220700		$1,000		***$1,000***
2	1230000		$200		***$200***
2	1230900		$200		***$200***
2	1230910	$200			***$200***
2	1230940		$200		***$200***
2	1232000		$200		***$200***
5	1234000			$500	***$500***
1	1234013	$100			***$100***
3	1237000		$300		***$300***
6	1280000		$600		***$600***
3	1280200		$300		***$300***
1	1280400		$100		***$100***
5	1292600		$500		***$500***
1	1292620	$100			***$100***
TOTAL	**109**				
ARMOUR OUTLEST TOTAL ALT 3		**$400**	**$6,100**	**$4,400**	**$10,900**
Note: Armor outlets of road waterbars, dips, and relief culverts that are within 320 ft of a stream and have slopes below the outlet that are >20%.					

Table 2-17. Relief Culverts by Road Number

B & B ALTERNATIVE 3 RELIEF CULVERTS			
ROAD #	**TYPE**	**NUMBER**	**Expense**
1210000	CMP	1	$3,600
1220650	CMP	1	$1,200
1220700	CMP	1	$1,200
1230000	CMP	1	$4,800
1230900	CMP	1	$2,480
1230900	CMP	2	$80
1234000	CMP	2	$2,400
1280000	CMP	1	$1,200
1280200	CMP	1	$2,400

1280220	CMP	1	$80
1280300	CMP	1	$1,200
1280400	CMP	1	$1,200
1290000	CMP	1	$1,200
1292000	CMP	1	$2,400
TOTAL CMP NEEDED		**16**	**$25,440**
Note: Install additional relief culverts or waterbars 160 ft before stream crossings that are downstream of hydraulically connected road segments below proposed units.			

Table 2-18. Waterbars by Road Number

B & B ALTERNATIVE 3 WATERBARS			
ROAD #	**TYPE**	**NUMBER**	**Expense**
1210150	WATERBAR	1	$80
1210300	WATERBAR	2	$160
1210870	WATERBAR	1	$80
1230330	WATERBAR	1	$80
1230910	WATERBAR	2	$160
1230930	WATERBAR	1	$80
1230940	WATERBAR	1	$80
1230940	WATERBAR	2	$80
1232310	WATERBAR	1	$80
1234013	WATERBAR	1	$80
1237000	WATERBAR	2	$160
1237620	WATERBAR	1	$80
1237650	WATERBAR	1	$80
1200860	WATERBAR1	1	$80
1280600	WATERBAR1	1	$80
1292600	WATERBAR1	1	$320
1292620	WATERBAR1	1	$160
TOTAL WATERBAR NEED		**21**	**$1,920**
Note: Install additional relief culverts or waterbars 160 ft before stream crossings that are downstream of hydraulically connected road segments below proposed units.			

Table 2-19. Replacement of Undersized Culverts

B&B ALTERNATIVE 3 REPLACEMENT OF UNDERSIZED CULVERTS					
	ROAD_NO_	**LEVEL 1 (CLOSE)**	**LEVEL 2 OPEN**	**LEVEL 3 OPEN**	**TOTAL $ NEED**
REMOVE UNDERSIZED CMPS REPLACE WITH 18" - 24" CMPS WITH ARMOR.					
APPROX 15 CMPS	**1210000**			**$25,000**	
APPROX 10 CMPS	**1234000**			**$15,000**	
APPROX 5 CMPS	**127000**		**$6,400**		
RECONSTRUCT/MED Total			***$6,400***	***$40,000***	***$46,400***

Alternative 4

Table 2-23. Biomass Product Units

SFP UNIT	Rx	Acres	Allocation	Species
93	SFP-SR	11	MAT	WF/DF
109	SFP-SR	12	MAT	PP/DF/WF
158	SFP-SR	8	MAT	WF/DF
160	SFP-SR	9	MAT	WF/DF
Note: Prescription(Rx)- SFP-SR(Special Forest Products-Stand Replacement)				

Table 2-27. Relief Culvert by Road Number

B & B ALTERNATIVE 4 RELIEF CULVERTS			
ROAD #	**TYPE**	**NUMBER**	**Expense**
1230000	CMP	1	$4,800
1234000	CMP	2	$2,400
TOTAL CMP NEEDED		**3**	**$7,200**
Note: Install additional relief culverts or waterbars 160 ft before stream crossings that are downstream of hydraulically connected road segments below proposed units.			

Table 2-26. Outlets to be Armored By Road Level

B & B ROADS ALTERNATIVE 4					
ESTIMATED # OF OUTLETS NEEDING ARMOR	**ROAD_NO_**	**LEVEL 1 (CLOSE)**	**LEVEL 2 OPEN**	**LEVEL 3 OPEN**	**TOTAL $ NEED**
10	1200800		$1,000		***$1,000***
5	1220000		$500		***$500***
2	1230000		$200		***$200***
2	1232000		$200		***$200***
5	1234000			$500	***$500***
1	1234013	$100			***$100***
3	1237000		$300		***$300***
TOTAL	**28**				
ARMOUR OUTLEST TOTAL AALT 4		**$100**	**$2,200**	**$500**	**$2,800**
Note: Armor outlets of road waterbars, dips, and relief culverts that are within 320 ft of a stream and have slopes below the outlet that are >20%.					

Table 2-28. Waterbars by Road Number

B & B ALTERNATIVE 4 WATERBARS			
ROAD #	**TYPE**	**NUMBER**	**Expense**
1230330	WATERBAR	1	$80
1232310	WATERBAR	1	$80
1234013	WATERBAR	1	$80
1237000	WATERBAR	2	$160
1237620	WATERBAR	1	$80
1237650	WATERBAR	1	$80
TOTAL WATERBAR NEED		**7**	**$560**
Note: Install additional relief culverts or waterbars 160 ft before stream crossings that are downstream of hydraulically connected road segments below proposed units.			

Alternative 5

Table 2-32. Biomass Product Units

SFP UNIT	Rx	Acres	Allocation	Species
56	SFP-SR	29	LSR	WF
58	SFP-SR	28	LSR	
77	SFP-SR	75	LSR	DF/WF
78	SFP-SR	19	LSR	DF/PP
80	SFP-SR	126	LSR	DF/PP
93	SFP-SR	11	MAT	WF/DF
109	SFP-SR	12	MAT	PP/DF/WF
152	SFP-SR	21	LSR	WF/DF
153	SFP-M	31	LSR	WF/DF
158	SFP-SR	8	MAT	WF/DF
160	SFP-SR	9	MAT	WF/DF
162	SFP-SR	14	LSR	WF/DF
167	SFP-SR	43	LSR	WF/DF
168	SFP-SR	26	LSR	WF/DF

Note: Prescription(Rx)- SFP-SR(Special Forest Products-Stand Replacement); SFP-M(Special Forest Products-Mixed Mortality);
Allocation- AWD(Administratively Withdrawn); LSR(Late Successional Reserve); MAT(Matrix);
Species- DF(Douglas Fir); LP(Lodgepole Pine); PP(Ponderosa Pine); WF(White Fir)

Table 2-35. Outlets to be Armored

B & B ROADS ALTERNATIVE 5

Armor outlets of road waterbars, dips, and relief culverts that are within 320 ft of a stream and have slopes below the outlet that are >20%.

ESTIMATED # OF OUTLETS NEEDING ARMOR	ROAD_NO_	LEVEL 1 (CLOSE)	LEVEL 2 OPEN	LEVEL 3 OPEN	TOTAL $ NEED
2	1200000			$200	***$200***
10	1200800		$1,000		***$1,000***
3	1200860		$300		***$300***
40	1210000		$300	$3,700	***$4,000***
1	1210100		$100		***$100***
1	1210150		$100		***$100***
2	1210300		$200		***$200***
5	1220000		$500		***$500***
10	1220700		$1,000		***$1,000***
2	1230000		$200		***$200***
2	1230900		$200		***$200***

2	1230910	$200			***$200***
2	1230940		$200		***$200***
2	1232000		$200		***$200***
5	1234000			$500	***$500***
1	1234013	$100			***$100***
3	1237000		$300		***$300***
6	1280000		$600		***$600***
3	1280200		$300		***$300***
1	1280400		$100		***$100***
5	1292600		$500		***$500***
1	1292620	$100			***$100***
TOTAL	**109**				
ARMOUR OUTLEST TOTALALT 5		**$400**	**$6,100**	**$4,400**	**$10,900**

Table 2-36 Relief Culverts to be Installed

B & B ALTERNATIVE 5			
Install additional relief culverts 160 ft before stream crossings that are downstream of hydraulically connected road segments below proposed units.			
ROAD #	**TYPE**	**NUMBER**	**$$$**
1210000	CMP	1	$3,600
1220650	CMP	1	$1,200
1220700	CMP	1	$1,200
1230000	CMP	1	$4,800
1230900	CMP	1	$2,480
1230900	CMP	2	$80
1234000	CMP	2	$2,400
1280000	CMP	1	$1,200
1280200	CMP	1	$2,400
1280220	CMP	1	$80
1280300	CMP	1	$1,200
1280400	CMP	1	$1,200
1290000	CMP	1	$1,200
1292000	CMP	1	$2,400
TOTAL CMPS NEEDED		**16**	**$25,440**

Table 2-37. Waterbars to be Installed

B & B ALTERNATIVE 5			
Install additional waterbars 160 ft before stream crossings that are downstream of hydraulically connected road segments below proposed units.			
ROAD #	**TYPE**	**NUMBER**	**$$$**
1210150	WATERBAR	1	$80
1210300	WATERBAR	2	$160
1210870	WATERBAR	1	$80
1230330	WATERBAR	1	$80
1230910	WATERBAR	2	$160

1230930	WATERBAR	1	$80
1230940	WATERBAR	1	$80
1230940	WATERBAR	2	$80
1232310	WATERBAR	1	$80
1234013	WATERBAR	1	$80
1237000	WATERBAR	2	$160
1237620	WATERBAR	1	$80
1237650	WATERBAR	1	$80
1200860	WATERBAR	1	$80
1280600	WATERBAR	1	$80
1292600	WATERBAR	1	$320
1292600	WATERBAR	2	$160
1292620	WATERBAR	1	$160
TOTAL WATERBAR NEED		**23**	**$2,080**

Table 2-38. Additional Roads Marked for Decommissioning in Alternative 5

ALTERNATIVE 5 PROPOSED ROADS DECOMMISSION FOR WILDLIFE		
ROAD #	**SURFACE**	**MILES**
1200105	NAT	0.12
1200430	NAT	0.42
1200432	NAT	0.26
1200552	NAT	0.35
1200620	NAT	0.49
1200630	NAT	0.63
1210391	NAT	0.22
1210395	NAT	0.33
1210430	NAT	0.13
1210465	NAT	0.10
1210482	NAT	0.07
1270825	NAT	0.11
1270953	NAT	0.13
1280159	NAT	0.20
1280370	NAT	0.29
2066330	NAT	0.23
2068203	NAT	0.16
MILES DECOMMISSION WILDLIFE		**4.52**
TOTAL MILES DECOMMISSION ALT 5		**55.11**

Table 2-39. Additional Roads Marked for Inactivation in Alternative 5

ALTERNATIVE 5 PROPOSED ROADS INACTIVATION WILDLIFE		
ROAD #	**SURFACE**	**MILES**
1200904	NAT	0.37
1210390	NAT	0.30
1210425	NAT	0.12
1210427	NAT	0.15
1270831	NAT	0.32
1270954	NAT	0.15
1270956	NAT	0.26
2068035	NAT	0.20
2068150	NAT	0.12
2068430	NAT	0.16
MILE INACTVATED WILDLIFE		**2.16**
TOTAL MILES INACTIVATED ALTERNATIVE 5		**21.83**

Resource Protection Measures

The following table summarizes design elements 8, 10, and 11

Unit Seasonal Restriction	Unit	Notes
Dry Season (Approx. June 15-Oct. 15), for Aquatic Concerns	1, 10, 26, 34, 37, 45, 46, 82, 93, 99, 100, 113, and Riparian Reserve Pods 6, 11, and 12	Applies to whole unit
Dry Season (Approx. June 15-Oct.15) **or** Winter Snowpack (minimum 20”), for seasonally wet soils or Aquatic concerns	23, 25, 27, 31, 32, 36, 67, 71, 73, 74, 76, 105, 106, 107, 111, 112, 115, 116, 118, 122, 124, 133, and 136	Applies to whole unit
Dry Season (Approx. June 15-Oct. 15) Log Haul, for sediment concerns	1, 2, 4, 6, 10, 25, 37, 38, 44, 45, 46, 47, 59, 91, 92, 93, 95, 99, 100, 124, 127, 128	Applies to log haul only; units 1, 10, 37, 45, 46, 93, 99, and 100 are also restricted to dry season operations within the entire unit (see above)

Appendix D

Responding To Recommendations Of Beschta Et Al. (1995) And Other Viewpoints On Post-Fire Salvage

The B and B Fire Salvage Interdisciplinary Team (IDT) considered the general principles and recommendations provided by Beschta et al in their paper "Wildfire and Salvage Logging", 1995. In addition, response is provided for the B and B Fire Salvage Project to comments made by Jerry Franklin to the Biscuit Recovery Project.

Based on considerable academic experience, the authors of Beschta et al provide their opinions on the issue of salvage following wildfires in the form of general principles and recommendations. The authors present their suggested policy principles and land management recommendations as generally applicable to federal lands throughout the western United States, or at least the interior Columbia and upper Missouri basins. The recommendations presented in the paper are not focused on the specific ecological, social, and economic characteristics of the post-fire conditions of the B and B Fire area. Additionally, the authors do not consider the multiple-use goals, objectives and standards of the Deschutes Forest Plan. Thus, the IDT considered the authors' suggested principles and recommendations in the context of specific post-fire conditions for the B and B Fire Area and Forest Plan management direction of the Deschutes National Forest.

The following is a summary of how the IDT and B and B Fire Salvage FEIS addresses the issues raised by Beschta et al (1995). It focuses on the Beschta recommendations pertaining to post-fire practices since that is the subject of the actions proposed with the B and B Fire Salvage project. All bold text is from the Beschta document.

"Ongoing human activity and the residual effect of past activity continue to threaten watershed ecosystem integrity.

a. "The ability of ecosystems to recover has been substantially compromised."
b. "Attempting to continue to manage fire and its consequences without altering or controlling other threats to ecosystems integrity, including logging, grazing, road building, and mining is scientifically and pragmatically unsound."

It is recognized by the team that the subwatersheds within which proposed salvage would occur have degraded conditions incurred as a result of past management activities. Existing conditions for watershed health, soils, stream channels and fisheries are summarized within the Affected Environment of the EIS. Although past management has caused some levels of environmental stress, land management agencies have made significant progress toward a holistic ecosystem approach in recent years (Everett, 1995).

The Metolius Watershed Analysis (1996) and the Metolius Late Successional Reserve Analysis (1996) both describe ecosystem system conditions, function, and processes in comparison to historic conditions for portions of the B and B Fire Salvage Project Area. Both of these analyses were considered in designing alternatives, and in describing the effects of the salvage proposal documented in the B and B Fire Salvage FEIS. The effects of the proposed salvage and alternatives on watershed, soils and other resources are described in the FEIS.

Analysis of post-fire conditions does reveal that cumulative effects as a result of the B and B Fire may have placed some of the ecosystem components at risk for degradation, specifically erosion susceptibility, sediment yield and channel integrity. The risks identified, however, are short-term when considering vegetative recovery following the fire. Field reconnaissance of burn severity and vegetative recovery in the first year has shown that re-growth has not been inhibited as a result of the fire and that the ability of this ecosystem to recover has not been compromised beyond repair.

Proposed salvage activities cover a small percentage of the subwatersheds in question and would be implemented in conjunction with Best Management Practices intended to reduce detrimental impacts capable of exacerbating watershed conditions. The project also extends protection for riparian areas and stream courses beyond that specified by Riparian Habitat Conservation Areas (RHCA) and Riparian Reserves in order to reduce disturbance from proposed activities on slopes within a sediment delivery distance from these channels.

The proposed salvage described in the B and B Fire Salvage FEIS is a one of several projects being considered in a larger context of fire restoration and recovery for the B and B Fire. A road analysis has been completed and a road management proposal has been developed which proposes to reduce the number of miles of open road within the B and B Fire Area. Many road locations proposed for closure and/or obliteration are within or along intermittent stream channels that were identified as direct sediment and runoff sources to these streams. Burned Area Emergency Rehabilitation (BAER) projects such as slope stabilization, contour felling and culvert repair and replacement have been completed within the fire perimeter, while several other projects aimed at recovery and restoration of the resources are in various stages of development and planning.

“Fires are an inherent part of the disturbance and recovery patterns to which native species have adapted.

a. “Fires are part of the pattern of disturbance and recovery that provides a physical template for biological organization at all levels.” Fires reset temporal patterns and processes that, if allowed to proceed undisturbed by additional human impacts, provide dynamic and biologically critical contributions to ecosystems over long time frames.”

In significantly altered ecosystems, natural disturbance processes may no longer be operating within historical ranges of variability (Agee 1994b, Hessburg et al. 1994), and their effects may be as foreign to the functioning of the ecosystem as human activities (Everett, 1995). The role of fire as a natural disturbance process within the B and B Fire area is described in the Metolius LSRA and in the B and B Fire Salvage FEIS.

The action alternatives in the B and B Fire FEIS were crafted to retain the ecological benefits of the fire while responding to the needs of society and goals of the Forest Plan. The historic role of fire as a disturbance process within the B and B Fire is described in both the B and B Fire Salvage FEIS and Metolius LSRA. Additionally, historic fire regimes are described in the Metolius Watershed Analysis, for Mixed Conifer Dry PAG on pages 54 and 55, and for the Ponderosa Pine PAG on pages 63 and 64.

Though fire is recognized as an important disturbance process within the B and B area several points must be considered in the management of the area.

- The conditions present within the B and B fire area prior to the fire reflected past management history including fire suppression. These conditions include four major vegetation trends (Metolius LSRA, 1996):

    - Greatly increased stand densities
    - Mortality of larger trees, insect and disease damage, catastrophic fire risk are increasing.
    - Species composition has been shifting from early to late seral species.
    - Stand structure has been shifting from larger tree sizes to smaller tree sizes, and from single or two canopy layers to multi-canopy layers.

- Given that the pre-fire vegetation conditions were outside the historic ranges of variability, the fire itself was of such an intensity and size that also was outside the range of historic of variability.

- The effects of the B and B Fire may include post-fire conditions that are uncharacteristic of historic fires.

- The design of the action alternatives in the B and B Fire salvage FEIS includes actions that would restore vegetation and fuels to sustainable conditions within treated areas.

In a study he conducted of fire history in the Jefferson Wilderness Area east of the cascade crest, approx. 7 miles west of the B and B Fire Area, Steve Simon, Area Fire Ecologist, made the following observation for the Grand Fir Zone "Without periodic burning there has been a marked increase in fuel loading and ladder fuels capable of carrying fire into the upper crowns" (Simon, 1991).

b. "The 'patchiness' of fire is a desirable characteristic, and many species depend on the environmental influences that fires create."

The area of National Forest lands within the perimeter of the B and B Fire totals 17,786 acres. Table F-1 displays, by burn severity, the amount of area proposed for salvage activity for Alternative 2, the preferred alternative.

Table F-1. B&B Fire Burn Severity and Salvage Treatment

Burn Severity	Acres Within B and B Fire Perimeter	Acres Proposed for Treatment in Alternative 2	Percent of Area Proposed for Treatment	Percent of Area Where No Treatment Would Occur
Mixed	3050	416	14	86
Non-Lethal	1915	0	0	100
Stand Replacement	12821	4430	35	65
Total	17786	4846	27	73

The amount of area left untreated with either salvage or special forest product utilization represents the majority of the B and B Fire area. Areas left untreated would recover at natural rates. Units selected for treatment are distributed within the fire area so that a patchwork of treated and untreated areas would result in a "mosaic" of conditions, resembling the patchiness associated with fire.

“There is no ecological need for immediate intervention on the post-fire landscape.”

The ecological need for salvage and fuels treatment within the B and B Fire area is based on the opportunity which exists to move some of the landscape toward vegetation and fuels conditions more reflective of those which supported a short interval fire-adapted fire regime (Fire Regimes I and IIIa, described in the Fire and Fuels Section, Chapter 3, FEIS). This fire regime occurs on approximately 83% of the B and B Fire area. Implementing activities which restore appropriate species composition, stand density, and fuels conditions that are consistent with these fire regimes would result in a more fire resilient forest (Agee, 2002).

Included in the purpose and need of the B and B Fire Salvage project is the recovery of economic value of burned timber. In order to recover this value, burned trees need to be harvested within two to three years in order to remain economically viable under the proposed prescriptions.

The recovery of economic value from burned trees also generates a source of funding to plant trees within activity units considered to be in the Stand Replacement mortality class (Mortality >80%). This would jump-start the return of conifer cover in approximately 20 and 30% of the two primary subwatersheds within the fire perimeter. Proposed activities would enter approximately 5,000 or 3,000 acres, respectively, for salvage operations under Alternatives 2 and 3 out of a total of 23,000 acres burned.

Immediate intervention was implemented following the fire in order to reduce the risk of increased water yield and storm flows under low cover conditions. BAER response included contour felling and seeding of approximately 2,499 acres of slopes exceeding 30% considered to have an elevated risk of erosion from overland flows created by convective storm events. Culverts on the primary forks of Spring and Street Creeks were repaired at the major mid-watershed locations and re-designed and replaced at the lower road crossings of these same streams in order to accommodate increased storm flows generated by the burned landscape. Improved fish passage was also accomplished on lower Street Creek as a result of these activities.

Existing condition should not be used as “baseline” or “desired” conditions upon which to base management objectives.

Management objectives are not based on the existing conditions following the B and B Fire. Existing conditions are used as a baseline upon which to measure the effects of the propose activities. Desired conditions and management objectives are described in the Deschutes Forest Plan. Effects of the B and B Fire and proposed activities, as well as cumulative effects are described in the FEIS, Chapter 3 for all resources affected.

No change to desired conditions described in the Forest Plan are being proposed. Forest Plan standards and guidelines are adhered to for the activities proposed.

“Fire suppression throughout forest ecosystems should not automatically be a management goal of the highest priority.”

General fire suppression goals, and standards and guidelines are described in the Deschutes Forest Plan and Fire Management Plan. Fire management goals and forest wide standards and guidelines are described in the Forest Plan pages 4-73 through 4-74. Fire suppression is beyond the scope of this salvage proposal and analysis.

“The region’s ecosystems, not just forests, are under severe strain. From a watershed perspective, the region suffers an ecosystem health problem, but the primary cure rests in curtailing human activities known to be damaging and counterproductive, and repairing or restoring roads that act as permanent sources of adverse impact.”

The analysis conducted for the B and B Fire Salvage is landscape based and borrows from both the Metolius LSR Assessment and the Metolius Watershed Analysis. Both of these documents describe historic and current conditions based on ecosystem processes, conditions and functions. There are other scientific views which support an active role in restoring vegetation and fuels conditions following a fire event (Fitzgerald, 2002 and Brown, 2003).

The B and B IDT conducted a road analysis containing recommendations for road obliteration (decommissioning) and road closures (inactivation). These recommendations are being carried forward to a road management proposed action. The road management proposed action has completed the scoping process and will be documented in a separate environmental document. The road management proposal is considered in the B and B Fire salvage FEIS as a reasonably foreseeable future action.

"We recommend that management of post-fire landscapes should be consistent with the following principles."

a. "Allow natural recovery and recognize the temporal scales involved with ecosystem evolution." "Human intervention on the post-fire landscape may substantially or completely delay recovery… or accentuate the damage."
b. "There is little reason to believe that post-fire salvage logging has any positive ecological benefits, particularly for aquatic ecosystems."
c. "There is considerable evidence that persistent, significant environmental impacts are likely to result from salvage projects… These impacts include soil compaction and erosion, loss of habitat for cavity nesting species, loss of structurally and functionally important large woody debris."

Analysis of the potential effects of the B and B Fire Salvage project within the EIS does not indicate that primary ecosystem processes would be detrimentally impaired by the proposed activities. Key watershed functions such as water yield, sediment delivery and peak storm flows have been elevated from pre-fire conditions by the fire and were analyzed to be nearly immeasurably exacerbated by proposed activities implemented under recommended RHCA buffer widths and Best Management Practices (BMPs) included in the EIS. Harvest and yarding systems utilizing helicopter and skyline operations are proposed on slopes exceeding 30% to reduce disturbance to the soil resource, while ground-based harvest systems would be implemented using designed layouts intended to limit the extent of multiple machine trips and associated detrimental compaction.

The Forest intends to implement the proposed activities in a manner in which the needs of soil, water, wildlife, fisheries and ecosystem resources are provided for within the context of the treatment proposals. Erosion losses, sediment delivery and water quality are addressed by proposing harvest activities outside the riparian areas sediment delivery boundaries in order to reduce disturbance of the soil and vegetation that has returned following the fire. Harvest prescriptions have been designed to provide enough snags for cavity nesting and foraging species and sufficient coarse woody debris to meet the needs of wildlife species dependent upon them.

The B and B EIS proposes no activities within the aquatic and riparian ecosystems. Portions of the riparian reserves were aerially seeded following the fire and had some diversity planting of native tree and shrub species. Large wood that was documented to have burned out of stream channels will be replaced naturally with currently standing dead and newly fallen trees that were killed by the fire. Although sediment delivery and runoff has the potential to increase during the immediate post-fire, low cover conditions, some vegetative cover has already returned within the riparian areas which will not be disturbed by proposed activities. These areas will be allowed to recover naturally and have been jumpstarted to some degree by the diversity planting implemented during the spring of 2003. There are also numerous upland acres within the fire perimeter that are not proposed for salvage and would also be left to recover naturally.

“No management activity should be undertaken which does not protect soil integrity.”

a. **“Soil loss and compaction are associated with both substantial loss of site productivity and with off-site degradation (water quality).”**
b. **“Reduction of soil loss is associated with maintaining the litter layer.”**
c. **“Although post-burn soil conditions may very depending upon fire severity, steepness of slope, inherent erodibility, etc., soils are particularly vulnerable in burned landscapes.”**
d. **“Post-burn activities that accelerate erosion or create soil compaction must be prohibited.”**

The EIS includes analysis of soil conditions following the fire and those predicted as a result of the proposed activities. Post-fire burn severity was found to be predominately moderate and low within the fire perimeter with less than 2% having high burn severities capable of altering productivity or hydrologic functions. While the initial vulnerability of the soil and water resources to erosion mechanisms is elevated due to the loss of cover, the return of vegetation has and will continue to occur on these sites under uninhibited post-fire rates.

Proposals to salvage log within the fire perimeter are acknowledged to incur detrimental soil disturbance in the form of compaction, vegetative disturbance from crushing and uprooting, and some levels of organic litter disturbance, especially within units proposed for ground-based harvest and yarding operations. The proposed harvest and yarding systems are designed in order to limit these impacts to meet standards and guidelines for the soil resource outlined in FSM-2500, R6 Supplement 2500-98-1. Hand-fell harvest and Helicopter and Skyline yarding systems are proposed for units with slopes exceeding 30% and ground-based logging systems would be implemented under BMP’s intended to limit the amount of detrimental compaction incurred. Subsoiling rehabilitation would be utilized to relieve compaction within ground-based units where detrimental conditions exceeded 20% of the activity area following harvest and yarding activities.

Disturbance levels following operations within activity units are not predicted to extensive enough to significantly reduce soil productivity or increase erosion losses from overland flows. Riparian protection buffers have been extended along the primary forks of Street and Spring Creeks to 320 feet in order to reduce the amount of soil disturbance within sediment delivery zones capable of sourcing sediment to intermittent or perennial stream channels. Areas in which harvest activities are proposed would also have increased amounts of debris and litter on the soil surface as a result of operations, reducing the energies of overland flows and limiting sediment movement as a result of sheet erosion. Additional sediment delivery as a result of proposed activities is predicted to be a fraction of that exposed and potentially delivered under post-fire conditions alone.

“Preserve species’ capability to naturally regenerate.”

> **“If warranted, artificial regeneration should use only species and seed sources native to the site, and should be done in such a way that recovery of native plants or animals is unhampered.”**

Aerial seeding of non-native, non-persistent species mix comprised of soft, white winter wheat (“Madsen”) and annual ryegrass (“Gulf”) was implemented over approximately 2,500 acres by the BAER team for slopes considered to have an elevated risk of erosion due to the loss of surface cover. Photo monitoring of the 1994 Entiat fires on the Wenatchee National Forest show that these species do not persist at levels capable of inhibiting the return and growth of native species beyond three years.

Planting of native conifer seedlings has occurred on 500 acres and is proposed to occur on about 3,900 acres following proposed harvest activities. Natural regeneration of conifers throughout the Stand Replacement mortality areas is unlikely to occur at significant rates since last years’ seed sources were burned before full maturation. The return of native annuals and shrubs has occurred to significant cover levels within other fire salvage areas on the Forest and has already become well established during the first growing season following the fire.

“Do not impede the natural recovery of disturbed systems.”

Much of the watershed would be left for natural recovery processes. Exotic noxious weed populations would be combated to limit their influence on delaying the recovery of native species. Extensive surveys, manual treatment, and monitoring of noxious weeds began in the fall of 2002 and will continue indefinitely. Decommissioning of roads would remove some roadbeds from and adjacent to stream channels that currently contribute sediment and runoff directly to the aquatic system. Additional roadbeds located in upland areas are also proposed for decommissioning, returning areas capable of supporting vegetation to a less disturbed condition.

Recommendations on Post-fire Practices

"Salvage logging should be prohibited in sensitive areas."

- **a. "Logging on sensitive areas is often associated with accelerated erosion and soil compaction."**
- **b. "Salvage logging by any method must be prohibited on sensitive sites, including: severely burned areas (no duff layer), on erosive soils, on fragile soils, in roadless areas, in riparian areas, on steep slopes, or any site where accelerated erosion is possible."**

The B and B ID team considered sensitive areas when designing alternatives for the project. Best Management Practices (BMPs) and the Deschutes National Forest Plan mandate specific protection for soil and water resources during proposed harvest activities. Recommendations for the use of hand felling along with helicopter and skyline yarding are to be implemented on units where slopes exceed 30%. No activities are proposed within roadless areas or Riparian Habitat Conservation Areas or Riparian Reserves. Additional protection for primary intermittent and perennial stream reaches have been extended to 320 feet in order to minimize disturbance within distances capable of delivering sediment to existing channels during sheet erosion events.

Soils within the B and B fire perimeter were exposed to wind and water erosion mechanisms as a result of the consumption of surface litter, duff and live vegetative components. Most of the soils located within proposed activity units with Sand Replacement harvest prescriptions had their duff layer entirely consumed during the fire and would meet the Beschta criteria for classification as sensitive. Some of these areas have had significant needle fall following the fire and most have had vegetative re-growth of annuals, shrubs and seeded grass that is providing litter cover capable of reducing raindrop impacts, overland flow energies and post-fire susceptibility to erosion.

"Fragile" soils were considered to be those identified as sensitive soils in the Deschutes Land Resource Management Plan, including soils with slopes exceeding 30% having elevated erosion risks and those located in bottomland landscape positions likely to have seasonal water tables. No activities are proposed within bottomland soil types while hand-fell harvest and helicopter or skyline yarding systems have been recommended for slopes exceeding 30%. These systems would lop tops off of merchantable material before yarding occurred and variably pile them to break up the continuity and reduce the overall levels of activity fuels on these sites.

"On portions of the post-fire landscape determined to be suitable for salvage logging, limitations aimed at maintaining species and natural recovery processes should apply."

- **a. "Dead trees (particularly large dead trees) have multiple ecological roles in the recovering landscape including providing habitat for a variety of species, and functioning as an important element in biological and physical processes. In view of these roles, salvage logging must leave at least 50% of the standing dead trees in each diameter class; leave all trees greater than 20 inches dbh or older than 150 years; generally, leave all live trees."**

b. **"Because of soil compaction and erosion concerns, conventional types of ground-based yarding systems should be generally prohibited."**
c. **"Helicopter and cable systems using existing roads and landings may be appropriate, however, even these… methods could locally increase runoff and sediment."**

The value of dead trees in biological and physical processes is recognized by the team and addressed in the snag and downed wood habitat and soils sections of Chapter 3. Current snag and downed wood guidelines on the Forest are a result of Northwest Forest Plan and Deschutes LRMP direction for retention, recruitment and cycling of snags and coarse woody material at levels that maintain ecological processes across the landscape. Harvest prescriptions would leave approximately 1/3 to1/2 of merchantable material over 10" in order to meet guidelines for snags for each Plant Association Group. No upper diameter limit has been set for the harvest prescriptions which could result in the harvest of trees over 20" within proposed activity units.

Silviculture prescriptions for salvage call for the removal of trees that are already dead or not expected to survive using criteria considering post-fire crown and bole scorch. Proposed activity area acreage within the Stand Replacement mortality class (>80% mortality from the fire) is about 35% of the total amount within the fire perimeter, leaving nearly 7,500 acres of untreated stands that would have 100% of the stand volume left on site to provide snag and coarse woody material.

All harvest and road related activities proposed in the salvage are consistent with the goal of minimizing soil erosion and negative impacts to both terrestrial and aquatic environments. Ground-based harvest and yarding systems are proposed within activity units with slopes <30% and would utilize BMPs to limit the extent of detrimental disturbance. The team has recommended additional protection for primary intermittent and perennial reaches of stream channels to address concerns for increased erosion and sediment delivery as a result of proposed activities.

"Building new roads in the burned landscape should be prohibited."

The action alternatives of the B and B EIS do not include any permanent road construction although they do propose to construct approximately 2.1 and 1.4 miles of temporary road, respectively, to access ridgetop locations above units identified for skyline yarding systems. Approximately 2.1 miles of currently closed roads will also be temporarily opened for harvest removal. All temporary roads constructed under this EIS would be fully decommissioned and allowed to revegetate following proposed activities requiring their use.

Current road densities within the primary subwatersheds of the analysis exceed Forest Plan Standards and Guidelines and may be contributing to elevated storm flows and sediment delivery to stream channels. The B and B ID team acknowledges that high road densities can be linked to a series of negative effects to the aquatic environment, including increased drainage miles and run-off, and potentially altered water chemistry. Wemple et al. (1996) demonstrates how road systems can increase peak flows and that drainage ditches can form gullies that can lead to direct input of flows and sediment to streams.

The B and B ID team identified approximately 32 miles of roads for obliteration or closure in the roads analysis in order to address density, run-off and sediment delivery problems. Some roads and culverts within the fire perimeter have been re-designed and improved as a part of the Burned Area Emergency Restoration package implemented in the fall of 2002 and the spring of 2003. Although road management is not a part of the EIS decision notice, it will be proposed in a separate environmental analysis.

"Active reseeding and replanting should be conducted only under limited conditions."

a. **"Active planting and seeding has not been shown to advance regeneration and most often creates exotic flora. Therefore, such practices should be employed only where there are several years of evidence that natural regeneration is not occurring."**
b. **"Native species from regional stocks that may enhance fire resistance of site may be planted if the effect is to not homogenize the landscape."**

c. **“Seeding grasses into burned forests has been shown to disrupt recovery of native plants and is likely to create more problems than it solves.”**
d. **“The use of pesticides, herbicides, and fertilizers should generally be prohibited.”**

Planting of conifer seedlings in salvage units would occur following proposed harvest activities to re-establish live conifers within the fire perimeter in a time frame where competition from shrubs and grasses would not inhibit their establishment. Natural regeneration of conifers throughout the Stand Replacement mortality areas is unlikely to occur at significant rates since there is no longer any seed sources. The return of native annuals and shrubs has occurred within other fire salvage areas on the Forest and has already become well established during the first growing season following the fire.

Because a sufficient supply of native, local-source seeds was not available, a non-native, non-persistent species mix comprised of soft, white winter wheat (“Madsen”) and annual ryegrass (“Gulf”), was selected during the BAER response to the B and B fire to help provide cover on slopes considered to have an elevated risk for post-fire, rill erosion above intermittent and fish-bearing perennial stream reaches. Aerial seeding occurred over approximately 2500 acres considered at risk due to the loss of surface cover, location within a dry forest type, slopes over 20%, and/or the presence of volcanic ash soils. Photo monitoring of the 1994 Entiat fires on the Wenatchee National Forest have shown that these species do not persist at levels capable of inhibiting the return and growth of native species beyond three years.

No herbicide use within the burned area perimeter is planned. Control measures for noxious and invasive weeds have included grazing by goats, but the principal control measure has been, and continues to be manual pulling or cutting.

“Structural post fire restoration is generally to be discouraged”

None of the alternatives considered in the EIS propose the installation of additional “hard” structures to function as sediment traps, fish habitat or slope and bank stabilization. BAER response efforts following the fire implemented contour felling and log erosion barriers on numerous slopes within the fire perimeter to capture sediment carried by potential overland flows, especially during first year, post-fire conditions of low vegetative and organic cover. These structures have not been seriously tested by precipitation events and still have the capacity to capture sediment as vegetative growth returns on the soil surface.

Restoration, rehabilitation and enhancement within the aquatic ecosystem in this project area are limited at the current time. In channel stream work has been limited to the redesign and installation of culverts to ensure passage of post-fire storm runoff, smaller woody debris, and fish movements. No plans are being considered to increase wood concentrations manually or to build sediment traps or other types of channel restoration/ rehabilitation or fish habitat enhancement projects as a result of the fire or as a result of the salvage operations.

The ID team completed a roads analysis during the EIS process and has made recommendations for the closure and/or decommissioning of approximately 32 miles of roads within subwatersheds burned by the fire. Priority conditions for closure were identified as those roads considered to be direct conduits to stream channels for storm flows and sediment that are located within or immediately adjacent to intermittent or perennial stream channels. Although road management for the fire area is not a part of the decision notice for the B and B EIS, the implementation of a separate road management Environmental Analysis is intended in the near future and would likely be a significant improvement to the current health of the aquatic environment in the watershed in terms of sediment delivery and storm flows. The EIS does include proposals to implement temporary roads for the action alternatives in order to access the ridge tops above a few units for skyline yarding. These roads would be fully decommissioned following proposed harvest activities and should not contribute to runoff or sediment production after subsoiling and obliteration activities occurred.

“Post-fire management will generally require reassessment of existing management.”

a. By increasing runoff, erosion, and sedimentation, fire may increase the risks posed by existing roads.
b. Therefore, post-fire analysis is recommended to determine the need for undertaking road maintenance, improvement, or obliteration.

The B and B IDT conducted a road analysis containing recommendations for road obliteration (decommissioning) and road closures (inactivation). These recommendations are being carried forward to a road management proposed action. The road management proposed action has completed the scoping process and will be documented in a separate environmental document. The road management proposal is considered in the B and B Fire salvage FEIS as a reasonably foreseeable future action.

Immediately following the B and B Fire resource conditions were assessed as part of the Burned Area Emergency Rehabilitation (BAER) process. Additional assessment was completed in a rapid assessment effort conducted by the district and forest specialists. These assessments considered existing management and the risks inherent in the condition of the watershed, from which numerous fire recovery and rehabilitation projects have been proposed or completed.

"Continued research efforts are needed to help address ecological and operational issues."

The ID team acknowledges the value of continued research in these areas although the EIS does not propose, authorize or fund any research activities. The BAER response team provided funding for the implementation and monitoring of post-fire slope stabilization treatments such as aerial seeding and log erosion barriers and the Forest is coordinating research with a Portland State Masters thesis project tracking sediment traps installed within the fire perimeter. Oregon State University is also conducting research within the fire perimeter under Professor Kathy Hibbard, who is examining seedling physiologic responses to post-fire environments. Considerable research has begun regarding fire ecology, fire effects, fire risks, fire recovery and restoration as part of the Joint Fire Science Program and the National Fire Plan throughout the western regions over the past number of years.

Reburn issues in post-fire environments are discussed within the effects analysis of the EIS. The team recognizes that the likelihood of ignition does not change significantly as a result of salvage or increased down wood levels. What can change, however, are fire behaviors, intensities and associated effects to resources should a reburn occur. Ice (1996) references the reburn of the Tillamook fire in the Oregon coast range within six years following that event. Anecdotal references document the reburn of thousands of snags and deadfall down wood throughout the fire area, although no evidence of the severity of this event was included. Proposed salvage is intended to reduce the amount of dead vegetation accumulated on these sites and provide breaks in the continuity of fuel loads across this landscape. Large continuous areas of high fuel loads are more likely to result in larger fires than where the spatial arrangement of high fuel loads is discontinuous.

The role of down and dead wood in providing for the full range of ecosystem processes and the needs of species is an ongoing debate. The B and B EIS provides for snag and coarse wood levels mandated by the Deschutes LRMP standards and guidelines and the Northwest Forest Plan. The introduction of the Decayed Wood Advisor (DecAID) tool developed by Marcot et al. (2002) into the wildlife analysis of this project is an ongoing endeavor used as an advisory analysis tool to help land managers evaluate effects of forest conditions and proposed management activities on organisms that use snags, down wood, and other wood decay elements. A large number of acres within the fire perimeter would not have any wood removed as a result of proposed activities and would carry significant loads of this material into the future. Treated acres would have snags and down wood at levels that would provide for some of the needs of species associated with this component.

The environmental effects of post-fire salvage and site preparation are described within the EIS in context to existing watershed and resource conditions under a no action scenario following the fire. Effects analysis includes documentation of the results of available research to describe predicted effects from the proposed activities.

“Additional information must be provided to the public regarding natural fires and post-burn landscapes to provide balance to a ‘Smokey Bear’ perspective of fires and forests. “

a. **Although post-fire landscapes are often portrayed as “disasters” in human terms, from an ecological perspective, fire is part of the normal disturbance regime and renewal of natural forest ecosystems.**
b. **An increased appreciation and understanding of natural disturbance regimes in the ecology of forest ecosystems is needed by the public, and the public’s land managers.**

Changes in federal wildland fire management are evident in: The Federal Wildland Fire Management, Policy and Program Review (1995), Managing the Impact of Wildfires on Communities and the Environment – A Report to the President In Response to the Wildfires of 2000, and A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy (2001). The National Fire Plan goals are:

- Ensuring sufficient firefighting resources for the future;
- Rehabilitating and restoring fire-damaged ecosystem;
- Reducing fuels (combustible forest materials) in forests and rangelands at risk, especially near communities; and
- Working with local residents to reduce fire risk and improve fire protection.

Specific to the B and B Fire, fire regimes are addressed in both a historic and existing context as well as vegetation conditions. Vegetation and fuels conditions that are sustainable considering the role of fire in this landscape are described in the Metolius LSR Assessment. Though fire occurrence is natural considering the lightning ignition source, the fire behavior observed (rate of spread, spotting, intensity, etc.) was not. Fire behavior is largely dependent on the amount, arrangement and condition of fuels and vegetation. The conditions of fuels and vegetation for much of the B and B Fire area was outside the range of historic variability, the fire burned at higher intensities over a larger portion of the area than would have been expected if conditions were closer to HRV’s.

The effects, then, of the B and B Fire are also more severe than would be expected historically. Following fires these same sites are outside the historical range of variability in amounts of snags and logs (Everett, 1995). Unless dead material is removed and stands are subsequently managed for historical tree densities , future fuel loading will be outside the historical range of variability for both live trees and dead and down, creating the potential for intense reburn situations. The “intense reburn” assumption is based on the physics of fire behavior, the greater the amount of available fuel the greater the fireline intensity in BTU’s and the difficulty of fire suppression (Rothermel, 1983).

Recommendations Concerning Fire Management

“Fire suppression activities should be conducted only when absolutely necessary and with utmost care for the long-term integrity of the ecosystem and the protection of natural recovery processes.”

This recommendation is outside the scope of the B and B Fire Salvage EIS. Minimum impact suppression techniques were used on the B and B fire whenever possible. Specific environmental effects of fire suppression activities on the B and B fire are discussed within the Cumulative Effects Analysis portions of Chapter 3 in the EIS.

“When land ownerships are mixed, the federal land management agencies should establish policies to prevent conflicts between re-establishment of natural disturbance regimes on federal land and the protection of private property.”

This proposal for policy change is outside the scope of the B and B Fire Salvage EIS.

As noted above, the National Fire Plan goals include identification of natural fire regimes, and condition class, and working collaboratively with local land owners and residents to identify fire risk and reduce fuel hazards especially near communities.

Jerry Franklin's Comments on the Biscuit Fire DEIS

Jerry Franklin is professor of Ecosystem analysis, College of Forest Resources from the University of Washington in Seattle. Professor Franklin was part of the Forest Ecosystem Management Assessment Team (FEMAT) in 1993 that ultimately was used in the drafting of the Northwest Forest Plan Record of Decision in 1994. Professor Franklin provided comments to the Biscuit Fire EIS on the Siskiyou and Rogue River National Forests.

Jerry Franklin, in his comment on the Biscuit Recovery EIS, mentioned that "establishment of dense, uniform stands is completely inappropriate in the LSRs and on any PAG identified as fire regime types I and II" (Franklin 2004).

Reforestation at rates of 200 trees per acre is not considered dense because regenerated stands which are not treated will not be developing an intermediate tree component until the average stand diameter is more than 8" dbh (Cochran 1994). Reforestation in this context will have variability following prescribed fire because fuels treatments, unlike customary thinning treatments, will not leave a uniform level of fuels. Franklin proposes variability in planting where the plan here is to introduce variability in the survival or established tree.

The Biscuit Fire, located in southern Oregon and northern California, began on July 13, 2002 and reached 499,965 acres. Estimated to be one of Oregon's largest in recorded history, the Biscuit Fire encompassed most of the Kalmiopsis Wilderness. The boundary of the Biscuit Fire stretches from 10 miles east of the coastal community of Brookings, Oregon; south into northern California; east to the Illinois Valley; and north to within a few miles of the Rogue River.

In his comments specific to the Biscuit Fire, Professor Franklin asserts salvage logging in Late Successional Reserves does not contribute to the revival of forest habitat and that it is antithetical to the recovery process. He also states that the Late Successional network was designed to accommodate large, intense natural disturbances and allow for natural recovery processes. Further in his comments on page 5, he states "one might question the appropriateness of allowing natural recovery processes to proceed if stand-replacement fire behavior with the resulting high levels of fuels were not characteristic of the LSRs".

It should be noted that the 1994 Final Supplemental Environmental Impact Statement which resulted in the Northwest Forest Plan relied heavily on the Forest Ecosystem Management Assessment Team report (FSEIS, 1994, page 3 & 4-3). In the Record of Decision for the Northwest Forest Plan, additional analysis was used to design the Late Successional Reserve system to "achieve the biological results required by law, while minimizing adverse impact on timber harvest and jobs (ROD, 1994, page 26)." The FEMAT report acknowledged that the approach for adaptive management should be an objective in forest management as new or more complete science becomes available as we learn how the forest stands respond to environmental conditions that were impossible to forecast. Also, on page ii, the report acknowledges that the social and economic needs of humans should be considered.

The path chosen for the Biscuit Fire project may or may not be the best course of action for the B and B Fire. To let natural processes proceed may not be as appropriate. Agee recognized this point in his article in "Conservation Biology In Practice," winter 2002, that passive management on the eastside forest LSRs over a century could potentially lead to losses of over half of the reserves in that time frame due to stand replacement fires and insect attacks, leaving no old growth characteristics.

Franklin also acknowledges eastside systems may function differently from westside forest ecosystems. In the fall edition of "Issues in Science and Technology Online," Agee and Franklin coauthored an article that quotes: "Uncharacteristic stand-replacement fires in dry forests can produce uncharacteristic levels of post-fire fuels, including standing dead and down trees. Removing portions of that particular biological legacy may be appropriate as part of an intelligent ecological restoration program, and not simply as salvage." They recommend that any management for fuels and ecosystems should be science based, which this analysis is.

Also recently, the rate of loss of habitat including connectivity to the Late Successional Reserve system on the Deschutes National Forest and adjacent Forests may indicate a need for more active management. Especially for protection for remaining Nesting, Roosting, and Foraging (NRF) habitat for the northern spotted owl.

Two important points made in Agee's comments on passive management are "The hard lesson that we should take away from the last decade of fire management in drier forests, particularly in the North American West, is that a choice to do nothing is a choice of action, not always one with a desirable outcome." He also recommends "In order of priority treatment should focus on surface fuel, ladder fuel, and then crown fuel." (Agee 2002a).