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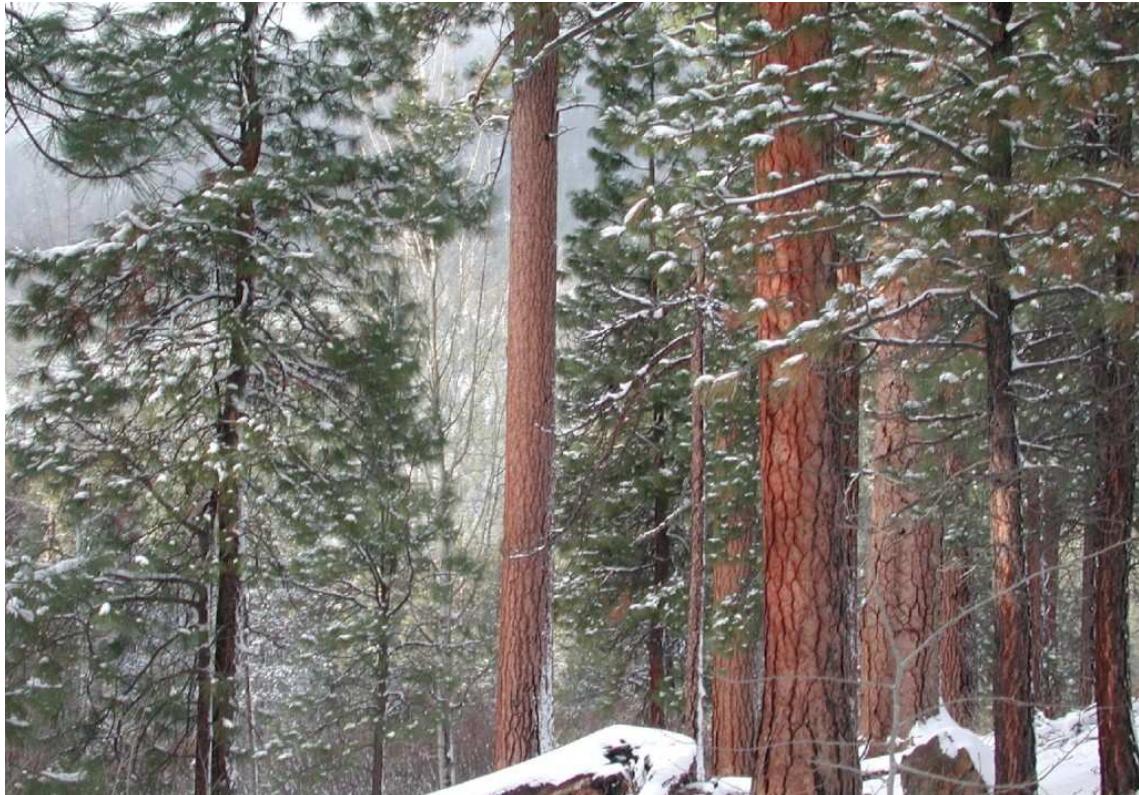
March 2008



Environmental Assessment

Glaze Forest Restoration Project

Sisters Ranger District, Deschutes National Forest
Deschutes County, Oregon



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Table of Contents

Summary	5
Introduction.....	7
Background.....	9
Management Direction.....	14
Analysis Considered and Incorporated By Reference	18
Desired Future Condition and Existing Condition.....	20
Purpose and Need for Action	25
Proposed Action	26
Decision Framework.....	26
Public Involvement	27
Consultation with Native American Tribes.....	28
Issues.....	29
Alternatives, including the Proposed Action	37
Alternative 1- No Action.....	37
Alternative 2- The Proposed Action.....	39
Alternative 3	42
Alternatives Considered But Eliminated from Detailed Study	45
Project Design Criteria and Mitigation Measures Common to All Alternatives .	45
Comparison of Alternatives	62
Environmental Consequences	69
Forest Vegetation.....	69
Hydrology	98
Fire Hazard	119
Wildlife	135
Fisheries	210
Botany/Rare Plants/Invasive Plants.....	230
Soils	241
Heritage Resources	261
Scenic Resources	264
Recreation Resources	272

Roads.....	277
Economics.....	281
Other Disclosures.....	288
Consultation and Coordination.....	290
References	291

SUMMARY

The Deschutes National Forest proposes to restore old-growth and second growth forests and Riparian Habitat Conservation Areas in the Glaze Forest Restoration Project with ecologically driven tree thinning, shrub mowing and prescribed fire on approximately 1,200 acres.

In 2005 a partnership to support proactive, restorative management in the Glaze area was proposed to the Forest Service by Tim Lillebo of Oregon Wild (formerly called the Oregon Natural Resources Council) and Cal Mukumoto of Warm Springs Biomass Project LLC. The goal of this partnership between a timber industry group, a conservation group, and the Forest Service is to break barriers of mistrust and create a template on how people with diverse viewpoints can cooperate to achieve ecosystem, community, and economic values. The partnership was formalized by a Challenge Cost Share agreement and is compliant with the Federal Advisory Committee Act. This is because although the partners provided their opinions, no agreements or consensus was sought from the partners on the course of action.

The project area is located 5 miles northwest of the City of Sisters, adjacent to the eastern boundary of Black Butte Ranch, a popular destination resort and homeowner community and is within the Sisters Ranger District, Deschutes National Forest, Oregon.

Remnant old growth forests are rare on the landscape and of great value both as habitat and to people who enjoy seeing large old trees. The partners support the Forest Service in developing a plan consisting of ecologically based management actions to benefit both old growth and second growth forest areas. Actions would restore structural and functional attributes of old growth forests that were once maintained by frequent fire and reduce the risk of damaging this unique area or surrounding communities with an uncharacteristic high intensity wildfire.

The partners also recognize that restoration cannot be accomplished without a supporting infrastructure which includes people, equipment, and markets for wood by-products such as biomass fiber or sawlogs. Revenues generated through by-products can help offset the high costs of restoration and produce jobs and economic benefits for local and regional economies.

This action is needed to improve forest health and sustainability by promoting the development of fire resilient old growth forest stands, diverse riparian forests, aspen stands, meadows, and large trees. An additional purpose of this project is to fulfill the goals of the partnership to collaboratively build trust and break barriers to achieve ecosystem, community, and economic values.

In addition to restoring old growth forests, the proposed action (Alternative 2) would reduce competing live ground, ladder and canopy vegetation and allow reintroducing the natural role of low intensity fire. Riparian Habitat Conservation Areas would also be restored by careful thinning and fuels reduction to improve the growth of vegetation and lower wildfire risk. These actions benefit fire and riparian dependent forests, plants and wildlife. Actions would lower the risk of moderate to high intensity wildfires to nearby communities, private properties, and special natural places as well as improve public and fire fighter safety.

The Forest Service evaluated the three alternatives:

- **Alternative 1 - No Action.** *No change would occur in the management of the area.*
- **Alternative 2- The Proposed Action.** *This alternative applies ecologically driven tree thinning to second growth and old growth forest areas. Trees up to 21" diameter may be cut, however mitigation measures address public concerns regarding trees over 16" diameter. Fuels reduction is accomplished by removing thinned trees and slash, and mowing shrubs. Low intensity prescribed fire would be used to re-introduce this important ecological process. This alternative uses an accepted shade model to allow hand thinning of smaller trees in Riparian Habitat Conservation Areas next to Indian Ford Creek from 12 to 50 feet from the creek. Thinning with low impact equipment over frozen ground is allowed in areas farther than 50 feet from the creek. Aspen stands, meadows and other Riparian Habitat Conservation Areas are treated by removing conifers and introducing prescribed fire.*
- **Alternative 3-** *This alternative addresses public concerns about removal of trees of commercial size in old growth stands by limiting the diameter of trees removed to under 6" (considered commercial size in Region 6). Second growth forests, aspen stands, and meadows are treated in the same manner as in Alternative 2. Alternative 3 also uses the accepted shade model for thinning in Riparian Habitat Conservation Areas but allows only hand thinning in Riparian Habitat Conservation Areas next to Indian Ford Creek.*

The number of acres treated in both alternatives is the same (approximately 1200 acres), however the action alternatives differ in the intensity of thinning old growth and the method of thinning in Riparian Habitat Conservation Areas.

Given the purpose and need, the deciding official would review the proposed action and the other alternatives in order to make the following decisions:

- Whether the Proposed Action would proceed as described, as modified, or not at all.
- What mitigations measures and monitoring requirements would be applied to the project.

For this decision, the District Ranger is the Responsible Official.

INTRODUCTION

Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into five parts:

- *Introduction:* The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Comparison of Alternatives, including the Proposed Action:* This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and/or other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Environmental Consequences:* This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.
- *Agencies and Persons Consulted:* This section provides a list of preparers and agencies consulted during the development of the environmental assessment. .

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

Glaze Forest Restoration Project Location

**Sisters Ranger District
Deschutes National Forest**

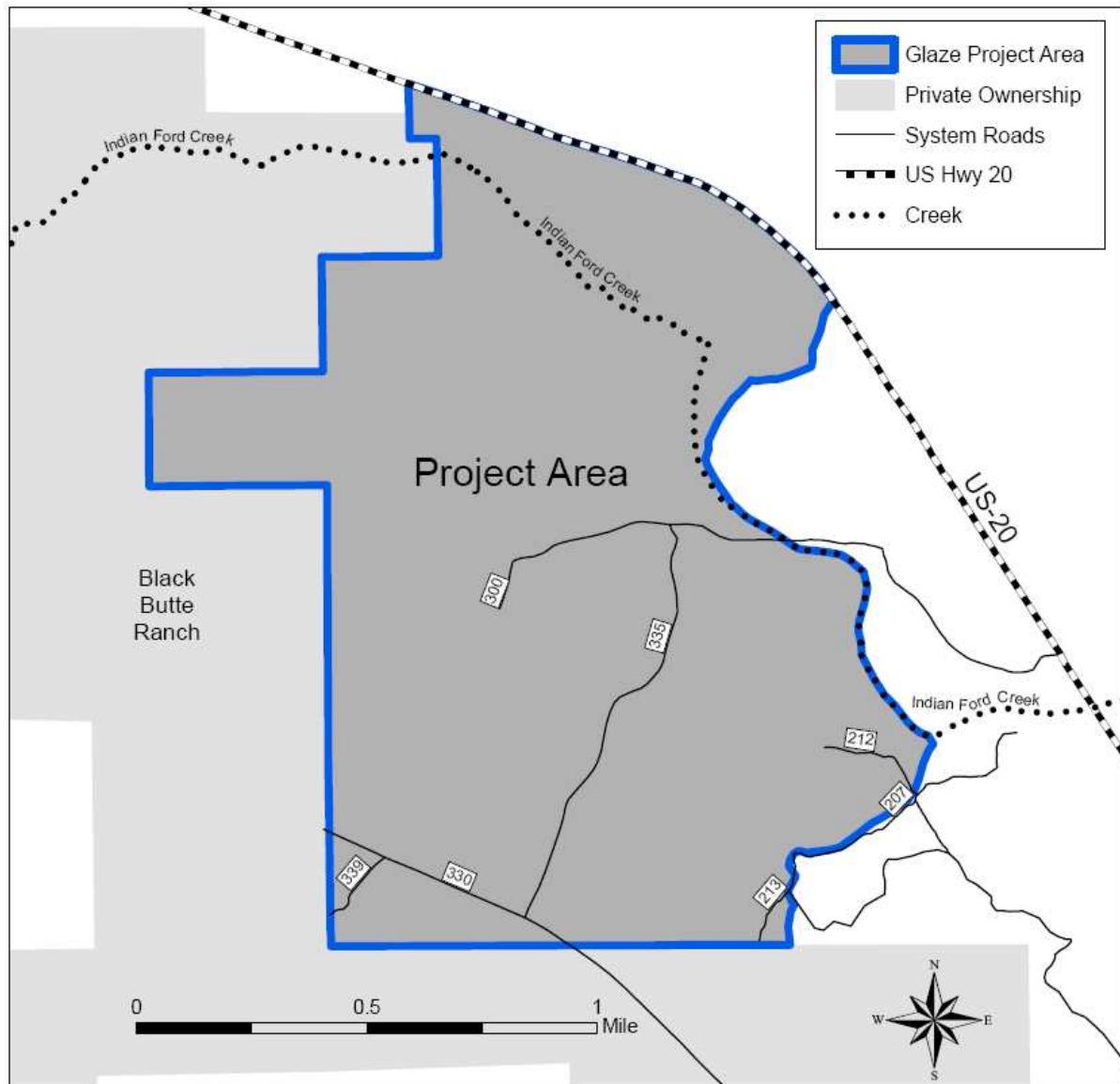
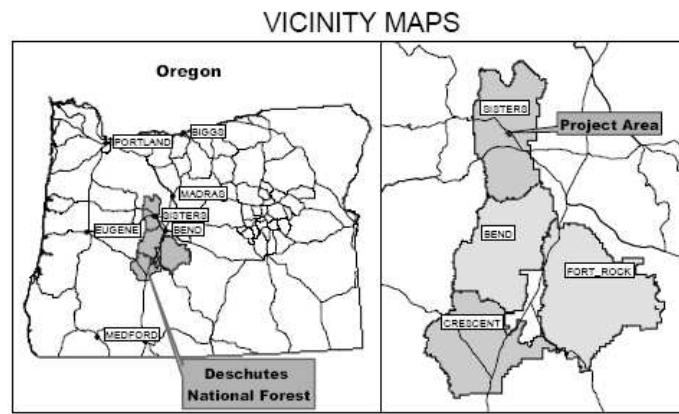


Figure 1- Glaze Forest Restoration Project Area

Background

Setting and Location

The Glaze Forest Restoration project includes about 1,200 acres within the 124,848 acre Whychus watershed. The project area is located 5 miles northwest of the City of Sisters, adjacent to the eastern boundary of Black Butte Ranch, a popular destination resort and homeowner community. The area is a diverse landscape of fire dependent old growth and second growth ponderosa pine forests, meadows, wetlands, and aspen stands and is bisected by Indian Ford Creek. Elevations range from about 3,240 feet at the eastern boundary to 3,360 at the western edge. Topography is essentially flat, with a gentle gradient that results in an eastern aspect.

The project area (Figure 1) is bounded by private lands on the south and west (primarily Black Butte Ranch), by Highway 20 to the north and by Indian Ford Creek, the east edge of Black Butte Swamp and forest road 1012-207 to the east. The legal description is as follows: T14S, R9E, sections 10, 11, 14 and 15, Willamette Meridian, Deschutes County, Oregon.

Area History

The Glaze area was used by Native Americans for hunting and gathering for thousands of years. Early European explorers and survey teams passed through in 1855 and 1870 and provide some early descriptions. A map from 1870 shows a trail labeled as "Trail to Warm Springs" along the east side of Glaze Meadow and then passing through the Indian Ford campground area (Hatton 1996). Glaze Meadow was homesteaded by Tillman Glaze in 1881 and the split rail fence which still stands today on the east end of the meadow was built during that time (Lucas 1991).

The Glaze family reported observing Native Americans camping and using sweat baths along Indian Ford Creek as well as burning forest areas near Indian Ford (Juris 1975). The following is the only documented account of Native American fire use on Sisters Ranger District but indicates it was perhaps a common occurrence.

"There were always Indians camped in the area when we were there. One of my most vivid memories is of one night when I was about 4 years old. My Uncle Joe Glaze had a cabin on the banks of the creek a few hundred yards from ours. About midnight one night he came pounding on our door and yelling, "Fire, fire, the woods are on fire!"All I could see were flames racing through the timber and I thought the world was on fire... The next morning Dad and Uncle Joe went back to see what happened. Miraculously, our cabin was safe. Uncle Joe asked some Indians how the fire started and they casually explained that they had fired the brush to keep their horses from straying."

Warren Glaze as told to Frances Juris (Juris 1975)

The Tillman Glaze homestead was originally referred to as "Till Glaze Swamp" and was once a very wet meadow with many willows and lodgepole pine (Hatton 1996). The hydrology of the area has been altered by changes in precipitation cycles, water withdrawals for irrigation, draining of wet meadows and swamps, and removal of beaver (USDA Forest Service 1998). Irrigation withdrawals on Indian Ford Creek began in the late 1800's. By 1902, the Black Butte Land and Livestock

Company began larger scale grazing operations including efforts to drain the extensive wet meadows in the area.

In 1922, S.O. Johnson purchased timber rights on about half of the forested area and most of the larger trees were removed during the 1930's. The Forest Service acquired this private land in a land exchange in 1940. The 1943 aerial photo (Figure 2) shows logged areas and remnant blocks of old growth pine forests.

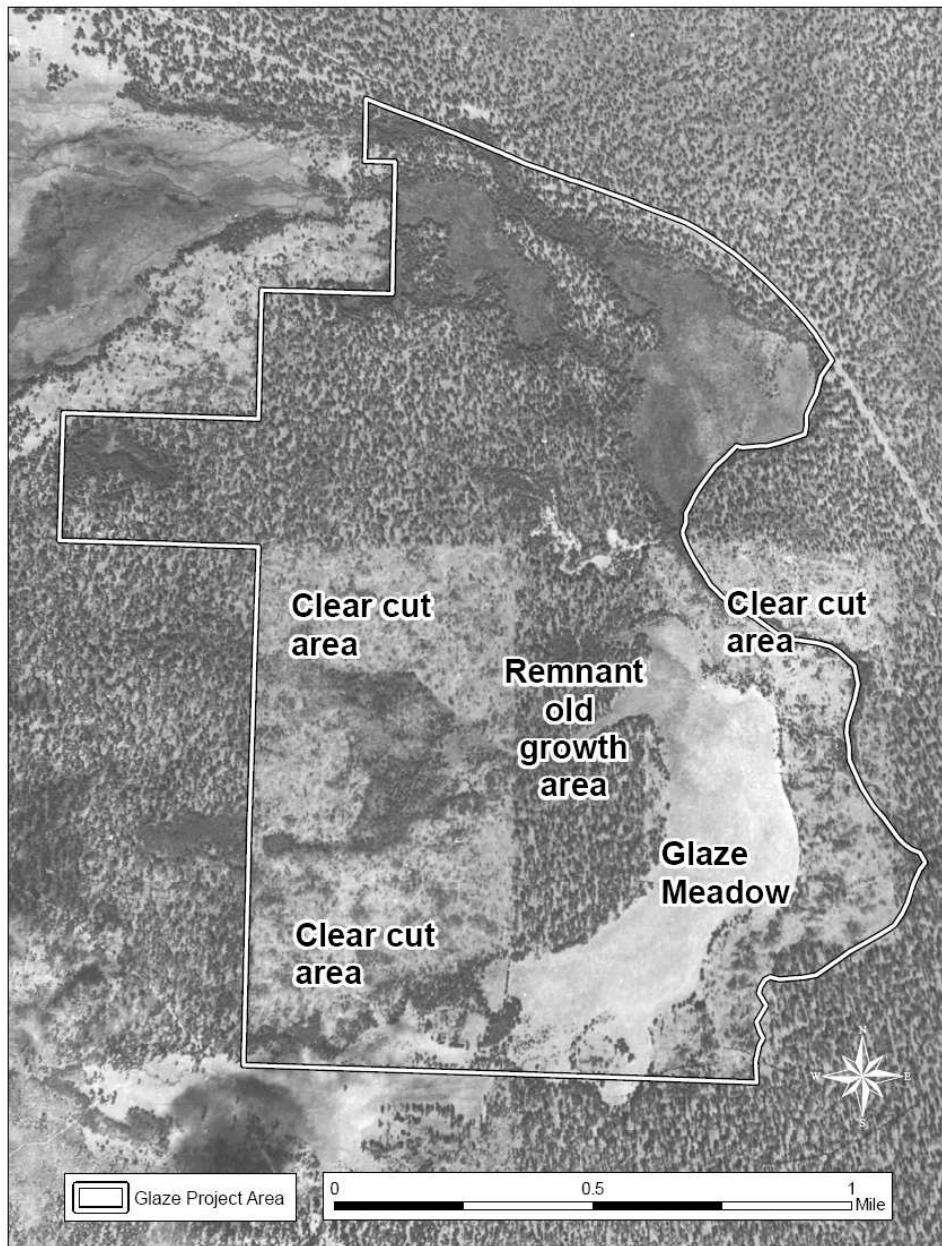


Figure 2. 1943 Aerial Photo Glaze Project Area –
Light squares show clear cut areas which are now second growth forests

The project area is easily seen from Black Butte Fire lookout and natural and human caused fires have been suppressed here for over 100 years. Grazing continued after the entire project area became public lands through land exchanges. The project area was then managed as the Glaze Grazing Allotment. Some logging by the Forest Service occurred in the 1970's and 1980's. During this period the adjacent destination resort, Black Butte Ranch, was developed and over 1200 home sites were sold and developed along with two golf courses.

In 1990 the unique biological qualities and social importance of the project area were recognized when it was designated as part of the Metolius Old Growth and Metolius Black Butte Scenic Management Areas in the Deschutes National Forest Land and Resource Management Plan (U.S. Forest Service 1990). As a part of the larger "*Metolius Conservation Area*", direction called for these lands to be managed differently with a high degree of community participation and a unique blend of arts and sciences applied with creativity (Deschutes National Forest Land and Resource Management Plan , pg. 164.)

The grazing allotment was closed in 1997. A vehicle closure order was implemented in 2000 which closed the area to off-road vehicles and other motorized use, except for administrative purposes. In the early 1990's the first reintroduction of low intensity fire was accomplished (Figure 3). Some small tree thinning and prescribed fire has been accomplished in the forest and meadows in the past 15 years.



**Figure 3. First entry introduction of prescribed fire in the Glaze Project Area
after thinning in second growth pine - 1992**

A New Partnership to Manage Old Growth

The question of whether active management is appropriate in old growth areas is controversial and has often been decided by lawsuits. However, several conservation groups now tentatively support ecologically based management in fire dependent eastside forests.

In 2005, a partnership to support proactive, restorative management in the Glaze area was proposed to the Forest Service by Tim Lillebo of Oregon Wild (formerly called the Oregon Natural Resources Council) and Cal Mukumoto of Warm Springs Biomass Project LLC. The goal of this partnership between a timber industry group, a conservation group, and the Forest Service was to break barriers of mistrust and create a template on how people with diverse viewpoints can cooperate to achieve ecosystem, community, and economic values.

The partners support the Forest Service in developing a plan consisting of ecologically based management actions to benefit old growth and second growth forest areas. Actions would restore structural and functional attributes of old growth forests that were once maintained by frequent fire and reduce the risk of damaging this unique area or surrounding communities with an uncharacteristic high intensity wildfire.



Figure 4. November 2007- Discussion with Partners and Public Participants at Glaze Public Marking Trials

The partners also recognize that restoration cannot be accomplished without a supporting infrastructure which includes people, equipment, and markets for wood by-products such as biomass fiber or saw-logs. Revenues generated through by-products can help offset the high costs of restoration and produce jobs and economic benefits for local and regional economies.

The partners met with the District Ranger on several occasions to share their individual views and opinions. They also spoke to the Interdisciplinary Team at the beginning of the project to explain why they had initiated the partnership and provided background on their viewpoints. The

Interdisciplinary Team then began its work looking at existing and desired future conditions for the project area, determining a proposed action, scoping with the public and adjacent landowners, and analyzing effects.

This type of interaction complies with the Federal Advisory Committee Act (FACA) which regulates Federal agency establishment or utilization of a group to obtain consensual advice or recommendations. FACA defines when such a group can be considered an advisory committee and the process necessary for its formation and proper functioning. FACA does not apply to individuals or representatives of groups who meet with Federal officials (s) to give individual advice or share facts or information (Reference 41 C.F.R. 102-3.40(e & f).

A Challenge Cost Share Agreement was completed in 2006 to describe how the partners would cooperate to achieve mutual objectives with the Forest Service. Oregon Wild and Warm Springs Biomass Project LLC have done extensive outreach, recruited volunteers for field studies, led field tours for hundreds of people, obtained grant funding to support the project.



Figure 5. 2005- Project Partner Tim Lillebo of Oregon Wild with Forest Service Specialists in the Glaze Old Growth Area. Photo by Project Partner Cal Mukumoto, of Warm Springs Biomass LCC.

Management Direction

Management direction for the Glaze Forest Restoration Project is found in the following environmental documents to which this analysis is tiered. The Desired Future Condition for the project area is defined by management goals in these documents and is discussed in more detail below. More discussion of Management Direction is found in Specialists Project Reports.

The project is outside the range of the Northern Spotted Owl and therefore does not fall within the management direction of the Northwest Forest Plan.

Deschutes National Forest Land and Resource Management Plan

The project area encompasses lands within the Deschutes National Forest Land and Resource Management Plan (USDA 1990) as amended by the Inland Native Fish Strategy (INFISH) and the Regional Forester Amendment #2 – Revised Continuation of Interim Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (or the “Eastside Screens”).

The Deschutes National Forest Land and Resource Management Plan provides guidance for management activities. It establishes goals, objectives, and standards and guidelines for each specific management area on the Forest, as well as Forest-wide standards and guidelines. Management Areas (MA) and associated standards and guidelines are described in Chapter 4 of the plan.

Management Allocations are displayed in Figure 5. A brief summary of the direction for management areas where treatment is proposed follows:

Metolius Old Growth (MA- 27): The goal for this management area is to provide naturally evolved old growth forest ecosystems for (1) habitat for plant and animal species associated with old growth forest ecosystems, (2) representations of landscape ecology, and (3) public enjoyment of large, old-tree environments. *The majority of the project area, 1,119 acres (94%) fall within this management area.*

The Metolius Old Growth Area is identified as part of a forest wide old growth network to be managed for the habitat requirements of the habitat indicator species, and therefore must emphasize the wildlife values associated with ponderosa pine old growth. A secondary objective in the Glaze Old Growth area is to manage for the scenic and social values of ponderosa pine old growth where they do not conflict with wildlife values. Vegetative treatments may conflict with recreation use, and use may be restricted for periods of time, but such occurrences are to be limited in size and number. The reintroduction of low intensity fire is encouraged to achieve desired old growth characteristics.

Glaze Forest Restoration Project
Deschutes Land and Resource Management Plan
Management Allocations

Sisters Ranger District
Deschutes National Forest

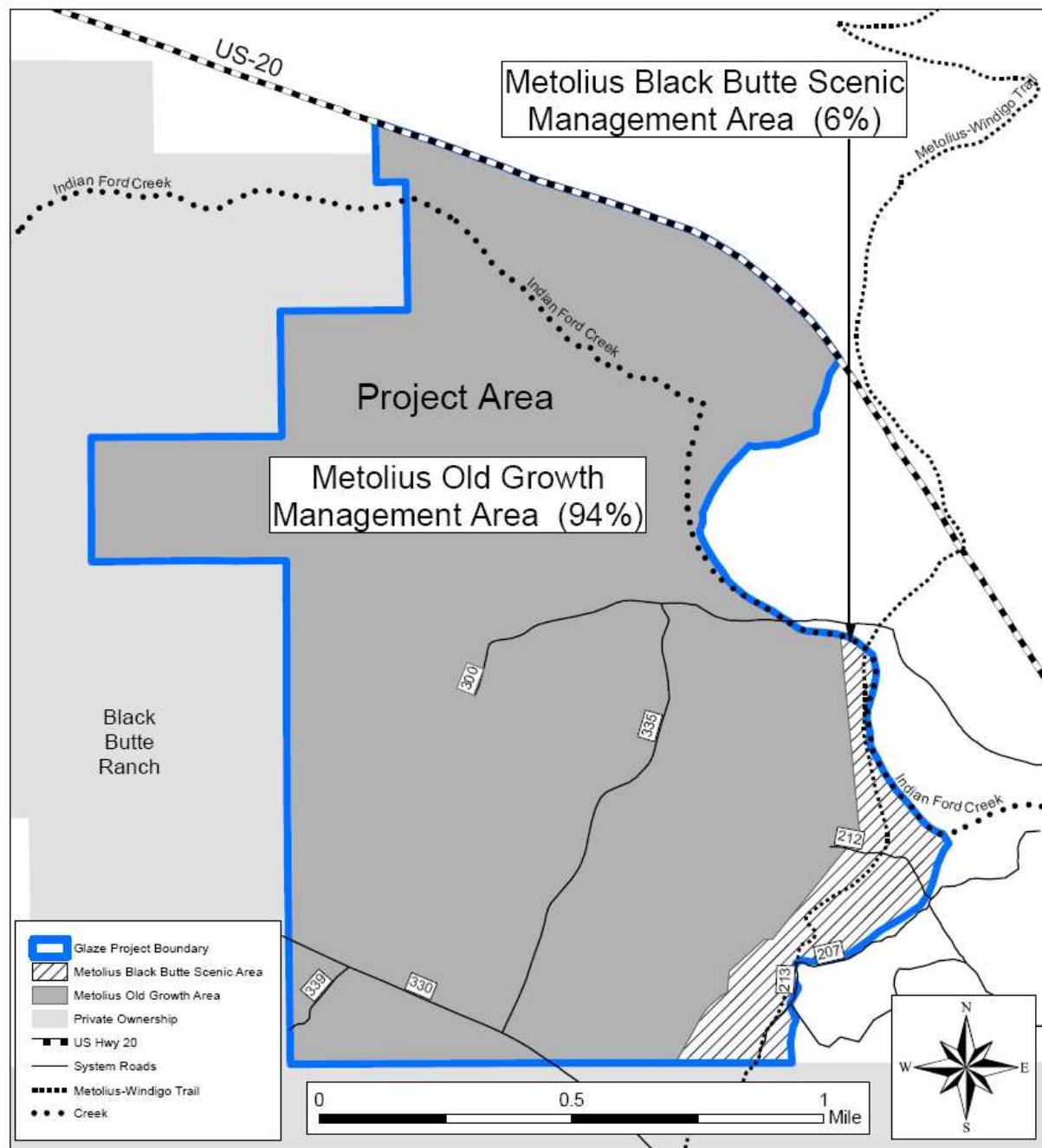


Figure 5. Deschutes Land and Resource Management Plan - Management Allocations

Metolius Black Butte Scenic (MA- 21): The goal for this management area is to perpetuate the unique scenic quality of Black Butte. Landscapes should be managed to protect and perpetuate the unique appearance of Black Butte, which can be seen from several areas within the project. The results of activities should not be evident to casual observers or will be visually subordinate to the natural landscape. *A small portion of the Glaze Restoration project area, 73 acres (6%) falls within this management area and is associated with the Metolius-Windigo Trail where it passes through the southeast corner of the project area.*

Applicable standards and guidelines require that forests in this area have a visual mosaic of large trees with stands of younger trees and species diversity where biologically possible. A visual quality analysis is required to determine where treatments are necessary, if cleanup activities can realistically be accomplished in specified time limits, where visual diversity should be enhanced, mitigations, and predicted visual conditions after treatments. Prescribed fires in this area are required to be shaped as natural occurrences and generally be less than 5 acres in size per block in foreground areas visible from system trails.

Common management objectives in these two allocations support restoring large trees, reducing the risk of high intensity wildfires to nearby communities, and providing healthy forest conditions.

The Metolius-Windigo Trail (RE- 35). Standards and guidelines for the trail state, “The intent of this trail was to not add additional constraints on other resource management activities. Management practices for a variety of resources will be encountered along the trail.” In addition, in the Record of Decision for the Deschutes Land and Resource Management Plan, it states that visual resource management along the Metolius Windigo Trail should protect scenic quality along a corridor 1/8th mile on either side of the trail and requires concurrent slash cleanup.

Regional Forester Amendment #2–Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (Eastside Screens)

In August 1993, the Regional Forester issued a letter providing direction to National Forests on the eastside of the Cascade Mountains on retaining old-growth attributes at the local scale and moving toward the historic range of variability (the range of forest conditions likely to have occurred before European settlement) across the landscape. This direction was called “Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales, Regional Forester’s Forest plan Amendment”, and became known as the “Eastside Screens”. The screens limit certain types of activities in watersheds where old growth forests are now less common than the historic range of variability.

A decision notice issued in May 1994 amended all eastside Forest plans to include this direction. The May 1994 decision notice was revised in 1995 and was called “Revised: Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales, Regional Forester’s Forest Plan Amendment #2”, and has continued to be known as the “Eastside Screens”. Since the 1995 revision, there have been several letters of clarification from the Regional Office regarding the eastside screens.

The Eastside Screens are intended to maintain management options for the future. More detailed discussion on project consistency with the screens can be found in the Forest Vegetation and Wildlife sections of this document.

Inland Native Fish Strategy - INFISH (1995)

The Inland Native Fish Strategy (USDA Forest Service 1995) provides interim direction to protect habitat and populations of resident native fish. These standards replace direction on riparian area management in the Eastside Screens. Portions of the watersheds where riparian dependent resources receive primary emphasis are called Riparian Habitat Conservation Areas (RHCA's) and management activities in these areas are subject to specific standards and guidelines. Riparian Habitat Conservation Areas include traditional riparian corridors, wetlands, intermittent headwater streams, and other areas where proper ecological functioning is crucial to maintenance of the stream's water, sediment, woody debris, and nutrient delivery systems. Specific Riparian Management Objectives from INFISH are found in the Fish and Hydrology sections of this document.

INFISH standards prohibit timber harvest, including firewood cutting in Riparian Habitat Conservation Areas, however they allow the application of silvicultural practices in Riparian Habitat Conservation Areas to acquire desired vegetation characteristics where needed to attain Riparian Habitat Management Objectives or to mitigate damaging effects from catastrophic events such as fire, flooding, volcanic, wind, or insect damage. Practices must be applied in a manner that does not retard attainment of Riparian Habitat Management Objectives and that avoids adverse effects on inland native fish (TM-1).

INFISH standards also require fuel treatment strategies, practices, and actions including prescribed burning be designed so as to not prevent the attainment of Riparian Habitat Management Objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions are needed (FM-1 and FM-4).

Clean Water Act (1977, as amended in 1982)

The State of Oregon, as directed by the Clean Water Act 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 Whychus Creek watershed are listed in the Hydrology Section of this analysis. To show that water quality is being protected, states are required to adopt water quality standards which must be approved by the Environmental Protection Agency. Best Management Practices and state-wide management plans are a requirement of the Clean Water Act and are used to meet water quality standards. Indian Ford Creek within the Glaze Forest Restoration Project area does not meet the State Standards for water quality and is discussed in this report within the Water Quality – 303(d) Listed Stream section. The project was designed to meet the requirements of the Clean Water Act.

Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program (USDA, 2005)

This environmental assessment is tiered to a broader scale analysis, the Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program. The associated Record of Decision amended the Deschutes National Forest Plan by adding management direction relative to prevention and treatment of invasive plants (formerly called noxious weeds).

Inventoried Roadless and Road Analysis

There are no Inventoried Roadless areas within the project. There are no proposed closures of existing system roads and no planned construction of new permanent roads associated with this project. Based on the action alternatives and in consultation with the Forest Road Manager and District Ranger it was determined that a Road Analysis was not required for this project.

Analysis Considered and Incorporated By Reference

Whychus Watershed Analysis (1998)

The Whychus watershed is one of seven Key Watersheds identified on the Deschutes National Forest. Key watersheds are identified as crucial to at-risk fish species and provide high water quality. A Watershed Analysis was completed as required to develop a landscape level assessment to guide project planning (U.S. Forest Service 1998). The assessment examined current and historic conditions and identified trends of concern in the watershed. The following trends were identified that are relevant to the project area:

Changes in Forest Structure

- ✓ There has been a loss of large old ponderosa pine trees due to logging and the exclusion of fire. Acres dominated by trees over 21" diameter have decreased by 88%.
- ✓ Acres of old growth pine forests have decreased by 79%.
- ✓ Forests are dominated by smaller average tree sizes than those that occurred historically.
- ✓ Acres dominated by trees between 5 - 20.9 inches have increased by 81%.
- ✓ Exclusion of fire has increased habitat instability and vulnerability to disturbances such as insects, disease and fire. Approximately 64% of pine forests are at unstable densities.

Changes in Fire Behavior

- ✓ The fire regime has been converted from a frequent, low severity fires to less frequent, moderate to high severity fires.
- ✓ Fire sizes and intensities have been increasing in ponderosa pine forest in the last decade.
- ✓ As of 1998, 70% of fires in ponderosa pine forests were human caused near the city of Sisters and near subdivisions.

Loss of Open Ponderosa Pine Forest Habitats

- ✓ Fire suppression and harvest have reduced the quantity and quality of open ponderosa pine forest habitats which support species like the rare Peck's penstemon wildflower, white-headed woodpeckers, and the northern goshawk.
- ✓ Housing developments have also reduced these habitats (Black Butte Ranch).

Degradation of Riparian Habitats

- ✓ Natural disturbances such as fire, flooding and beaver activity which rejuvenate riparian habitats have been reduced by human intervention. This has affected the vigor of streamside trees and shrubs. This has also caused a decline in aspen trees.
- ✓ Riparian habitats have been degraded by water diversions, grazing, and the removal of trees and vegetation. This has increased stream temperatures and decreased streambank stability. Less than 9% of the watershed has riparian areas dominated by large trees.
- ✓ There is less down wood and large live and dead trees in riparian areas due to past logging and this reduces its habitat value for plants, wildlife and fish.
- ✓ Riparian habitats are key habitats for many wildlife species. Approximately 200 species found or suspected to occur on Sisters Ranger District use riparian for breeding, roosting or foraging.
- ✓ Meadows have dried up due to channelization and water diversion. Fire suppression has contributed to shrinking their size as trees grew and encroached into meadows.

Goals and treatment objectives identified for the Glaze Forest Restoration Project are drawn from the recommendations made in the Whychus Watershed Analysis. These recommendations include:

- Thin trees to reduce stand densities to prolong the life of large trees (over 21" diameter) (pg. 233).
- Thin to help smaller trees grow faster and become larger sooner (pg. 233).
- Thin in riparian areas to reduce stand densities to prolong the life of large trees and help smaller trees grow faster and become larger sooner (pg. 235).
- Maintain or increase integrated fuels management in strategic locations to protect urban interface forest habitats and private property from wildfire (pg. 221).
- Develop an Old Growth Management plan for the Glaze Old Growth area (pg. 223).
- Continue habitat restoration in the Glaze Old growth area to reduce wildfire risk to Black Butte Ranch and restore fire in meadow and forest areas to benefit the rare plant Peck's Penstemon and wildlife species dependent on fire maintained ponderosa pine forests (pg. 223).
- Work collaboratively with key partners and landowners to develop community based stewardship and protect urban forests (pg. 220).
- Use prescribed fire when possible in conjunction with other silvicultural treatments or alone to restore forest habitats (pg. 226).
- Generate forest commodities as a result of restoration actions (pg. 226).
- Look for opportunities to regenerate aspen stands (pg. 228).
- Maintain and enhance Peck's penstemon habitats (open forests, meadows) with proven tools such as prescribed fire (pg. 236).

Greater Sisters Country Community Wildfire Protection Plan (2006)

The Greater Sisters Country Community Wildfire Protection Plan

(<http://www.projectwildfire.org/cwpp.html>) provides a framework to protect human life and reduce property loss due to uncharacteristic wildfire in the communities and surrounding areas of Sisters/Camp Sherman, Black Butte Ranch, and Cloverdale Rural Protection Districts. The project area is 100% within the Wildland Urban Interface zone and will indirectly accomplish objectives identified in the plan.

Desired Future Condition and Existing Condition

Desired Future Condition: Old Growth Ponderosa Pine Forests



The desired future condition for ponderosa pine forests in the project area is a late seral or old growth forest. Forest structure would be a mosaic pattern, open ponderosa pine forest (or full of gaps, patches and clumps of trees), 70- 90% dominated by one or two storied stands of large trees over 21" in diameter, with 10-30% of the area in smaller patches of younger trees in even age clumps ((1/10-1/4 acre in size with a few larger). The forest should have both single snags, patches of snags, patches of shrubs, and large and small downed wood.

Fire should be a process that is evident and able to play more of its historic role. Shrubs and grasses should be generally young and vigorous reflecting the influence of frequent low intensity fire. Understories would be composed of native plants and no invasive plants would occur.

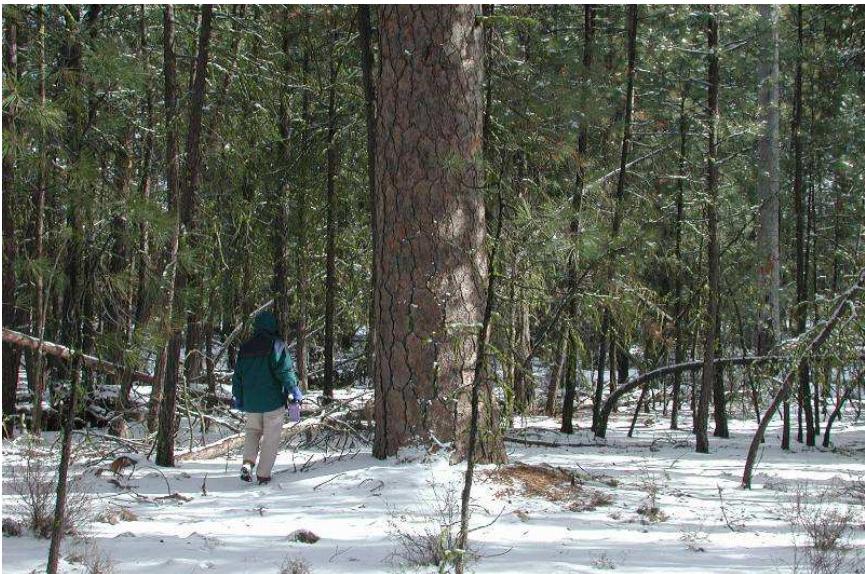
This type of structure would reflect the top end of the Historic Range of Variability identified for ponderosa pine stands in the Whychus Watershed Analysis (1998) and Whychus Late Successional Reserve Assessment (2001). In areas where few large trees remain today this desired future condition is a long term goal and will take many years to develop.

Existing condition:

Old Growth Stands

(Treatment Areas: 5, 6, 11, 14, 18, 19, 22, 26, 27, 29)

Old Growth stands contain enough trees per acre over 21" in diameter to be classified as old growth (or Late Old Structure). However, conditions in these stands do not meet Management Area goals due to decades of timber management practices and fire suppression. These practices resulted in changes from the historic composition and structure of forest stands as described in the Whychus Watershed Analysis summary above. High densities of trees are causing large old trees to die and replacements for these large trees are growing slowly. Much of the areas, including stands with important remnant old growth trees, are at high risk of loss from insects, disease, or wildfire.



Some areas have been thinned or burned with prescribed fire in the past several decades and are in better condition .

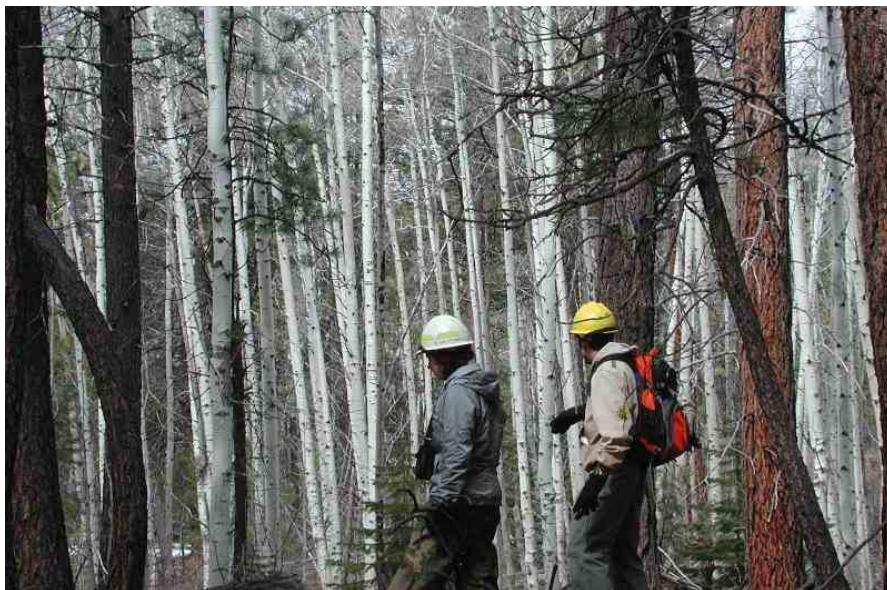
Existing condition: Second Growth Areas (Treatment Areas: 1, 2, 3, 4, 16, 24, 25)



Second growth stands do not contain enough trees per acre over 21" in diameter to be considered old growth (or Late Old Structure). Conditions in these stands do not meet Management Area goals due to decades of timber management practices and fire suppression. These areas were largely clear cut in the 1930's and were commercially thinned in the late 1980's. This has resulted in changes from the historic composition and structure of forest stands as described in the Whychus Watershed Analysis summary above.

Second growth forest stands have few large trees or snags and are lacking large down wood. They have little spatial diversity and look more uniform than historic old growth forests. Trees are dense and overstocked making them unlikely to develop large trees without thinning to reduce tree densities. Pine beetle activity is increasing in these areas. These conditions also contribute to an elevated risk of wildfire to near by communities.

Desired Future Condition: Aspens Stands



Aspen stands should be generally even aged with smaller, young trees present in the understory. Dying patches of aspen trees and down wood should be present over about 10-30% of the area to provide diversity and security for elk, deer, and other wildlife species. Understories should be composed of native plant species and no invasive plants should occur.

Existing condition: Aspens Stands (Treatment Areas: 7, 8, 16,17, 20, 23)

Aspen groves are in decline due to fire suppression and competition from encroaching conifers. Little aspen regeneration is occurring. Many trees are dying and falling down.

Desired Future Condition: Indian Ford Creek Riparian Areas

The area surrounding Indian Ford Creek should be a diverse conifer forest dominated by ponderosa pine, including large trees which provide shade and cover to the creek. Hardwoods such as aspen, cottonwoods and bog birch should be co-dominant in many areas to provide habitat for beaver and neo-tropical birds. Snags and down wood should be common. Understory plants would be diverse and no invasive plants should occur.

Existing condition : Indian Ford Creek Riparian Areas (Treatment Areas portions of 4, 15, 12, 26, 27):

Conditions in riparian areas surrounding Indian Ford Creek do not meet Management Area goals due to decades of timber management practices, grazing, water diversions, and fire suppression. This has resulted in changes from the historic composition and structure of the streamside forest. Larger shade producing trees are rare and trees have poor vigor and small, thin crowns. Fuels loads are high and if a wildfire were to enter these areas there is a high risk of losing key ecosystem components such as streamside trees, down wood and snags in an uncharacteristic fire.

Desired Future Condition: Grass dominated meadows (Glaze Meadow)

Open meadow habitats should have little tree encroachment along meadow edges. The meadows should be dominated by native plant species and no invasive plants should occur. Ideally, these areas would function as wet meadows and provide water storage and late season water release to Indian Ford Creek.

The situation with current water use and existing ditches would need resolution for full hydrological restoration (outside the scope of this project).

**Existing condition -Grass dominated meadows (Treatment Areas 8, 9, 10, 13):**

Small trees are encroaching in the meadows and few shrubs are regenerating due to the exclusion of fire. A first entry prescribed fire under conditions of low soil moisture created some areas of deep burns where cheatgrass has established.



Desired Future Condition- Wet Meadows (Black Butte Swamp) and other wetlands

Wet meadow habitats would have little tree encroachment along meadow edges. A mosaic of willow shrubs would occur including young willows. These meadows would be dominated by native plants species and no invasive plants should occur.

Ideally wet meadows would function to provide water storage and late season water release to Indian Ford Creek.

Existing condition: Wet Meadows (Black Butte Swamp) and other wetlands (Treatment Areas 12, 15, and 21):

Small trees are encroaching in the wet meadows and few shrubs are regenerating due to the exclusion of fire. Some willows have died. A first entry prescribed fire in 1998 done under conditions of low soil moisture created some areas of deep burns. Drier portions of this burn were invaded by cheatgrass.



However, in more moist areas of the burn, willow regeneration was seen for the first time in decades.

Cheatgrass patches need to be reduced before additional burning occurs on a large scale. Some experimental burning is recommended through monitoring experiments. Current water use and existing ditches would need resolution for full hydrological restoration and is outside the scope of this project.

Purpose and Need for Action

The **purpose** of the project is to restore old-growth forest conditions and Riparian Habitat Conservation Areas with ecologically driven thinning, shrub mowing, and prescribed fire.

This action is **needed** to meet the goals for the Metolius Old Growth and Metolius Black Butte Scenic Management Allocations and achieve the Desired Future Conditions described in detail above. The proposed action would improve forest health, sustainability, and resiliency, by promoting the development of old growth forest stands, diverse riparian forests, aspen stands, meadows, and prolong the life of large old trees. Project activities would move forested areas toward structural attributes typical of fire maintained old growth ponderosa pine forests such as a range of tree densities, stands dominated by large trees, clumpy spatial arrangements, snags and downed wood. This would improve the ability of existing large trees to survive and create conditions that are more favorable for the development of future large trees.

Actions would reduce competing live ground, ladder and canopy vegetation and reintroduce the natural role of low intensity fire. Nutrient cycling, pine regeneration, and stimulation of fire evolved understory plants would be enhanced. This would lower the risk of moderate to high intensity wildfires to nearby communities, private properties, and special natural places as well as improve public and fire fighter safety as recommended in the Greater Sisters Country Community Wildfire Protection Plan.

An additional purpose of this project is to fulfill the goals of the partnership to collaboratively build trust and break barriers to achieve ecosystem, community, and economic values. This requires a transparent process and extra attention to communication and listening. By proceeding slowly and carefully in this project and by taking the time to build understanding and trust, it is hoped there would be more support and partnership opportunities for similar forest restoration projects in the future.

Proposed Action

The action proposed by the Forest Service to meet the purpose and need is to use variable mosaic thinning, mowing, and prescribed fire to restore desired future conditions across the project area. The project does not require any new road construction. Approximately 1,200 acres would be treated.

The proposed action is composed of nine elements:

- 1) Thin approximately 416 acres in second-growth ponderosa pine stands to promote the development of old-growth forest conditions over the long term.
- 2) Thin approximately 458 acres in old-growth ponderosa pine stands to maintain and restore old-growth forest conditions.
- 3) Thin, with and without openings in approximately 79 acres of aspen stands to restore the viability of aspen clones. Fencing will be installed to protect young aspen from browsing by big game.
- 4) Remove small encroaching conifers within approximately 236 acres of meadow by hand thinning.
- 5) Thin and reduce fuels on approximately 551 acres of Riparian Habitat Conservation Areas which overlay both second growth and old growth stands. These include: aspen groves, riparian forests around Indian Ford Creek, and forests around wetlands, ponds, and meadows. *NOTE: The number of acres in this element overlay second growth and old growth forests, aspen, and meadows, so acres are double counted. These are not additional acres.*
- 6) Install a temporary modular “Acrow” Bridge across Indian Ford Creek to eliminate the need for road reconstruction on existing meadow road crossings.
- 7) Reintroduce fire as needed as the key natural disturbance process in ponderosa pine ecosystems.
- 8) Utilize existing roads as temporary roads for removing and hauling wood products. There is no construction of new temporary roads. The miles of roads used is dependent on the logging system of the chosen stewardship contractor and would range from 2 miles (harvester forwarder system) to 3.5 miles (feller/buncher system). Temporary roads in the old growth stands would be subsoiled to eliminate them after work is completed. Temporary roads in the second growth stands would be retained for future access.
- 9) Allow public review and comment on tree marking prescriptions during the public comment period. The decision maker commits to considering public input and striving to resolve or address issues.

Decision Framework

Given the purpose and need, the deciding official reviews the proposed action and the other alternatives in order to make the following decisions:

- Whether the Proposed Action will proceed as described, as modified, or not at all.

- What mitigations measures and monitoring requirements will be applied to the project.

For this decision, the District Ranger is the Responsible Official.



Public Involvement

The proposal was listed in the Deschutes and Ochoco National Forests Schedule of Proposed Actions (SOPA) on January 1, 2006. The proposal was provided to 412 public and other agencies for comment during scoping beginning on April 13, 2006. Media stories about the project have appeared in the Oregonian, The Bulletin, The Source, the Sisters Nugget, and on Oregon Public Radio. In addition, as part of the public involvement process, the Forest Service and partners have held over 70 field tours and meetings to discuss the project.

Groups involved in meetings and field discussions include:

Local Agencies and Governmental Interests: City of Sisters, Deschutes County Forester, Oregon Congressional Offices (Sen Wyden, Sen. Smith, Rep. Walden, Rep. DeFazio, Rep. Blumenaur, Rep. Hooley, Rep. Wu.), Governor Kulongoski's Staff , Deschutes/ Ochoco Resource Advisory Committee, Deschutes County Commissioners, Crook County Natural Resource Planning Committee, Oregon Department of Forestry, Jefferson County Commissioners, Oregon Dept. of Fish and Wildlife, Deschutes Provincial Advisory Committee.

Adjacent landowners: Black Butte Homeowners Association and Natural Resources Committee, Friends of Black Butte Ranch, Black Butte Ranch General Manager.

Tribal Interests: Confederated Tribes of Warm Springs Oregon Natural Resources and Government Affairs and Planning, Geovisions, Warm Springs Forest Products Industries, Klamath Tribal Forester.

Timber Industry Interests: Ochoco Lumber, Fagan Logging, Melcher Logging, American Forest Resource Council, Sustainable Northwest, Quicksilver Logging, Interfor, Forest Resources Association, Forest Stewardship Council, Integrated Resource Management Inc.

Conservation Interests: Audubon Society, Sierra Club, Wilderness Society, Cascadia Wildlands, Blue Mountain Biodiversity Project, Siskiyou Wildlands, Earth Justice Legal Defense Fund, Natural Resources Defense Council, Western Environmental Law Center, Pacific Environmental Advocacy Center, Defenders of Wildlife, Hells Canyon Preservation Council, Sisters Forest Planning Committee, Native Plant Society, East Cascades Bird Conservancy, Friends of the Metolius, Nature Conservancy, Western Fire Ecology Center, Rocky Mountain Elk Foundation, The Larch Company.

Wildfire Protection Agencies and Interests: Black Butte Ranch Fire Department, Project Wildfire Committee, Greater Sisters Area Community Fire Plan, Central Oregon Partnership for Wildfire Risk Reduction, Sisters/Camp Sherman Fire Department.

Other Interests: Oregon State University, Oregon Hunters Association, Institute for Journalism and Natural Resources, Fire Learning Network.

Using the comments from the public, other agencies, and groups listed above, the interdisciplinary team developed a list of issues to address (see Issues section).

Consultation with Native American Tribes ---

Government-to-government consultation with the Confederated Tribes of Warm Springs Oregon occurred in the form of a letter describing the project area and proposed action. The Forest Service and/or the project partners made numerous contacts with various branches of the Tribal government and enterprises including: the Confederated Tribes of Warm Springs Natural Resources Department, Government Affairs, and Planning Department, Geovisions, Warm Springs Forest Products Industries. The Klamath Tribal Forester was also contacted.

The Tribal business Warm Springs Biomass Project LLC is a partner in the project. Another Tribal business, Geovisions contributed survey work and is the fiscal agent for a Title II Grant obtained by the partners in 2006 to pay for field work and analysis. Ms. Brigitte Whipple, Tribal Anthropologist surveyed the area for culturally significant plants and numerous Tribal members surveyed the area as part of Geovisions donated work to provide detailed road and trail mapping.



Figure 7. Warm Springs Geovisions Crew checking GPS Units before field mapping

Issues

The following issues were identified through collaboration with other agencies, the public, as well as by the Forest Service Interdisciplinary Team (IDT). Issues are of three types:

- (1) **Key Issues** – which are used to design alternatives to the Proposed Action;
- (2) **Analysis Issues** – which are used to address environmental effects and to compare alternatives.
- (3) **Issues Not Addressed in Detail** – issues or concerns that are addressed through alternative design and/or mitigation or are beyond the scope of the project.

Key Issues: During the analysis, scoping, and collaborative process two Key Issues were identified. These key issues were used to design a second action alternative (Alternative 3).

1) KEY ISSUE - Size of Trees Removed

What size of trees should be removed to meet the Purpose and Need for the Action?



The size of trees that are cut and removed is the overwhelming public issue identified for the project. Many people requested diameter limits be identified for the size of trees to be cut because they are concerned that large trees will be removed for commercial rather than ecological reasons.

Most people requested a 16" diameter at breast height (hereafter referred to as "diameter") limit, although others suggested 8, 9, 12, 14, 15, or 21" diameter limits. Trees larger than 6" diameter are considered of "commercial" value in Region 6. The Eastside Screens allow trees under 21" diameter to be removed for ecological reasons. One individual questioned the rationale for not removing trees over 21" diameter.

Building public trust in the science of ecologically applied silviculture to develop and protect old growth forests is an important goal of the project. Because this is an old growth restoration project in an Old Growth Management Area there are many ecological and silvicultural reasons to retain "legacy trees" which were part of older stands and provide important genetic and structural diversity. Many of these trees are less than 21" in diameter.

There is no arbitrary diameter limit for the proposed action in this project, other than the eastside screen limit of 21 inches. Estimates from stand exams indicate the majority of trees (approximately 99%) which need to be removed for ecological based density management are smaller than 16 inches diameter. Approximately 80% of the trees which would be removed are estimated to be smaller than 8 inches in diameter.

Because of the sensitivity around the tree diameter issue and the desire to build trust, the decision maker will require that the public has the opportunity to review trees marked for thinning during the comment period. The decision maker commits to considering public input and striving to resolve or address public issues with tree marking.

A second action alternative (Alternative 3) was developed to address public concerns regarding diameter of trees removed. Alternative 3 would not allow harvest of commercial material (trees greater than 6 inches diameter) in old growth or Late Old Structure (LOS) stands but would allow thinning of trees less than 21 inches diameter in second growth areas. There are few trees over 16" diameter in second growth forest areas.

This issue applies to thinning throughout the project area.

Mitigations and Design Criteria: Public concern regarding trees over 16 inches diameter will be addressed in either alternative by the following project design criteria and mitigations:

- All old growth trees that were well established under the historic fire regime prior to the time of European settlement (i.e., pre-settlement trees) would be retained. This includes small old growth trees.
- No trees greater than 21" diameter will be removed except for safety reasons and temporary road use (only as a last resort in this case).
- Thinning from below will emphasize retaining the largest trees at any particular location.
- The only instances in which 16" diameter to 20.9" diameter trees would be removed are if there are many trees in the same location greater than 16" diameter or, on occasion, a smaller tree may be retained over a 16" diameter to 20.9" diameter tree if the smaller tree is better condition regarding crown (larger, fuller, greener) and stem (less number of defects such as crooks, forks and sweep) characteristics than the larger tree.
- All trees will be retained in no-treatment retention patches on approximately 10% of the project area.
- Public review and feedback on the marking prescriptions will be encouraged.
- The District Ranger will address public concerns about marking prescriptions.

Measures: To evaluate issues related to size of trees removed and impacts to forest health:

- *Number of trees over 16 inches diameter removed.*

2) KEY ISSUE - Intensity and Method of Riparian Thinning

How much riparian thinning should be done around Indian Ford Creek to meet the Purpose and Need for the Action while protecting stream shade and water quality and what method should be used?

The project partners, Oregon Wild and Warm Springs Biomass L.L.C., requested that the Forest Service consider as much thinning as ecologically sound in riparian areas to encourage large tree development and growth of aspen and hardwoods. The existing fuel conditions concern fire specialists as well because assessments indicate key ecosystem elements could be lost if a wildfire entered these important habitats.

Indian Ford Creek is a perennial fish-bearing stream. It has been listed by the Oregon Department of Environmental Quality under the Clean Water Act Section 303(d) because it does not meet federal water quality standards by exceeding the State water temperature standard. This condition is due to upstream water impoundments and diversions, resultant low instream flows, and the removal of riparian vegetation outside of the project area on private land. However, shade in the project area cannot be reduced and water quality cannot be impacted by this project because of the stream's 303(d) status.

The intensity and appropriate method for thinning in the Riparian Habitat Conservation Area surrounding of Indian Ford Creek is an issue identified by the Forest Service Interdisciplinary Team. The Proposed Action prescribes thinning and prescribed fire in the 51 acres of Indian Ford Creek's Riparian Habitat Conservation Areas to develop larger trees, increase the rate of the long term recovery of stream shade, and reduce fuels. Stream shade will not be reduced in the short term. Riparian areas surrounding the creek in the project area lack large trees and diverse healthy shrub communities due to past logging and grazing. The Proposed Action (Alternative 2) uses an accepted shade model to allow hand thinning of smaller trees from 12 to 50 feet from the creek and thinning with low impact equipment over frozen ground in areas farther than 50 feet from the creek. The other action alternative (Alternative 3) also uses the accepted shade model but utilizes only hand thinning in the Riparian Habitat Conservation Area which extends to 300 feet from the creek. In other Riparian Habitat Conservation Areas in the project, restoration actions would be the same under both alternatives.

Mitigation: Mitigations measures are required in both alternatives. Trees which are tall enough to shade the creek or provide down wood in the Riparian Habitat Conservation Area will be left. Hand thinning is required in the first 50 feet next to Indian Ford Creek under Alternative 2 and in the entire 300 foot riparian buffer under Alternative 3. In Alternative 2, low impact equipment must be used over frozen ground between 50-300 feet to prevent sedimentation to the creek.

Measures:

- *Acres of compaction in the Riparian Habitat Conservation Area.*
- *Stream - Alteration of stream bank and bed stability measured by changes in streamflow, sedimentation, riparian vegetation, and large wood recruitment.*
- *Wetlands – Acres compacted within the wetland; acres of riparian vegetation converted to other species or no vegetation.*
- *Number of trees felled in the primary shade zone.*

Analysis Issues: During the analysis, scoping, and collaborative process nine Analysis Issues were identified. These issues, along with applicable laws, regulations, and policies were used to design the Proposed Action and a second action alternative. Measures for each issue were developed to analyze how each of the action alternatives addresses the Purpose and Need for Action.

ANALYSIS ISSUE – Forest Vegetation

Improvements to Forest Health and Sustainability and Resiliency-How can project activities recreate spatial patterns, forest composition, and tree densities more typical of historic fire maintained forests?

Altered successional patterns from past harvest and fire exclusion are working against the long-term survival of remnant old-growth trees. Second growth forests are uniform in tree size and structure and unlikely to grow to resemble the patterns and structure found in historic old growth forests without the re-creation of a mosaic of tree sizes and densities and the reintroduction of fire.

Mitigation: Action alternatives were designed to restore the structure, density, species composition, and fuel profile of the ponderosa pine forests to within the historic range of variability found within this forest type.

Measures:

- *Percent of the project area at higher risk of losses to insects and diseases as defined by a measure of forest density (Upper Management Zone).*
- *Number of acres where treatments create conditions more favorable to the development of stand structure and composition similar to historic conditions*
- *Number of acres and percent of the project area where treatments create conditions more favorable to the survival of existing large trees as defined by a measure of forest density (Upper Management Zone).*

ANALYSIS ISSUE - Reduction of Fire Hazard

Will treatments reduce the fuels in the area to allow effective fire suppression if necessary and the successful re-introduction of fire?

The project area has missed five to nine natural fire cycles and this has led to a buildup of forest fuels that would support moderate to high intensity fire behavior if an unplanned wildfire was to occur. Most of the area is in a condition class (FRCC 2, 3) that indicates a moderate to high risk of losing key ecosystem components in the case of a wildfire. The forests, plants, and many wildlife in the area are fire dependent and would benefit from low intensity fire playing its natural role.

Mitigation: Action alternatives were designed to reduce fuels and reintroduce fire while protecting habitat and scenic values.

Measures:

- *The number of acres moved from high intensity wildfire fuels conditions to moderate or low intensity wildfire fuels conditions.*

ANALYSIS ISSUE - Impacts to Wildlife

- *Will vegetation treatments disturb or reduce Late Old Structure habitats (old growth) or wildlife habitat for threatened, endangered, sensitive species or other species such as Management Indicator Species, land birds or other species of conservation concern?*

Thinning, mowing and burning can remove forage, hiding cover, thermal cover and nest sites for wildlife. Connectivity of old growth stands and other important structural elements such as large old trees, dead trees and downed wood or coarse woody debris can be affected by thinning and prescribed fire. The Oregon Department of Fish and Wildlife commented that they were particularly interested in maintaining cover for mule deer migration through the area, restoring single story late old structure for old growth obligate species, and restoring aspen, meadows and swamps to benefit many wildlife species. Wildlife viewing and educational opportunities could also benefit.

Mitigation: Action alternatives were designed to protect and enhance short-term impacts habitats and meet all requirements of the Eastside Screens for wildlife habitat. Actions will maintain nesting and foraging habitat, and hiding and thermal cover for wildlife needs. Variable mosaic thinning patterns and untreated patches will provide habitat diversity and leave a variety of habitats on the landscape. A variety of specific design criteria and mitigation measures are outlined to protect snags and restrict disturbance around nests if they are discovered.

Measures:

- *A variety of specific features are examined including: large old trees, connectivity, snag and coarse down wood habitats, ponds, stream and wet meadow habitats, changes to nesting and foraging habitats, and changes to hiding cover and forage.*

ANALYSIS ISSUE - Impacts to Fish

Will the project disturb fish or fish habitat?

Thinning, mowing and burning can affect fish habitat quality by increasing sediment caused by ground disturbance near streams. The installation of the Acrow bridge could produce sediment or disturb fish.

Mitigation: Trees which are tall enough to shade the creek or provide down wood in the Riparian Habitat Conservation Area will be left. Low impact equipment must be used over frozen ground to prevent sedimentation to the creek. The installation of the bridge will minimize entering the stream with equipment and protect the stream from sediment with gravel pads and minimal ground disturbance. Seasonal restrictions for instream work are required.

Measures:

- *A variety of specific features are examined including: streambed embeddedness, large wood, pool frequency or quality, off-channel habitats, spawning gravel, fish passage, refugia, stream bank condition and floodplain connectivity.*

ANALYSIS ISSUE - Impacts to Botany/Rare Plants

Will project activities harm or enhance sensitive plant populations?

Thinning, mowing and burning can improve habitat conditions for Peck's penstemon which is a fire evolved species requiring sunlight and bare mineral soil to proliferate. However ground based equipment can crush or uproot plants. A portion of the population in the Glaze area is classified as "protected" by the Conservation Strategy for the plant and this requires actions to be taken which maintain, enhance, or restore habitat and benefit the plant. Only incidental loss of individual plants is allowed.

Mitigation: Action alternatives were designed to avoid or minimize potentially adverse impacts to the rare endemic plant Peck's penstemon by requiring timber cutting or removal activities over snow or frozen ground to minimize the type of soil displacement that would injure plants. Measures to prevent the introduction of invasive plants would also be taken to protect habitat quality and are discussed below.

Measures:

- *Probability of detrimental impacts as estimated by amount and degree of ground disturbance.*
- *Potential for beneficial effects from proven management techniques such as prescribed fire.*

ANALYSIS ISSUE - Introduction of Invasive Plants (Noxious Weeds)

Will vegetation treatments introduce invasive plants or cause existing invasive plant populations to expand?

Thinning, mowing and burning can introduce or create more habitat for invasive plants.

Mitigation: Action alternatives were designed to prevent introduction of invasive plants and minimize the spread of existing invasive populations. Burning meadows will be delayed until cheatgrass populations can be reduced in size. Equipment cleaning clauses are required. Ground disturbance will be minimized by measures which protect soil, rare plants, and riparian areas.

Measures:

- *Risk of weed spread as estimated by amount and degree of ground disturbance.*

ANALYSIS ISSUE - Impacts to Soils

Will project activities cause detrimental soil conditions?

The use of ground based equipment for thinning or mowing can increase the amount and distribution of detrimental soil conditions, including compaction. Removing trees or prescribed burning can potentially cause adverse changes to soil organic matter levels. Use of equipment on soils with seasonal water tables can cause resource damage. Soils within sensitive riparian areas and adjacent to streams can increase the potential for sediment delivery following soil disturbance.

Mitigation: Action alternatives were designed to avoid or minimize potentially adverse impacts to soils by controlling equipment operations to locations and conditions that are less susceptible to

resource damage. Project design criteria include minimizing the extent of new soil disturbance from mechanical treatments by implementing appropriate design features for avoiding or minimizing detrimental soil impacts from project activities. Detrimental soil conditions will not exceed Forest Plan standards.

Measures:

- *Change in extent of detrimental soil disturbance*
- *Amount of coarse woody debris (CWD) and surface organic matter retained*

ANALYSIS ISSUE - Impacts to Cultural Resources

- *Will project activities harm cultural resources such as prehistoric or historic sites, including the Glaze homestead era fence?*
- *Will project activities harm or enhance culturally significant plant resources in the area?*

Ground based equipment can harm prehistoric sites and culturally significant plants. Common species in the area identified as of interest to the Tribe include: bearberry, tule, wild rose, quaking aspen, chokecherry, vine maple, juniper, and yarrow.

Prescribed fire could inadvertently destroy historic wooden structures such as the 1880's era fence which surrounds part of Glaze Meadow and was built by early homesteaders. This fence is important to the Sisters Historical Society and others interested in the areas history.

Mitigation: Cultural resource sites will be avoided or protected during project activities. The area was surveyed for culturally significant plants and management recommendations are followed.

Measures:

- *Number of cultural sites protected.*
- *Acres of habitat restored for culturally significant plants.*

ANALYSIS ISSUE - Impacts to Scenic Values and the Recreation Experience

- *Will project activities reduce scenic quality?*
- *How can project activities minimize effects to the scenery visible from horse trails and walking trails?*
- *Will project activities affect recreational activities in the area?*

The impacts of thinning, mowing and burning can create short-term visual effects which some people find obtrusive. The public's recreational experience can be disrupted by the noise and activities associated with thinning, mowing, or burning operations.

Mitigation: Action alternatives were designed to minimize ground disturbance and will generally occur in winter or early spring seasons to avoid seasons of higher recreational use in the area. Thinning activities and fuels cleanup will account for retention visual standards to be met in the Metolius Black Butte Scenic Allocation along the Metolius Windigo trail. **Measures:**

- : *Short term changes to scenery and time period for fuels cleanup*
- *Displacement of users.*

ANALYSIS ISSUE – Economics of the Project

- *How much will project activities cost?*
- *What is the value of material removed?*

Restoration projects which thin primarily small trees and have many operating restrictions to protect sensitive resources are expensive. Such projects do not pay for themselves, but rather cost taxpayers money. New contracting options such as stewardship contracting can help fund restoration activities by offsetting work costs against product values.

Mitigation: Action alternatives were designed to allow as much ground based work with machinery as possible with mitigation measures such as working over frozen ground to protect sensitive plants, soils, and riparian areas.

Measures:

- *Project costs*
- *Product values and net values.*

Issues not Addressed in Detail: During the analysis, scoping, and collaborative process three issues were identified that are not addressed in detail.

Issue: Concerns about process and public involvement

One individual noted that although the project has a unique origin it must follow the same process as other projects, particularly regarding the competitive sale of commercial material. The project will follow all Forest Service policies and regulations for sale of commercially valuable wood products.

Issue: Increased use of off-road vehicles in the area

Thinning, mowing and burning can open forest areas and allow people to drive vehicles through widely spaced trees more easily. However, the Glaze area is already under a Special Closure Order (#01-001, October 2000) which prohibits unauthorized vehicles or Off Highway Vehicles including: motorcycles, dune buggies, 4 Wheel Drives, snowmobiles, cars, or other vehicles designed to be operated off of a road. It is illegal to operate Off Highway Vehicles under Title 16 USC Section 551 and punishable by a fine of up to \$5000 or up to 6 months imprisonment. Closure gates will be maintained. Signs will be reposted and enforcement officials will be notified of changed conditions.

Issue: Larger watershed management issues (Black Butte Ranch Golf course, grazing, and sewage management).

One individual thought that the Forest Service should take the lead in encouraging Black Butte Ranch to improve management of their golf course, grazing operation, and sewage treatment plant to improve watershed effects related to fertilizers, irrigation practices, rest and rotation of pastures, and discharge of sewage effluent into Indian Ford Creek. Water quality in the watershed is addressed in this analysis as it applies under cumulative effects. However, although the Forest Service engages in informal discussions with Black Butte Ranch concerning watershed issues, Black Butte Ranch is privately owned and the issue is outside the scope of the project and subject to local, County, and State ordinances.

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

This chapter describes and compares the alternatives considered for the Glaze Forest Restoration Project. It includes a description of each alternative considered. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., mechanical thinning versus hand thinning) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e., the amount of erosion or cost of mechanical thinning versus hand thinning).

Alternatives

Alternative 1- No Action

Under the No Action alternative, current management plans would continue to guide management of the project area. No thinning, mowing, or prescribed fire would be implemented to accomplish project goals. A Special Area Closure to restrict vehicle access for other than administrative reasons would remain in effect. A special use permit that allows guided horse riding trips would continue. Implementation of previous decisions such as fence removal and some invasive plant control by hand would also continue. No temporary bridge would be installed over Indian Ford Creek.

Forests and Riparian Habitat Conservation Areas would remain at densities which pose a risk to the longevity of old growth trees and slow development of younger trees. Fuels would remain at levels which pose a moderate to high risk of losing key ecosystem components in the case of a wildfire.

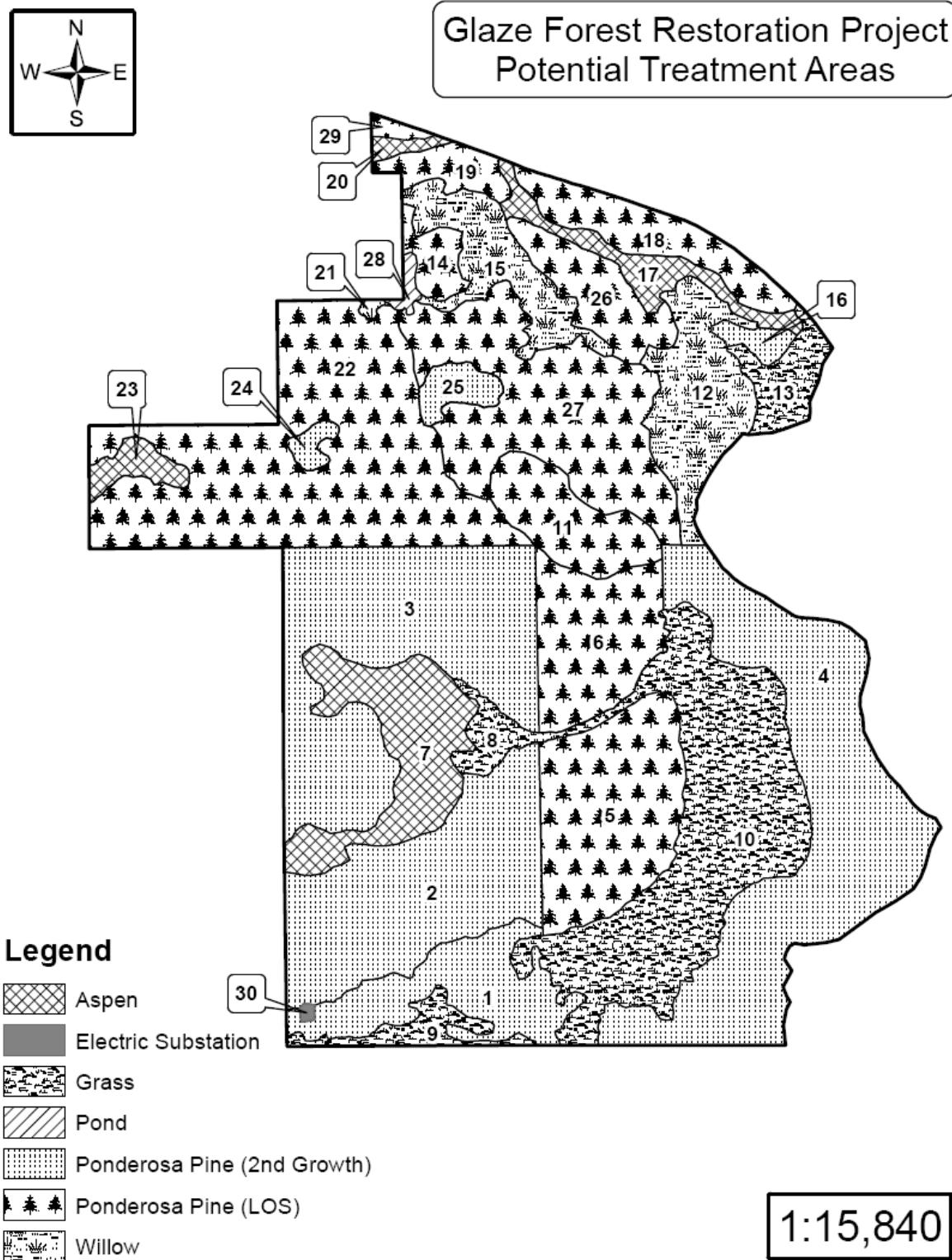


Figure 9. Potential Treatment Area map for all Alternatives

Alternative 2- The Proposed Action

The action proposed by the Forest Service to meet the purpose and need would use variable mosaic thinning, mowing, and prescribed fire to restore desired future conditions across the project area. The project does not require any road construction. Approximately 1,200 acres would be treated.

“Mosaic thinning” is an approach where trees are removed in a non-uniform pattern to create a spatially complex stand. Guiding objectives are to maintain a visually appealing forest, increase resistance to high severity wildfires, accelerate development of large diameter trees, restore clumpiness and unevenage structure, and stimulate a more diverse and functional understory plant community.

The project area was stratified into potential treatment areas based on current dominant vegetation type and for the ponderosa pine dominated vegetation type into structure type (second growth and late and old structure (LOS)). Figure 9 displays the potential treatment areas.

The proposed action is composed of nine elements:

- 1) Thin approximately 416 acres in second-growth ponderosa pine stands to promote development of old-growth forest conditions over the long term.** Variable mosaic thinning will be concentrated in young black bark trees and will emulate historic stand patterns. Thinning would retain all trees greater than 21 inches diameter at breast height (hereafter referred to as “diameter”); the majority of thinning will occur in trees less than 16 inches diameter. Small old growth trees (trees with old growth characteristics, regardless of size) will be retained. Shrubs will be mowed to change fuel profiles.
- 2) Thin approximately 458 acres in old-growth ponderosa pine stands to maintain and restore old-growth forest conditions.** Variable mosaic thinning would retain all trees greater than 21 inches diameter; the majority of thinning will occur in trees less than 16 inches diameter. Small old growth trees will be retained. Younger trees will be retained to emulate historic stand patterns. Shrubs may be mowed where needed to change fuel profiles.
- 3) Thin, with and without openings, in approximately 79 acres of aspen stands to restore the viability of aspen clones.** Thinning would girdle or cut and remove encroaching conifers, usually less than 16 inches diameter. Small group openings of one to five acres would be created in some areas where aspen clones are in very poor condition (i.e. few remaining live trees, live trees with poor crowns, advanced stem decay, few regenerating aspen are present, and heavy browsing by big game). Fencing will be installed to protect young aspen from browsing by big game.
- 4) Remove small encroaching conifers within approximately 236 acres of meadow.** Small conifers would be cut and removed, or piled and burned, or girdled, or killed with prescribed fire. Prescribed fire would be used in drier meadow areas to stimulate vegetative diversity and nutrient cycling for ecological benefit. Before prescribed fire is used, cheatgrass patches found in the meadows must be reduced in dominance by “weed whacking” with a mechanical handheld mower for several years.

5) **Thin and reduce fuels on approximately 551 acres of Riparian Habitat Conservation Areas including: aspen groves, riparian forests around Indian Ford Creek, and forests around wetlands and ponds to restore riparian conditions.** Riparian treatments are designed to protect water quality, particularly stream temperature, while favoring aspen, shrubs and increasing tree growth. A carefully sequenced prescription involving distance from the stream, tree diameter, and tree height is required to insure stream shade is not decreased.

NOTE: The number of acres in this element overlay second growth and old growth forests, aspen, and meadows, so acres are double counted. These are not additional acres.

6) **Install a temporary modular “Acrow” Bridge across Indian Ford Creek to eliminate the need for road reconstruction on existing meadow road crossings.** Beaver activity in the area has flooded low meadow areas and portions of existing system roads. This natural restoration of the area’s hydrology is important to protect. Some roads which access the northern portion of the project are now seasonally or permanently flooded and would require reconstruction that would alter meadow areas with culverts and fill. To avoid impacting meadows, a 50 foot temporary modular steel Acrow bridge would be installed on an existing system road at an old bridge crossing on Indian Ford Creek and removed and rehabilitated after the project ends. If conditions change and the road crossings become dry or totally frozen they may be used.

7) **Reintroduce fire as needed as the key natural disturbance process in ponderosa pine ecosystems.** Prescribed fire would be utilized to reduce fuels and for ecological benefit in pine forests, aspen stands, meadows and riparian areas. Mitigation measures would place sideboards on the use of fire in some areas to protect streams from sediment, prevent the spread of invasive plants and protect scenic quality.

8) **Utilize existing roads as temporary roads for removing and hauling wood products.** There is no construction of new temporary roads. The miles of roads used is dependent on the logging system of the chosen stewardship contractor and would range from 2 miles (harvester forwarder system) to 3.5 miles (feller/buncher system). Temporary roads in the old growth stands would be subsoiled to eliminate them after work is completed. Temporary roads in the second growth stands would be retained for future access. A map of temporary roads is displayed in Figure 10.

9) **Allow public review and comment on tree marking prescriptions during the public comment period.** The decision maker commits to considering public input and striving to resolve or address issues.

Table 1. Alternative 2- Unit Prescriptions (refer to Figure 9 Map)

Treatment Area Unit	ACRES	Treatment Prescription
1	43.2	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
2	93.3	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
3	119.5	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
4	142.5	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
5	68.3	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
6	45.0	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
7	50.5	Aspen / Lodgepole- Conifer thinning, group openings, and small pile burning
8	9.7	Aspen/Grass Meadow- Conifer removal, small pile burning, Prescribed Fire after mechanical removal of cheatgrass
9	11.9	Grass Meadow- Conifer removal, Prescribed Fire after mechanical removal of cheatgrass
10	125.2	Grass Meadow- Conifer removal, Prescribed Fire, after mechanical removal of cheatgrass
11	29.5	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire, avoid treatment in beaver pond unless dry
12	42.1	Willow Meadow – Conifer removal
13	15.4	Grass Meadow – Conifer removal, Prescribed Fire, after mechanical removal of cheatgrass
14	9.2	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
15	31.0	Willow Meadow - No Treatment except mechanical removal of cheatgrass
16	4.9	Aspen/Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
17	17.9	Aspen - Conifer thinning, small pile burning
18	29.1	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
19	11.7	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
20	2.9	Aspen- Conifer thinning, small pile burning
21	0.9	Willow Meadow- Conifer removal except mechanical removal of cheatgrass
22	149.5	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
23	8.1	Aspen- Conifer thinning, small pile burning
24	3.7	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
25	8.5	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
26	24.4	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
27	88.8	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire

Treatment Area Unit	ACRES	Table 1 Alternative 2- Unit Prescriptions (continued)
28	2.3	Pond – No treatment
29	2.3	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
30	0.6	Electric Substation- No treatment
TOTAL	1192	

Alternative 3

Alternative 3 addresses public concerns regarding removal of commercial size trees in old growth areas and requests for limiting the diameter of thinned trees in old growth stands. This alternative limits trees thinned in old growth stands to 6" in diameter. Trees over 6" diameter are considered to be of commercial value in Region 6. Riparian treatments are less intensive and require hand thinning all trees within Riparian Conservation Habitat Areas. The other eight elements of the alternative such as mosaic thinning in second growth areas, aspen thinning, temporary bridge installation, meadow restoration treatments, and public review of marking are the same as in Alternative 2. Refer to Figure 9 above and Table 2 below.

Table 2. Alternative 3- Unit Prescriptions (refer to Figure 9 Map)

Treatment Area Unit	Acres	Treatment Prescription
1	43.2	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
2	93.3	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
3	119.5	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
4	142.5	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
5	68.3	Old Growth Mosaic Thinning up to 6" , Prescribed Fire
6	45.0	Old Growth Mosaic Thinning up to 6" , Prescribed Fire
7	50.5	Aspen / Lodgepole- Conifer thinning, group openings, and small pile burning
8	9.7	Aspen/Grass Meadow- Conifer removal, small pile burning, Prescribed Fire after mechanical removal of cheatgrass
9	11.9	Grass Meadow- Conifer removal, Prescribed Fire after mechanical removal of cheatgrass
10	125.2	Grass Meadow- Conifer removal, Prescribed Fire after mechanical removal of cheatgrass
11	29.5	Old Growth Mosaic Thinning up to 21", generally under 16" with mitigations Prescribed Fire, avoid treatment in beaver pond unless dry
12	42.1	Willow Meadow – Conifer removal except mechanical removal of cheatgrass
13	15.4	Grass Meadow – Conifer removal, Prescribed Fire after mechanical removal of cheatgrass
14	9.2	Old Growth Mosaic Thinning up to 6", Prescribed Fire
15	31.0	Willow Meadow - Conifer removal
16	4.9	Aspen/Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire

Treatment Area Unit	Acres	Table 2 Alternative 3- Unit Prescriptions (continued) Treatment Prescription
17	17.9	Aspen - Conifer thinning, small pile burning
18	29.1	Old Growth Mosaic Thinning up to 6" , Prescribed Fire
19	11.7	Old Growth Mosaic Thinning up to 6" , Prescribed Fire
20	2.9	Aspen- Conifer thinning, small pile burning
21	0.9	Willow Meadow- Conifer removal, except mechanical removal of cheatgrass
22	149.5	Old Growth Mosaic Thinning up to 6" , Prescribed Fire
23	8.1	Aspen- Conifer thinning, small pile burning
24	3.7	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
25	8.5	Second Growth Mosaic Thinning up to 21", generally under 16" with mitigations, Prescribed Fire
26	24.4	Old Growth Mosaic Thinning up to 6" , Prescribed Fire
27	88.8	Old Growth Mosaic Thinning up to 6" , Prescribed Fire
28	2.3	Pond – No Treatment
29	2.3	Old Growth Mosaic Thinning up to 6" , Prescribed Fire
30	0.6	Electric Substation- No treatment
TOTAL	1192	

Glaze Forest Restoration Project Temporary Roads

**Sisters Ranger District
Deschutes National Forest**

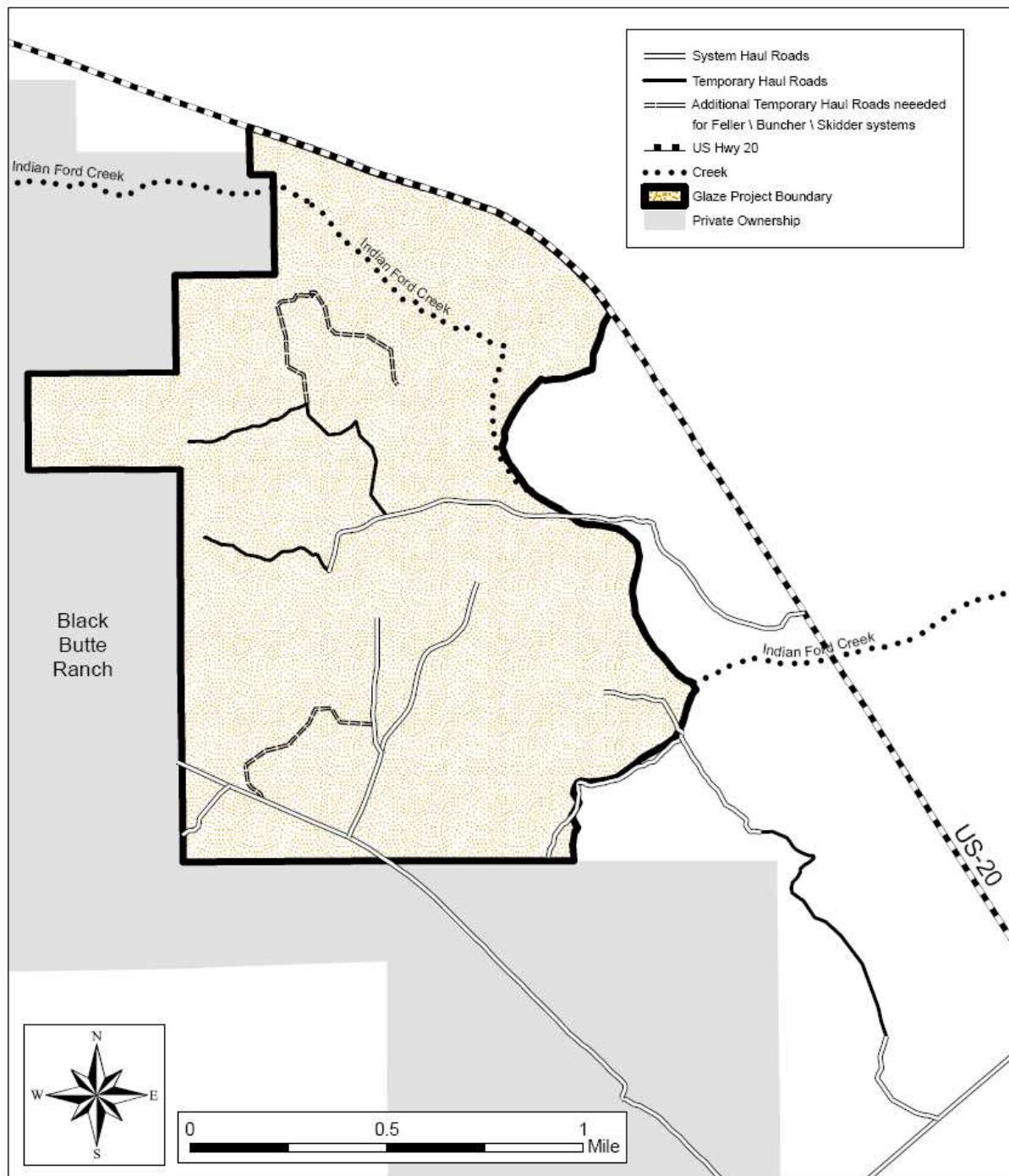


Figure 10. Temporary Roads Map for all Alternatives- All are existing roads

Alternatives Considered But Eliminated from Detailed Study

Setting Maximum Diameter Limits of 8, 9, 12, 14, 15, or 16 Inches

A variety of diameter limits were suggested by the public as the maximum size that should be thinned. In most cases this concern was particularly in reference to old growth forest areas. The opinion that only “precommercial” thinning should be allowed was also submitted.

The Interdisciplinary Team addressed these concerns by creating an alternative which represented the low end of the range of diameters suggested (Alternative 3), so that the full spectrum of diameters was encompassed by the alternatives. This also created a “precommercial” alternative for old growth areas by thinning trees up to 6 inches in the old growth forest stands. Trees over 6” in diameter are considered to be of commercial value in Region 6. In addition, both action alternatives provide mitigation measures to address the concern about what size trees are marked by allowing public review of marking with the opportunity to discuss and resolve conflicts with the Decision maker.

Project Design Criteria and Mitigation Measures Common to All Alternatives

In response to known issues, resource conditions, and public comments on the proposal, the project was designed to minimize impacts, these elements are called the “Design Criteria”.

“Mitigation measures” are specific actions that could be taken to minimize, avoid or eliminate potentially significant impacts on the resources that would be affected by the alternatives, or rectifying the impact by restoring the affected environment (40 CFR 1508.02). Mitigation of adverse effects would involve changing or modifying the actions described under the alternatives that may cause effects.

There are many actions that the Forest Service may apply to enhance project design, but may not be required to avoid or mitigate potentially significant impacts from implementing the selected Alternative. These optional project enhancements are called “Recommendations” and would be considered during project implementation.

Rating. The rating criteria for effectiveness of mitigations measures is listed below:

- **Poor:** The action would have benefit, but would have a major conflict with other project objectives and goals.
- **Low:** The action would have benefit, but the benefit is difficult or expensive to achieve and of minor value, and may have conflicts with other objectives or goals.
- **Medium:** The action would have minor or major benefit, and conflicts with other objectives or goals are minor or none.
- **High:** The action would have major benefit, conflicts with other objectives or goals are minor or none. The action also helps meet other objectives or goals.

The following section summarizes the design criteria and mitigation measures applied to the action alternatives.

Project Design Criteria and Mitigation Measures to address Public Concerns regarding the Size of Trees cut

Public concern regarding trees over 16 inches diameter will be addressed by the following project design criteria:

- All old growth trees established under the historic fire regime prior to the time of European settlement (i.e., pre-settlement trees) would be retained. This includes small old growth trees regardless of size.
- No trees greater than 21" diameter will be removed except for safety reasons and temporary road construction (only as a last resort in this case).
- Thinning from below will emphasize retaining the largest trees at any particular location.
- The only instances 16" diameter to 20.9" diameter trees would be removed would be if there are many trees in the same location that are greater than 16" diameter or, on occasion, a smaller tree may be retained over a 16" diameter to 20.9" diameter tree if the smaller tree is growing more vigorously than the larger tree.
- All trees will be retained in no-treatment clumps on approximately 10% of the project area.

Mitigation Measures for the concern regarding the size of trees cut

- Public review and feedback on the marking prescriptions will be encouraged. *High effectiveness*
- The District Ranger will address public concerns about the prescriptions. *High effectiveness*

Project Design Criteria for Riparian Habitat Conservation Areas

Thinning Operations within Riparian Conservation Areas

Removal of logs from Riparian Habitat Conservation Areas will require the use of low impact harvest equipment. Approved systems may include harvester-forwarder systems, small ATV's with an arch attachment, pulling line or hand felling toward the outside boundary and reaching in to pull logs out of the Riparian Habitat Conservation Areas.

- Skidding would only be allowed with one end suspension and only for logs less than 12 inches in diameter. The intent is to only allow skidding with small ATV types of equipment and only in areas where a very limited amount of material (less than 10 trees per acre) would be removed.
- Harvest in areas where greater than 10 trees per acre would be removed would require specialized low impact equipment to limit soil disturbances. Specialized equipment includes the ability to both cut and process the log at the stump. Processed logs must be removed from the Riparian Habitat Conservation Areas on a trailer and would be placed in decks outside of the Riparian Habitat Conservation Areas. No skidding of logs would be allowed within the Riparian Habitat Conservation Areas. Decks are defined as areas in which processed logs (logs which have already been limbed and cut to length) are staged prior to loading on the trucks. A deck differs from a landing in that logs are processed at a landing while no processing occurs at the deck.

Design Criteria for Riparian Habitat Conservation Areas by Area Type and Alternative

Riparian Habitat Conservation Areas treatments are the same for both action alternatives except for the treatment of the Indian Ford Creek Riparian Habitat Conservation Area. Riparian Habitat Conservation Area design elements were divided into four categories: 1) Indian Ford Creek Riparian Habitat Conservation Areas below Black Butte Swamp, 2) intermittent streams and lava tube wetland Riparian Habitat Conservation Areas, 3) wetlands greater than 1 acre Riparian Habitat Conservation Areas, and 4) haul within Riparian Habitat Conservation Areas.

1) Indian Ford Creek Riparian Habitat Conservation Areas below Black Butte Swamp (300 ft on southwest side of stream)

The main concerns regarding treatments within this category are maintenance of stream temperature, large wood recruitment, and sediment delivery. As a result, treatments vary based on the distance from the stream and the height or diameter of trees proposed for removal.

Temperature Management Area

Stream temperature in Indian Ford Creek, which is listed on the Oregon 303(d) list for excessive temperature, is protected by not felling or removing any vegetation within the primary shade zone. The primary shade zone for Indian Ford Creek within the Glaze Forest Restoration Project area was determined based on a temperature modeling study (USDA Forest Service and BLM 2005) for Northwest Forest Plan area streams. The same concepts and principles used in this study apply to the streams in the project area managed under INFISH guidance.

The Northwest Forest Plan Temperature Total Maximum Daily Load (TMDL) Implementation Strategies (2005) identifies a primary shade zone which varies according to the height of existing overstory trees and hill slope in the immediate area. The following table establishes the width of the primary shade zone based on the Temperature Implementation Strategies for the Glaze Forest Restoration Project (Table 3).

**Table 3. Primary Shade Zone Width (slope distance),
Based on Adjacent Hill Slope (USFS and BLM 2005).**

Height of Trees to be felled	Distance from stream for hill slopes <30%
Trees < 20 ft tall	12 ft
Trees 20 to 60 ft tall	28 ft
Trees > 60 to 100 ft tall	50 ft

The Temperature Implementation Strategies allow the distances in Table 3 to be less (but not less than 12 ft.) if any of the following conditions apply:

- The trees are located on a south facing slope (175-185 degree azimuth) and therefore do not provide stream shade;
- An appropriate level of analysis is completed and documented, such as shade modeling, using site-specific characteristics to determine the primary shade tree width; and or
- Field monitoring or measurements are completed to determine the width where optimum Angular Canopy Density (65% or greater) is achieved (see TMDL Implementation Strategies).

These guidelines were incorporated into the design elements for the Glaze Forest Restoration Indian

Ford Riparian Habitat Conservation Area treatments (Figures 10 and 11). Both action alternatives would strictly follow the guidance in the Northwest Forest Plan Temperature TMDL Implementation Strategies (2005).

Large Wood Recruitment Area

To maintain recruitment of large wood, no trees within 50 ft of Indian Ford Creek and only trees less than 16" diameter in Alternative 2 and less than 12" diameter in Alternative 3 between 50 and 100 ft. from Indian Ford Creek would be removed (Figures 10 and 11). By restricting the size of tree removed in the primary wood recruitment zone (within 100 ft of a stream), no large wood that could potentially reach the stream (wood that is > 12" diameter within the active channel) would be removed.

Sediment Delivery Area

To reduce sediment delivery from treatments proposed in the project, no ground-based machinery, or fireline construction is allowed closer than 50 ft. from Indian Ford Creek. Pile burnng must be done at least 100 feet from the creek. Density management activities outside of this area on the flat bench above the creek (at least 50 ft from Indian Ford Creek) are restricted to hand-thinning or thinning with low impact equipment over frozen ground which varies by alternative (Figure 10 and 11). Mowing brush over frozen ground is allowed in Alternative 2. Underburning and pile burning are allowed but piles would be located on the flat bench above the stream and would be less than 100 ft² and not cover more than 5% of the area within Riparian Habitat Conservation Area.

Specific Criteria

Common to all areas- Alternative 2 and 3- Hand-thinning may occur in any season.

Alternative 2 - Indian Ford Creek Riparian Habitat Conservation Areas (300 ft on each side of creek) (Figure 11)

- No Treatment within 12 ft of the creek.
- Hand-thin upland trees < 20 ft tall between 12 ft - 28 ft from Indian Ford Creek.
- Hand-thin upland trees < 60 ft tall between 28 ft - 50 ft or the bench of the creek, whichever is greater.
- Thin < 16" diameter upland trees with low impact equipment over frozen ground between 50 ft (or the bench of the creek, whichever is further from the stream) and 100 ft from the stream.
- Thin upland trees with low impact equipment over frozen ground between 100 ft and 300 ft from Indian Ford Creek.
- Allow mowing of brush over frozen ground between 50 ft and 300 ft from Indian Ford Creek.
- Allow underburning beyond 50 ft from the stream but no construction of fire line. Use only existing trails, roads, or wet line for containing the fire.
- Locate burn piles at least 100 feet away from live and intermittent stream channels.
- Piles should be less than 100 ft² and not cover more than 5% of the area within Riparian Habitat Conservation Area.

Alternative 3 - Indian Ford Creek Riparian Habitat Conservation Areas (300 ft on each side of creek) (Figure 12)

- No Treatment within 12 ft of creek.
- Hand-thin upland trees < 20 ft tall between 12 ft - 28 ft from Indian Ford Creek.
- Hand-thin upland trees < 60 ft tall between 28 ft - 50 ft from Indian Ford Creek or the bench of the creek, whichever is greater.
- Hand-thin upland trees < 12 diameter between 50 ft - 300 ft from Indian Ford Creek
- Do not mow brush with ground-based equipment.
- Allow underburning beyond 50 ft from the stream but no construction of fire line. Use only existing trails, roads, or wet line for containing the fire.
- Locate burn piles at least 100 feet away from live and intermittent stream channels.
- Piles should be less than 100 ft² and not cover more than 5% of the area within Riparian Habitat Conservation Area.

Alternatives 2 and 3

Intermittent tributary to Indian Ford Creek /Riparian Habitat Conservation Areas and Lava Tube wetland (70 ft on each side of creek/wetland)

- Hand-thin within 70' of intermittent stream and lava tube wetland.
- Do not mow brush with ground-based equipment. Mowing or brush removal can be done by hand.
- Do not cut trees along stream bank.
- Allow underburning but no construction of fire line. Use only existing trails, roads, or wet line for containing the fire.
- Locate burn piles outside of Riparian Habitat Conservation Area.
- Allow crossing of lava tube wetland at designated crossings.

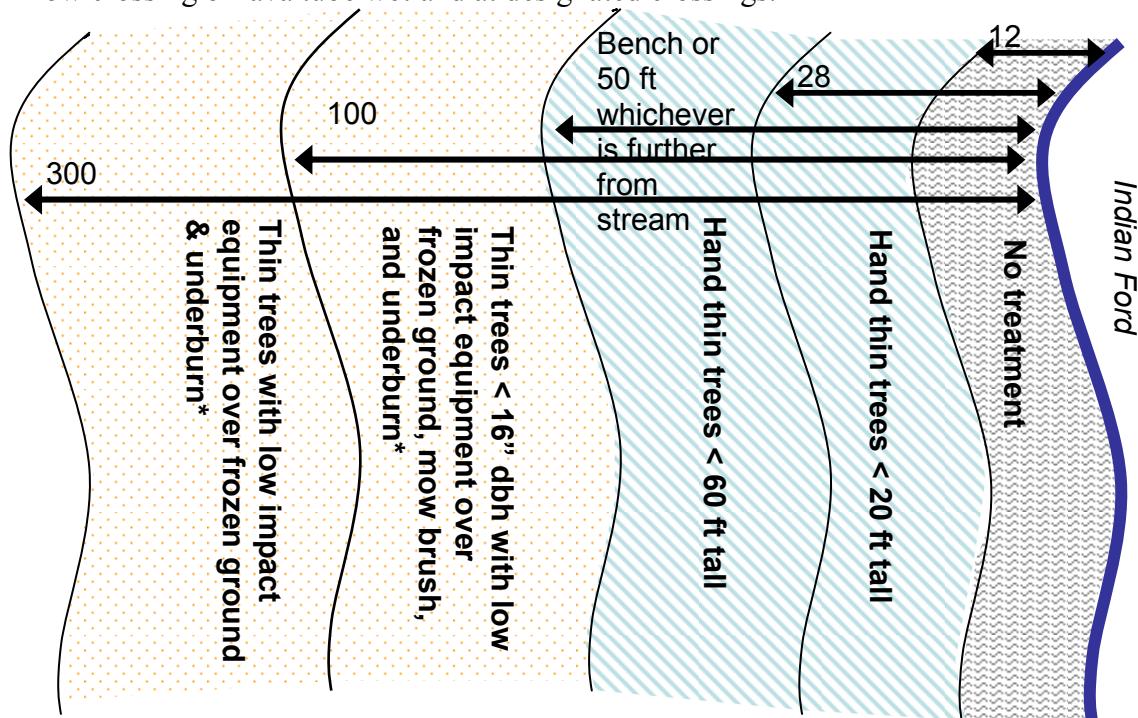
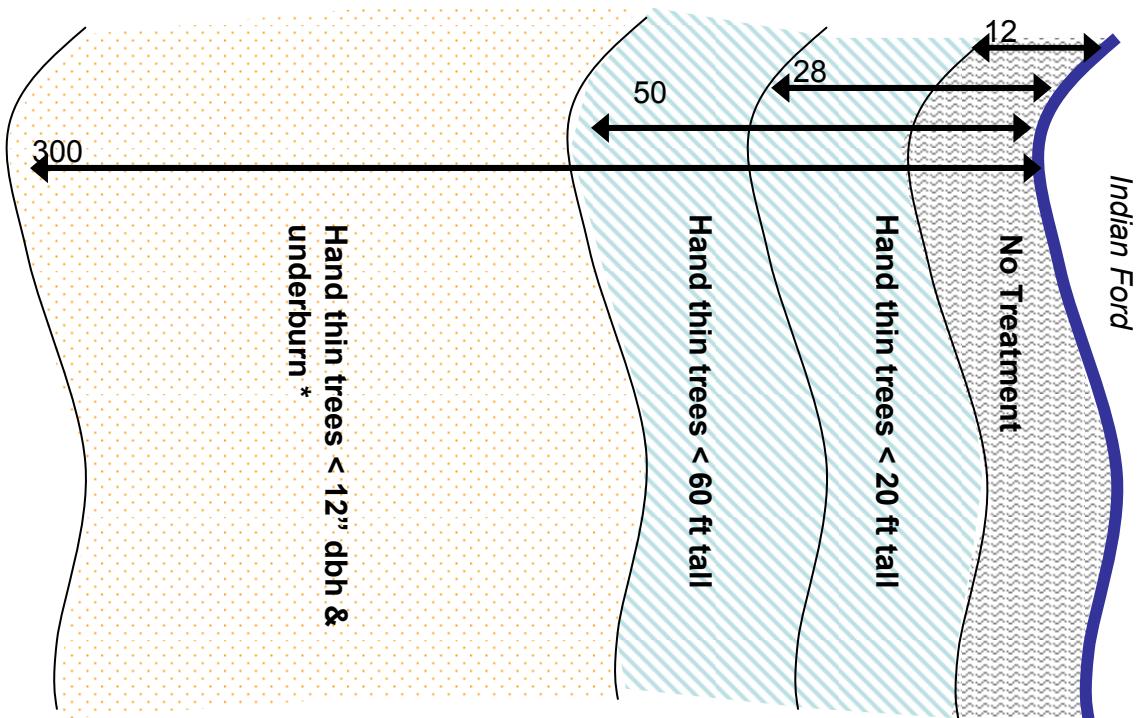


Figure 11 Alternative 2 - Riparian Habitat Conservation Area Prescription for Indian Ford Creek



* Underburn using existing trails and roads as fireline

Figure 12. Alternative 3 Riparian Habitat Conservation Area Prescription for Indian Ford Creek

2) Intermittent Streams and lava tube wetland Riparian Habitat Conservation Area (70 ft of each side of stream/wetland)

The main concern regarding treatments within this category is sediment delivery. To reduce sediment delivery from treatments proposed in the Glaze Forest Restoration Project, no ground-based machinery, fireline construction, or pile burning is allowed within the Riparian Habitat Conservation Area of this category. Hand thinning is allowed in both Riparian Habitat Conservation Areas and ground-based machinery is allowed to cross the lava tube wetland at designated crossings to access other treatment areas.

3) Wetlands greater than 1 acre Riparian Habitat Conservation Areas (wetland + 150 ft around wetlands except where stream Riparian Habitat Conservation Areas overlaps, then go with largest buffer)

The main concern regarding treatments within this category is protection of sensitive soils, such as soils with a seasonal high water table. Treatment with low impact equipment, including mowing of brush, is allowed in the Riparian Habitat Conservation Area surrounding the wetlands. However, to prevent detrimental soil disturbance within wetlands, density management treatments are not allowed in some treatment areas and are restricted to hand-thinning. Thinning with low impact equipment over frozen ground is allowed in other areas.

Specific Criteria

- Thinning in Riparian Habitat Conservation Areas will be allowed only with low-impact equipment.
- Brush will be mowed with low-impact equipment in Riparian Habitat Conservation Areas around wetlands (i.e. no ground based equipment within wetland)
- Some trees to be thinned into meadow perimeter will be marked and felled for wood recruitment
- Pile burning and underburning will be allowed in Riparian Habitat Conservation Areas surrounding the wetland but not in the wetland.
- No firelines will be constructed. Use only existing trails, road, or wet line for containing the fire.

Aspen Restoration /Riparian Habitat Conservation Areas

- Upland trees will be thinned with low-impact equipment over frozen ground within the wetland portion of the Riparian Habitat Conservation Areas in units 7 (see unit specifics) and 8.
- Upland trees within the wetland portion of the Riparian Habitat Conservation Areas in treatment areas 16, 17, 20 & 23 will be hand thinned.
- Fuels treatments will hand pile (units 16, 17, 20 & 23 within wetland portion) or machine pile (units 7 and 8) and burn or underburn..
- Burn piles will be located at least 100 feet away from live and intermittent stream channels.
- Piles will be less than 100 ft² and not cover more than 5% of the area within the Riparian Habitat Conservation Area.
- Underburning can done, but no fireline will be constructed
- No brush mowing will occur.

Grass Dominated Meadows/ Riparian Habitat Conservation Areas

- Upland trees in units 9, 10, & 13 will be hand thinned.
- Lop and scatter or hand piling and burning will be done outside of the meadow.
- Some trees to be thinned into meadow perimeter will be marked and felled for down wood recruitment.
- Prescribed fire will be allowed after reducing dominance of cheatgrass with a hand held mower.

No Treatment Wetlands

- No treatment, except hand thinning of conifers is proposed within the wetland portion of the Riparian Habitat Conservation Areas associated with treatment areas 11, 12, 15, 21, 28, and 30, except prescribed fire in treatment areas 11 and 28 if the ponds are dry.

4) Haul within Riparian Habitat Conservation Areas

The main concern with haul is sediment delivery to Indian Ford Creek and compaction in wetlands. Haul routes were designed to provide the least amount of impact to soils, wetlands, and streams. In addition, contract contingencies such as restricting haul when the roads are too wet and maintaining road drainage, would be implemented. To prevent increasing compaction from roads, all temporary roads were located on existing road surfaces associated with non-system roads. Between 2 and 3.5 miles of temporary roads would be used to access treatment areas, with 0.4 miles in Riparian Habitat Conservation Areas. All temporary roads are existing roads located on already compacted areas and would be closed and/or subsoiled after harvest activities are completed.

The 1012-335 road, which crosses the wet, western wetland arm of Glaze Meadow, could be used for haul if the road bed was completely dry or frozen. Strict project design elements would be implemented to insure the road bed does not degrade and cause the wetland to become disconnected from Glaze Meadow. If appropriate conditions do not exist for use of the 1012-335 road then the 2000-300 road over Indian Ford Creek would be used as a haul route. The crossing of Indian Ford Creek at the gated 2000-300 road is currently an over-widened ford with abundant fine sediment in the substrate. To minimize sedimentation from haul a temporary modular Acrow bridge would be installed and removed after all harvest and associated activities are complete.

Road maintenance would be necessary on the 2000-300 road near the 1012-335 road junction to improve drainage. It appears that the new beaver pond has elevated or redistributed groundwater levels and springs have emerged adjacent to the 2000-300 road and water is intermittently flowing near the road.

Specific Criteria

- No new roads will be created.
- No streams or waterbodies will be forded during haul.
- All non-system temporary roads in the old growth allocation will be subsoiled to restore road prisms as habitat.
- The temporary bridge across Indian Ford Creek will be removed after completion of activities.
- All Level I roads (3 miles) used for haul will be returned to closed road status after use.

Mitigation Measures for Temporary Acrow Bridge Installation and Removal

- Limit the number of stream crossing to below 14. *Moderate effectiveness*
- Do not remove any shade producing vegetation. *High effectiveness*
- Instream work is allowed between July 1- September 30. *High effectiveness*
- Rehabilitate the site after bridge removal by removing fill, improving the ford by narrowing the crossing and lining the bed with clean gravel. *Moderate effectiveness*

Project Design Criteria and Mitigation Measures for Fire Hazard

- Identify prescribed burning test plots in aspen areas to monitor if fire will enhance aspen sprouting and maintenance.

Mitigation Measures

- Conduct prescribed fire in compliance with National Ambient Air Quality Standards, Oregon Department of Environmental Quality regulations and restrictions, and under the Oregon Smoke Management Plan regulations and restrictions. *High effectiveness*
- During project implementation continue to monitor 1st order (direct mortality) and 2nd order (stress and subsequent insects or disease) fire effects on old growth trees. If long duration and residence time smoldering in duff layers occurs at the base of trees, rake and break up smoldering duff. *High effectiveness*

Project Design Criteria and Mitigation Measures to Protect Wildlife**Mitigation Measure for Public Concern about Bird Boxes**

- Protect bird boxes during thinning or prescribed fire operations, or remove and save for relocation. *High effectiveness*

Mitigation Measures for Snags

- Harvest activities, both pre-commercial and commercial, will retain all existing snags greater than or equal to 10 inches diameter except where they create a safety hazard. Standing dead trees, which present a safety hazard, would be felled and left in place. *Moderate effectiveness*
- Apply a sufficient buffer of live trees that are not cut around existing snags to minimize the need to fall snags as hazard trees during logging operations. *Moderate effectiveness*

Recommendations for Snags

- During prescribed fire operations consider lining large snags (i.e. 21 inches diameter or larger) that are at a high risk of consumption. Criteria to apply include: 1) is the snag likely to burn?, 2) Is it a large snag > 21" diameter?, 3) Can duff be raked away around the snag to reduce the probability it will burn? If so, line the snag if possible.
- Consider spring burning (when 1,000 hour fuel moistures are higher) to decrease the chances of large snag and down wood consumption by fire.

Mitigation Measures for Coarse Woody Debris or Down Wood

- During prescribed fire operation, consumption of down wood is restricted to the following criteria. Consumption of down wood at least 12 inches in diameter at the small end and at least 6 feet in length (at rate of 40 lineal feet per acre in ponderosa pine) will not exceed 3 inches total (1 ½ inches per side). This complies with Forest Plan Amendment #2 (USDA 1995). *Moderate effectiveness*

Recommendations for Coarse Woody Debris or Down Wood

- During prescribed fire operations consider lining large snags (i.e. 21 inches diameter or larger) that are at a high risk of consumption. Criteria to apply include: 1) is the snag likely to burn?, 2) Is it a large snag > 21" diameter?, 3) Can duff be raked away around the snag to reduce the probability it will burn? If so, line the snag if possible.
- Consider spring burning (when 1,000 hour fuel moistures are higher) to decrease the chances of large snag and down wood consumption by fire.

Mitigation Measures for Red-tail Hawk

- **No known nest sites exist in the project area.** Restrict disturbing activities within ¼ mile of any known or newly discovered nests from March 1st through August 31st. 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 the species indicated is not nesting or that no young are present that year. Waivers are valid only until the start date of the restriction period of the following year. *Moderate effectiveness*
- Maintain forested character within 300 feet of any newly discovered active nest site and implement restrictions that limit disturbance as outlined above. *Moderate effectiveness*

Recommendations for Red-tail hawk

- Protect large snags during treatments.

Mitigation Measures for Goshawk

- **No known active nest sites exist in the project area.** Restrict disturbing activities within ¼ mile of any known or newly discovered nests from March 1st through August 31st. 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 the species indicated is not nesting or no young are present that year. Waivers are valid only until the start date of the restriction period of the following year. *Moderate effectiveness*
- If a new territory is discovered, a 30 acre no treatment area around the nest will be identified and a 400 acre Post Fledging Area will be delineated as outlined in the Eastside Screens. *Moderate effectiveness*

Recommendations for Goshawk

- During thinning activities vary spacing to mimic more natural patterns found on the landscape.

Mitigation Measures for Coopers and Sharp-shinned Hawks

- **No known nest sites exist in the project area.** Restrict disturbance activities within ¼ mile of any newly discovered nests from April 15th through August 31st. 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 the species indicated is non-nesting or no young are present that year. Waivers are valid only until the start date of the restriction of the following year. *Moderate effectiveness*

Mitigation Measures for Great Gray Owl

- **No known nest sites exist in the project area.** Restrict disturbance activities within ¼ mile of any known or newly discovered nests from March 1st through June 30th. 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 the species indicated is not nesting or no young are present that year. Waivers are valid only until the start date of the restriction period of the following year. *Moderate effectiveness*

Recommendations for Lewis' Woodpecker, Olive-sided Flycatcher, Chipping Sparrow, Flammulated Owl, Brown Creeper, Red-naped Sapsucker

- To avoid potential nest destruction and loss of broods, schedule harvest and post harvest activities, including mowing, prescribed burning, and hand thinning after the nesting season in appropriate habitat from March 15th to June 15th.

Project Design Criteria and Mitigation Measures to Protect Fisheries- Also see Riparian Habitat Conservation Area Criteria

Mitigation Measures for Fisheries (Redband Trout)

- Seasonal in -water work is allowed from July 1 to September 30. *High effectiveness*
- Gravel placement at the bridge crossing will be clean of fines and will be above of the active channel. *Moderate effectiveness*

Project Design Criteria and Mitigation Measures to Protect Botanical Resources and Prevent Invasive Plants

Rare Plant Species

Conduct any mechanical timber cutting and/or removal activities over snow or frozen ground. The intent is to minimize soil displacement that would crush or uproot Peck's penstemon plants.-

Mitigation Measures for Rare Plants

- Do not create any new landings in Peck's penstemon population areas. Confer with District Ecologist on specific locations. Decking is allowed over sufficient snow or frozen ground. *Moderate effectiveness*

Mitigation Measures to prevent Invasive Plant Species

- Use contract clauses to prevent the inadvertent introduction of invasive plant species by contractors. *High effectiveness*
- Continue hand pulling all bolting or flowering knapweed along the Rd 330, at the southern edge of the project area, in the summer and fall preceding each period of project-related treatments. Flag and clearly label the boundary of this site to prevent unintentional mechanical entry during project-related activities. *Moderate effectiveness*
- Reduce cheatgrass (*Bromus tectorum*) populations within meadow areas before prescribed fire is reintroduced. Use a handheld mower or "weed whacker" early in the season to remove developing seedheads and exhaust plant reserves. *Moderate effectiveness*
- Treat prescribed fire as an experimental tool on the wet and grass-dominated meadows. Preliminary burns should cover no more than 10% of the area of either type of meadow. Monitor and review results for 3 years, particularly with regard to noxious weed establishment, before conducting further burns. Do not burn over any area that includes or is within 50 meters of cheatgrass (*Bromus tectorum*). *Moderate effectiveness*

Project Design Criteria and Mitigation Measures to Protect Soils

The following implementation guidelines are designed to avoid or minimize potentially adverse impacts to soils by controlling equipment operations to locations and conditions that are less susceptible to resource damage. Project design criteria include minimizing the extent of new soil disturbance from mechanical treatments by implementing appropriate design features for avoiding or minimizing detrimental soil impacts from project activities. Options include using some or all of the following:

- ✓ Use existing log landing and trail networks (whenever possible) or designate locations for new trails and landings.
- ✓ Designated locations for new trails and landings need to best fit the terrain and minimize the extent of soil disturbance.
- ✓ To minimize detrimental soil impacts, attempt to match specialized equipment such as harvester forwarder or all season's vehicles to the types of material being removed.
- ✓ If mechanical slash piling is used machine operations will be limited to working on existing trails.
- ✓ If traditional harvester skidder equipment is used, maintain spacing of 100 to 150 feet for all primary (main) skid trail routes, except where converging at landings. Closer spacing due to complex terrain must be approved in advance by the Timber Sale Administrator and Soil Scientist. Main skid trails have typically been spaced 100 feet apart (11% of the unit area). For the larger activity areas (greater than 40 acres) that can accommodate wider spacing distances, it is recommended that distance between main skid trails be increased to 150 feet

to reduce the amount of detrimentally disturbed soil to 7 percent of the unit area (Froehlich 1981, Garland 1983). This would reduce the amount of surface area where restoration treatments, such as subsoiling, would be required to mitigate impacts to achieve soil management objectives.

- ✓ Restricting skidders and tractors to designated areas (i.e. roads, landings, designated skid trails) and limit the amount of traffic from other equipment off designated areas. Harvester shears will be authorized to operate off designated skid trails at 30 foot intervals and make no more than two equipment passes on any site specific area to accumulate materials.
- ✓ Use of directional felling techniques from pre-approved skid trails, and suspending the leading end of logs during skidding operations.
- ✓ Operate equipment over frozen ground or a sufficient amount of compacted snow to protect mineral soil. Equipment operations should be discontinued when frozen ground begins to thaw or when there is too little compacted snow and equipment begins to cause soil puddling damage (rutting).

Mitigation Measures for Soils

Apply appropriate Best Management Practices (BMPs) to all ground disturbing management activities, as described in General Water Quality Best Management Practices (Pacific Northwest Region, 1988). These BMPs are tiered to the Soil and Water Conservation Practices Handbook (FSH 2509.22) which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Deschutes Land and Resource Management Plan states that BMPs will be selected and incorporated into project plans in accordance with the Clean Water Act for protection of waters of the State of Oregon (Deschutes Land and Resource Management Plan 4-69).

Specific BMPs commonly used to minimize the effects of road systems, fuels and timber management activities on the soil resource are briefly described for this project proposal.

- Use old landings and skidding networks whenever possible. Assure that water control structures are installed and maintained on skid trails that have gradients of 10 percent or more. Ensure erosion control structures are stabilized and working effectively (Deschutes Land and Resource Management Plan SL-1; Timber Management BMP T-16, T-18). *High effectiveness.*
- In all proposed activity areas, locations for new yarding and transportation systems would be designated prior to the logging operations. This includes temporary roads, spur roads, log landings, and primary (main) skid trail networks. (Deschutes Land and Resource Management Plan SL-1 & SL-3; Timber Management BMP T-11, T-14 & T-16). *Moderate effectiveness.*
- Surface drainage on temporary roads – minimize the erosive effects of concentrated water through the proper design and construction of temporary roads (Road BMP R-7). *Moderate effectiveness.*
- Road maintenance – conduct regular preventive maintenance, including during times of haul, to avoid deterioration of the road surface and minimize the effects of erosion and sedimentation (Road BMP R-18, R-19). *Moderate effectiveness.*

- Skid trails and landings would be rehabilitated by subsoiling as needed to meet the 20% standard for detrimental conditions following fuels treatments. Rehabilitate additional primary skid trails and landings, where appropriate, if funding is available. *High effectiveness*
- Rehabilitate all temporary roads by closing and waterbarring or subsoiling impacted surfaces in the old growth areas where appropriate immediately following post-harvest operations to restore hydrologic function. *High effectiveness*
- Protect soils and water during prescribed burn operations – a burn plan addressing compliance with all applicable Deschutes Land and Resource Management Plan standards and guidelines and Best Management Practices will be completed before the initiation of prescribed fire treatments in planned activity areas. Prescribed burn plans need to include soil moisture guidelines to minimize the risk of intense fire and adverse impacts to soil and water resources (Deschutes Land and Resource Management Plan SL-1 & SL-3; Timber BMP T-2, T-3 & T-13; Fuels Management BMP F-2, F-3). *Moderate to High effectiveness*.
- Protect Soils and Water resources by piling the majority of slash to be burned on existing areas of detrimental compaction such as skid trails or landings in order to reduce incurring additional detrimental impacts between skid trails. Promote the use of grapple piling machinery and restrict all machine traffic used for fuels treatments or Special Forest Product removal to skid trails and landing areas created during the commercial salvage activities or existing prior to these operations. Hand-pile slash between skid trails that is located out of reach of grapple machinery operating from skid trails or landing areas. *High effectiveness*
- Coarse woody debris/down wood – assure that on Ponderosa Pine sites, a minimum of 5 to 10 tons per acre of large woody debris (greater than 3 inches in diameter) is retained within activity areas to provide organic matter reservoirs for nutrient cycling that helps maintain long-term site productivity (Deschutes Land and Resource Management Plan SL-1). Assure that on Mixed Conifer sites, a minimum of 10 to 15 tons per acres (greater than 3 inches in diameter) is retained for long-term nutrient cycling. *Moderate effectiveness*.
- Maintain duff layer – strive to maintain fine organic matter (organic materials less than 3 inches in diameter; commonly referred to as the duff layer) over at least 65 percent of all activity areas (pertains to both harvesting and post harvest operations). If the potential natural plant community (i.e., site) is not capable of producing fine organic matter over 65 percent of the area, adjust minimum amounts to reflect potential vegetation site capabilities (Deschutes Land and Resource Management Plan SL-6; Fuels Management BMP F-2; Timber Management BMP T-13). *Moderate effectiveness*.
- Use sale area maps for designating soil and water protection needs (Timber Management BMP T-4). *Moderate effectiveness*.

Project Design Criteria and Mitigation Measures to Protect Heritage Resources

To avoid reducing the potential for data to be collected from significant and unevaluated heritage resources in the project area the following project design criteria will be followed:

- All landings and slash piles will be located outside of known eligible and unevaluated heritage site locations.

- All skidding and hauling will be located outside of known eligible and unevaluated heritage sites or will be conducted on frozen ground, using low impact skidding or hauling equipment, or with a physical barrier between lithic scatter sites that are eligible or unevaluated and any skid or haul route through the site.
- No fire lines for fuel reduction burning will be built within known eligible or unevaluated heritage sites.
- No eligible or unevaluated heritage site that contains artifacts or features that could be degraded or destroyed by fire will be burned.
- Lithic scatter sites with only stone artifacts will not be mopped up after fire with hand tools or other activities.

Mitigation Measures for Heritage Resources

Avoid known sites in these units. Logging over frozen ground with minimal soil disturbance is considered avoidance. *High Effectiveness*

- Unit 4 - avoid 3 sites (1 acre, 1 acre, and 5-10 acres)
- Unit 19 - avoid 1 site (0.8 acre)
- Unit 22 – avoid 1 site (0.4 acre)
- Unit 27 – avoid 2 sites (approx 1 acre) and (5.3 acres)
- Unit 26 – avoid north end of 1 site (0.2 acres)

Project Design Criteria and Mitigation Measures to Protect Scenery

It is recommended a Landscape Architect be involved in tree marking, especially in relation to areas seen from horse trails.

**The following mitigation measures are applicable for all proposed treatment units, including units within the foreground landscape areas (0-1/4 mile) of permitted horse trails (see map in recreation section)and the Metolius Windigo trail.

Mitigation Measures for Scenery

- Vegetation treatment activities should be subordinate to existing landscape character and result in landscape patterns that mimic patterns created by natural disturbance (e.g. fire) to the greatest extent practical. The line, form, color, and texture elements found within the existing landscape should be present and maintained. *High effectiveness*
- Proposed treatments to reduce fuel loading should not dominate naturally established line, form, color or texture elements within the proposed treatment areas.
High effectiveness
- Clean-up activities for foreground landscape within the proposed treatment units and landings along trails frequented by the recreating public should be completed within one year for these Retention allocation areas. *High effectiveness*
 - 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') of trails.
 - Slash piles should be small and not be obvious to the casual forest visitor (viewing the area from a trail) following post treatment activities.

- When prescribed fire is utilized in the Old Growth Management Area allocation, avoid scorching above 2/3 of the live crown in units located within the Foreground landscape of trail corridors. Severely damaged and/or burned trees can be treated by pruning, and/or removed soon after as part of post treatment activities, within a one year time frame. *Moderate effectiveness*
- When prescribed fire is utilized in the Metolius Black Butte Scenic Area allocation follow direction that states prescribed fires are required to be shaped as natural occurrences and generally be less than 5 acres in size per block in foreground areas visible from the Metolius Windigo Trail.
- Minimize ground disturbance and damage to vegetation in foreground landscape areas seen from scenic and travel corridors. Logging over frozen ground or snow is an acceptable mitigation. *High effectiveness*
- Flush cut stumps in the proposed units along the Metolius Windigo Trail within the immediate foreground landscape area (75 feet from trail). *Moderate effectiveness*
- Where possible, design and locate skid trails and landing areas at least 300 feet away from scenic and travel corridors. Use parallel (to a travel corridor) skid trails to help reduce visual effect. Logging over frozen ground or snow is an acceptable mitigation. *Moderate effectiveness*
- 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 utilized to reduce residual visual effect in the landscape. *Moderate effectiveness*
- Removal of all flagging materials soon after project completion. *High effectiveness*

Mitigation Measures to Protect Recreation /Special Uses

- Minimize activities in the peak of the Special Use permittees operating season (June-August) if possible. Provide educational materials about the project and its goals to the permittee to share with clients. *Moderate effectiveness*
- Use signing and put notice in local newspaper to inform public about ongoing landscape treatments along trails and to inform public when trails will be obstructed or closed. *Moderate effectiveness*.
- Restrict haul of wood material as needed to reduce conflicts with recreation activities (Deschutes Land and Resource Management Plan M19-29). When restrictions are not practical, short term closure of public access may be necessary. *Moderate effectiveness*.
- Protect trail tread by minimizing travel on or across trails with logging equipment and restore damaged tread to standard (coordinate with trails specialist). *Moderate effectiveness*.
- Minimize amounts of logging debris down on trails. Remove any debris within a reasonable time period. *Moderate effectiveness*.

Project Design Criteria For Road Use

- In general, system roads will require maintenance work, including surface spot rockering and roadside brushing.
- NFSR 1012335 road can only be used as a haul route under completely dry or frozen conditions. This is in order to protect the road surface from becoming incised and causing the adjacent meadow to become hydrologically disconnected from the surrounding wetlands.

- Pre-haul road maintenance would be necessary at the Black Butte Ranch back-gate entrance on NFSR 1012330 and the 2000300 road where a spring has emerged in the roadway. Both areas would require spot rocking.
- NFSR 1012330 crosses a 135 foot segment of asphalt paved Hawks Beard Lane, in Black Butte Ranch. This segment requires a padding of crushed aggregate to protect the asphalt.
- Depending on the width of commercial vehicles, reconstruction of private and/or Forest Service gates may be necessary.
- Non-system roads used for haul would be closed following vegetation management activities or allowed to re-vegetate naturally or be subsoiled described earlier.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 4. Comparison of Alternatives, Key Issues, and Analysis Issues

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Key Issue: Size of Trees removed	No trees removed	In Old growth and Second growth trees up to 21" diameter may be removed. 0-4 trees/acre over 16" diameter could be removed over 874 acres Mitigation measures address trees over 16" diameter and small old trees	In Old growth trees up to 6" diameter may be removed. No trees over 6" would be removed on 458 acres. In Second growth trees up to 21" diameter may be removed. 0-4 trees/acre over 16" diameter could be removed over 416 acres Mitigation measures address trees over 16" diameter and small old trees
Key Issue: Riparian Habitat Conservation Area Treatments Measures: 1) compaction in Riparian Habitat Conservation Areas 2) stream bank and bed stability 3) compaction in wetlands 4) trees felled in the primary shade zone	No treatment in Riparian Habitat Conservation Areas	Trees 12 -50 feet from Indian Ford Creek are hand thinned (tree height limits to protect shade) Use mechanical thinning and mowing over frozen ground between 50 and 300 feet from the Indian Ford creek Due to Best Management Practices and mitigation, no measurable changes to compaction , stream bank and bed stability including sedimentation, or shade	Trees 12 -300 feet from Indian Ford Creek are hand thinned (tree height limits to protect shade) No mechanical thinning or mowing with ground based equipment Due to Best Management Practices and mitigation, no measurable changes to compaction , stream bank and bed stability including sedimentation, or shade
Analysis Issue: Forest Health Percent of area above the Upper Management Zone and at risk of insects and disease, especially bark beetles	72% of the project area is above the Upper Management Zone. 77% of the old growth and 67% of the second growth acres are above upper management zone.	Approximately 29% of the project acres would be above the Upper Management Zone after treatment. 44% of old growth acres above Upper Management Zone 12% of second growth acres above Upper Management Zone	Approximately 43% of the project acres would be above the Upper Management Zone after treatment. 70% of old growth acres above Upper Management Zone 12% of second growth acres above Upper Management Zone

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Analysis Issue: Forest Health Acres where treatments create conditions more favorable to the development of stand structure and composition similar to historic conditions	Stands continue to be dominated by trees <21" diameter, and with continued development of fire intolerant species	On 874 acres, smaller trees would be removed, especially in the fire intolerant species, increasing the average tree size of the remaining stands. More stands would be dominated by pine.	On 416 acres of second growth, treatments and outcomes are the same as Alt 2. On 458 acres of old growth, treatment is limited to thinning only trees <6" diameter. Approximately 66% of the old growth acres would receive very little thinning-derived benefits to stand structure and species composition
Analysis Issue: Developing Late Old Structure or Old growth Acres and Percent of area where treatments create conditions more favorable to the survival of existing large trees	77% of the project area is above the Upper Management Zone. Accelerated loss of large old growth pine and shift to smaller size classes	412 acres of old growth would be thinned. Approximately 44% of the old growth in the project area would remain above the upper management zone. This also considers that 10% or 46 acres are untreated as retention patches for wildlife	412 acres of old growth would be thinned. Because thinning is limited to trees <6" diameter, approximately 70% of the old growth in the project area would remain above the upper management zone. This also considers that 10% or 46 acres are untreated as retention patches for wildlife
Analysis Issue: Fire hazard Acres of high intensity wildfire fuels conditions moved to moderate or low	1192 acres High Intensity Fuel Conditions	O acres High Intensity Fuel Conditions 578 acres Moderate Intensity Fuel Conditions 874 acres Low Intensity Fuel Conditions	458 acres High Intensity Fuel Conditions 578 acres Moderate Intensity Fuel Conditions 416 acres Low Intensity Fuel Conditions
Analysis Issue: Impacts to Wildlife - Bald eagle Large pine habitats adjacent to meadows	No direct impact to eagles, but long term trend towards loss of large trees for perching and nesting.	Reduced risk of loss of large perch and nest trees, and enhanced conditions favorable to development of future large trees on 874 acres.	Reduced risk of loss of large perch and nest trees, and enhanced conditions favorable to development of future large trees on 416 acres, and slightly improved conditions on another 458 acres.

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Analysis Issue: Impacts to Wildlife – bufflehead Snag and pond habitats	No impact to habitat	No impact to habitat	No impact to habitat
Analysis Issue: Impacts to Wildlife – Crater Lake tigertail Streamside habitats	No impact to habitat	No impact to habitat	No impact to habitat
Analysis Issue: Impacts to Wildlife – Late and Old growth habitat (LOS) Connectivity between late old structure habitats	Continued risk of loss of late old structure habitats across the landscape due to fire, insects and disease	No treatment in connectivity corridors	No treatment in connectivity corridors
Analysis Issue: Impacts to Wildlife – Late and Old growth habitat(LOS) Loss of or changes to late old structure habitats	Continued risk of loss of late old structure habitats across the landscape due to fire, insects and disease	458 acres of old growth would be thinned. Less than 40% of the old growth in the project area would remain above upper management zone.	458 acres of old growth would be thinned. Because thinning is limited to trees <6" diameter, approximately 64% of the old growth in the project area would remain above upper management zone.

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Analysis Issue: Impacts to Wildlife - Management Indicator Species dependent on dead wood, including woodpeckers and pygmy nuthatch Changes to amounts and distribution of snags and down woody material	No direct impact to snags and down wood, except long term trend towards increased smaller snags and loss of existing large snags from fire and lack of new recruitment due to shortage of developing large trees.	Minimal loss of large snags felled as hazard trees or during prescribed fire. Increased development of large pine on 874 acres results in long term recruitment of large snags and down wood. Reduced fire risk on 874 acres maintains existing snags and large down wood.	Minimal loss of large snags felled as hazard trees or during prescribed fire. Increased development of large pine on 416 acres results in long term recruitment of large snags and down wood. Reduced fire risk on 874 acres maintains existing snags and large down wood.
Analysis Issue: Impacts to Wildlife - Management Indicator Species not dependent on dead wood, including raptors Changes to amounts and distribution of nesting and foraging habitats	No direct impact to raptors, but long term trend towards loss of large trees for perching and nesting.	Reduced risk of loss of large perch and nest trees, and enhanced conditions favorable to development of future large trees on 874 acres. Thinning in second growth and old growth will reduce stand densities and may reduce some potential nesting habitat in the short term, while protecting other potential habitats from loss by fire.	Reduced risk of loss of large perch and nest trees, and enhanced conditions favorable to development of future large trees on 416 acres, and slightly better conditions on another 458 acres. Thinning in second growth will reduce stand densities and may reduce some potential nesting habitat in the short term, while protecting other potential habitats from loss by fire.
Analysis Issue: Impacts to Wildlife - Management Indicator Species – mule deer Changes to amount and distribution of forage and hiding cover	533 acres are currently classified as hiding cover Hiding cover increases in the short term, but would be at risk from fire.	Hiding cover is reduced to 31% on portions of the 533 acres of thinning. This meets the Deschutes Land and Resource Management Plan Standard of 30%. The percent forage available is reduced to 69%.	Hiding cover is reduced to 31% on portions of the 533 acres of thinning. This meets the Deschutes Land and Resource Management Plan Standard of 30%. The percent forage available is reduced to 69%.

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Analysis Issue: Landbird Conservation Strategy, including Lewis' wood-pecker, chipping sparrow, flammulated owl, brown creeper, red-naped sapsucker, and olive-sided flycatcher Changes to amounts and distribution of habitats	No direct impact to snags and down wood habitats, except long term trend towards increased smaller snags and loss of existing large snags from fire and lack of new recruitment due to shortage of developing large trees.	Minimal loss of large snags felled as hazard trees or during prescribed fire. Increased development of large pine on 874 acres results in long term recruitment of large snags and down wood. Reduced fire risk on 874 acres maintains existing snags and large down wood. Thinned stands increase nest security for Lewis' wood-peckers by increasing sight distances for detecting predators. Thinning, mowing, and prescribed burning may result in short term loss of shrub habitats, but will result in long term improvement to habitat diversity and resiliency.	Minimal loss of large snags felled as hazard trees or during prescribed fire. Increased development of large pine on 416 acres results in long term recruitment of large snags and down wood. Reduced fire risk on 874 acres maintains existing snags and large down wood. Thinned stands increase nest security for Lewis' wood-peckers by increasing sight distances for detecting predators. Thinning, mowing, and prescribed burning may result in short term loss of shrub habitats, but will result in long term improvement to habitat diversity and resiliency.
Analysis Issue: Impacts to Fish Changes to stream habitats	No changes to streambed embeddedness, large wood, pool frequency or quality, off-channel habitats, spawning gravel, fish passage, refugia, streambank condition, or floodplain connectivity.	No measurable change or effects to any habitat components due to mitigation and avoidance of activities within the Riparian Habitat Conservation Areas and floodplain.	No measurable change or effects to any habitat components due to mitigation and avoidance of activities within the Riparian Habitat Conservation Areas and floodplain.
Analysis Issue: Impacts to Fish Disturbance of Individuals	No disturbance to individuals	Temporary bridge installation will result approximately 20 minutes of minor turbidity from mobilization of existing streambed silt.	Temporary bridge installation will result approximately 20 minutes of minor turbidity from mobilization of existing streambed silt.
Analysis Issue: Impacts to Botany/Rare Plants: Probability of detrimental impact to rare plant populations	No detrimental soil disturbance, but long term trend towards loss of habitat due to absence of fire and increased canopy cover.	Mitigation of logging over frozen ground/snow will minimize short term loss of individual plants from ground disturbance on 874 acres. There will be long-term benefits to the population from more sunlight, reducing duff layers and thatch in the meadows and prescribed fire.	Mitigation of logging over frozen ground/snow will minimize short term loss of individual plants from ground disturbance on 874 acres. There will be long-term benefits to the population from more sunlight, reducing duff layers and thatch in the meadows and prescribed fire.

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Analysis Issue: Impacts from Invasive Plants Acres of detrimental soil disturbance created that will encourage or facilitate invasive plant establishment	No effects	Increased risk of invasive plant introduction and spread on 874 treated acres. Mitigation measures will minimize risk.	Increased risk of invasive plant introduction and spread on 874 treated acres. Mitigation measures will minimize risk.
Analysis Issue: Impacts to Soils Change in extent of detrimental soil disturbance	Approximately 40% of the project area has detrimental soil conditions from previous treatments .	Approximately 70 acres of detrimental soil conditions exist. Another 53 acres would be impacted during activities.	Same as Alternative 2
Analysis Issue: Impacts to Soils Amount of coarse woody debris and surface organic material retained	Adequate amounts of woody debris and organic material currently exist over the project area, and would increase over time, unless completely removed in a high intensity fire.	Harvest would reduce potential sources of coarse woody debris, however harvest activities would recruit it to the forest floor from slash and breakage. Low temperture prescribed fire would remove some surface litter and duff. This reduces fuel loadings and wildfire potential for a hotter from g damaging burn, releases nutrients and maintains adequate organic material.	Same as Alternative 2

	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Analysis Issue: Impacts to Cultural Resources: Number of cultural sites protected Acres of Cultural plant habitat enhanced	No changes or effects to cultural resource sites 0 acres habitat enhanced	Mitigation and avoidance results in no sites unprotected. 1192 acres habitat enhanced	Mitigation and avoidance results in no sites unprotected. 1192 acres habitat enhanced
Analysis Issue: Impacts to Scenic values and Recreation Experience: Short term changes to scenery, displacement of users, and time period for fuels cleanup	No visual impacts or disturbance to the recreation experience. Long term reduction in scenic quality and visual diversity as stands degenerate and trees die and fall, dead woody material reduces access, and large old growth trees become scarce. No displacement of users.	Short term visual impacts from treatments to at least 90% of the trails in the project area. Long term benefits to scenic quality and visual diversity as treated stands are opened, view distance is increased, and large trees become more dominant in the view. Fuel treatment clean-up would be completed within one year. Project design avoids activities in peak user period.	Short term visual impacts from treatments to at least 90% of the trails in the project area. Long term benefits to scenic quality and visual diversity as treated stands are opened, view distance is increased, and large trees become more dominant in the view. This alternative removes fewer small trees (6" to 12") than in Alt 2, so benefits to scenic quality are correspondingly less. Fuel treatment clean-up would be completed within one year. Project design avoids activities in peak user period.
Analysis Issue: Economics of the Project Project Cost Product Values	No short term costs or products removed Long term risk of loss to wildfire, insects and disease	Cost= \$873,800 Product Value=\$622,650 Net Value= (-\$251,150)	Cost= \$732,400 Product Value=\$474,725 Net Value= (-\$257,675)

ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

Past, present, and future activities that may be considered in the following analysis include:

- 1) Fire suppression since early 1900's
- 2) Grazing since 1880's and ditching
- 3) 1930's logging that removed old growth (see 1943 historic photo in Chapter 1)
- 4) Highway 20 Fuels reduction (1990's and ongoing)
- 5) Black Butte Ranch ponds and creek channel manipulations
- 6) Glaze grazing allotment (closed in mid 1990's)
- 7) Grazing on private lands- Black Butte Ranch & downstream
- 8) Black Butte Ranch sewage effluent (point source pollution in winter)
- 9) Black Butte Ranch wells & irrigation
- 10) Irrigation withdrawals downstream
- 11) Black Butte Stables Horse operation and trails
- 12) Road maintenance
- 13) Sisters Area Fuels Reduction Project (SAFR)

Forest Vegetation

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Forest Vegetation Specialist Report for this project (Tandy, B. 2008). Additional information is contained in the full specialist report.

Affected Environment

Landscape Overview

The historic condition of the vegetation in the Glaze project area and surrounding landscape is described in the Sisters/Whychus Watershed Analysis (USDA, 1998). This analysis indicates that fire played a significant role in creating open, fire-climax forests across the Glaze Meadow project area.

Historically, the ponderosa pine plant associations (73% of the project area) were part of a large, essentially unfragmented, landscape patch that was dominated by medium/large tree (21"+ diameter) ponderosa pine habitats that were primarily single-stratum late and old structure. Historically, the mixed conifer and ponderosa pine forests were strongly influenced by frequent fire disturbances that maintained open under stories and a dominance of long-lived, fire adapted species such as ponderosa pine. All of these processes, in turn, helped reduce competition for water and nutrients, prevented large scale effects from insect and disease cycles, and maintained vigor in the dominant tree species.

Over the past 100 years, human caused changes (fire exclusion, timber harvesting, road construction, etc.) have occurred in the Whychus watershed and in the Glaze Meadow project area (USDA, 1998). Perhaps the greatest impacts on ecosystem stability have been the exclusion of fire and the removal of the medium/large tree component through timber harvest. Both of these practices have resulted in significant changes in forest densities, species composition and structure. Years of fire exclusion has resulted in increased numbers of small trees and allowed the establishment of fire intolerant species such as western juniper in the ponderosa pine plant associations and white fir, Douglas-fir and lodgepole pine in the mixed conifer and riparian plant associations. Timber harvest up until the early to mid 1990's removed a significant portion of the medium/large tree component, thus contributing to a significant change in stand structure from medium/large tree dominated stands to small tree dominated stands.

Plant Associations and Plant Association Groups

Plant community classification in the Pacific Northwest Region follows guidelines established in FSH 2090.11 (USDA Forest Service, 1991). It is founded on the concept of "Potential Natural Communities" (Hall, 1998). Potential Natural Communities are: "The biotic community that would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbance under present environmental conditions. Grazing by native fauna, natural disturbances such as drought, floods, wildfire, insects and diseases, are inherent in the development of potential natural communities which may include naturalized nonnative species." (FSH 2090.11, USDA Forest Service, 1991)

In the Pacific Northwest Region, the term used for potential natural communities is "plant associations" (Hall, 1998). Plant associations for the Pacific Northwest Region are described without considering disturbance caused by natural elements (as well as human-caused disturbances), including fire (Hall, 1998). Consequently, a plant association is composed of species that will be most competitive over time (climax species) and these species will prevent the establishment of less competitive species (seral species) under current climate and site conditions (Hall, 1998).

Plant associations on the Sisters Ranger District and within the Glaze Meadow project area were determined through field mapping of the potential natural vegetation using the protocol established by Volland (1985) and Kovalchik (1987), with input from the Area IV Ecologist and other Forest Specialists including silviculturists, ecologists, botanists and stand exam personnel. The associations and series were then grouped by their climax species, site potential, and temperature and moisture similarities into Plant Association Groups, using the categories listed in the Deschutes WEAVE (Watershed Evaluation and Analysis for Viable Ecosystems) document (USDA, 1994) and are displayed in Table FV-1 and Figure FV-1.

Ponderosa pine: Ponderosa pine plant associations are found over a majority of the project area (approximately 73%). In this plant association group, ponderosa pine is the main seral and climax

species, growing in small, even-age groups or as fairly uniform second growth. Minor amounts of western juniper, lodgepole pine, white fir and Douglas-fir may be present.

Meadow: Meadow plant associations are found on approximately 11% of the project area and are associated with Glaze Meadow, a large complex of meadows in the south and southeast portion of the project. The plant associations found within this type are described in Kovalchik (1987) and are grass dominated seasonally wet/dry meadows.

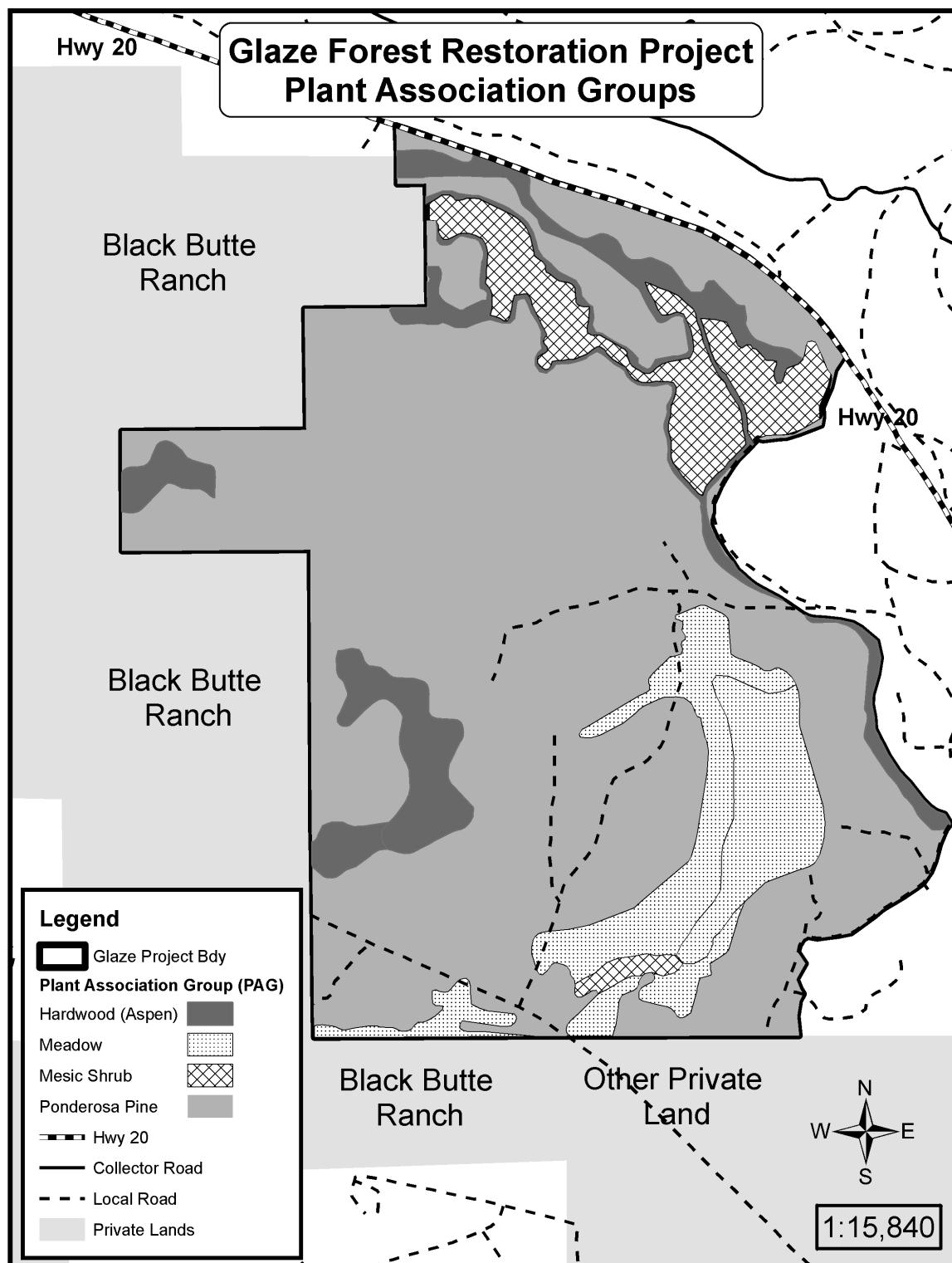
Hardwood: Hardwood (i.e., aspen) plant associations are found on approximately 9% of the project area. The plant associations found within this type are described in Kovalchik (1987). These plant associations are found as patches or as stringers along the edges of meadows or mesic shrub plant associations. In these plant associations, aspen is the dominant hardwood with lodgepole pine and ponderosa pine as the dominant conifers.

Mesic Shrub: Mesic shrub plant associations are found on approximately 7% of the project area and are associated with Black Butte Swamp, a large complex of shrub fields and meadows in the north portion of the project. The plant associations found within this type are described in Kovalchik (1987) and are willow dominated and perennially wet.

Table FV-1: Plant Association Groups and Plant Associations.

Plant Association Group (PAG)			Plant Association			
Name	Acres	% Acres	Name	Code	Acres	% Acres
Ponderosa Pine	874	73%	Ponderosa Pine / Bitterbrush / Fescue	CPS2-11	794	67%
			Ponderosa Pine / Bitterbrush-Manzanita / Fescue	CPS2-17	56	5%
			Ponderosa Pine / Sedge-Fescue-Peavine	CPG2-12	24	2%
Meadow	133	11%	Kentucky Bluegrass Community Type	MD31-11	72	6%
			Nebraska Sedge Community Type	MM29-12	50	4%
			Cusick Bluegrass Association	MD19-11	10	1%
Hardwood	104	9%	Quaking Aspen-Lodgepole Pine / Douglas Spiraea / Widefruit Sedge Community Type	HQM4-11	77	6%
			Quaking Aspen / Common Snowberry / Blue Wildrye Community Type	HQS2-21	27	2%
Mesic Shrub	81	7%	Willow / Sitka Sedge Association	SW11-15	54	5%
			Willow / Kentucky Bluegrass Community Type	SW11-11	27	2%
	1192	100%			1192	100%

Figure FV-1. Plant Association Groups in the Glaze Meadow Project Area



Historic Disturbance Regimes

Table FV-2 displays the historic disturbance regimes that were dominant within the Glaze Meadow project area based on similarly described natural fire regimes (Agee 1990, 1993; Brown 1995; Hann and Bunnell 2001).

Table FV-2. Historic Disturbance Regimes within the Glaze Restoration Project Area

Biophysical Environment	Dominant Disturbance Factors	Disturbance Regimes * (Agee, 1990)	Average Disturbance Patch Size Acres	Typical Landform Setting	Typical Elevation	Aspect
Non-Forest Grass Meadow	Fire	High	1 – 125	Level	3,320	Flat
Non-Forest Mesic Shrub	Fire	High	1 – 30	Level	3,320	Flat
Quaking Aspen	1) Fire 2) I & D	High Moderate	1 – 50	Level to Concave	3,320	Flat
Ponderosa Pine	1) Fire 2) I & D	Low Low	40 – 100 1 – 20	Elevated and dry Sites	3,320	Flat / Rolling

*Low severity regimes: 0-35 year return interval, 0-25% tree mortality,

Moderate severity regimes: 35-100 year return interval, 26-75% tree mortality,

High severity regimes: 100+ year return interval, 75% + tree mortality

Influences of Disturbance Size and Intensity on Forest Vegetation

Disturbances are an important process in continuing the cycle of renewal in most ecosystems, and some amount of mortality from disturbances is desirable, particularly for those species such as woodpeckers that are associated with snags. However, there has been an important change in the type of disturbances that are now affecting this ecosystem. The primary historic disturbance was frequent, low-intensity fire, which helped maintain stable ecosystem functions and old growth characteristics in the ponderosa pine plant associations that dominate the Glaze Meadow project area. Other important historic disturbance agents in the project area were western pine beetle and western dwarf mistletoe. In general, historical disturbances in the Glaze Meadow project area caused mortality from single trees to small groups of trees and rarely, larger patches. This resulted in the important, though minor, structural elements of diseased, dead, damaged and down trees. Many species (wildlife, plant, insect, fungi, microorganisms, etc.) have evolved with the historic cycles and scales of disturbance and successional patterns.

The current primary types of disturbances on the Sisters Ranger District are uncharacteristic wildfire (less frequent, moderate to high severity) (USDA, 1998) and insects and diseases, primarily bark beetles and western dwarf mistletoe. This change may result in fluctuations in habitat conditions more extreme than historic levels for this forest, with potential loss of important habitat elements, such as larger long-lived trees, canopy cover, large snags and down wood (Graham et al., 1999). In addition, there may be a trend of slower recovery of the system, partly due to the effect of high intensity wildfires on soil productivity. The result is a greater impact on those species which have adapted to dense habitat conditions, while it may benefit some early seral species, which can tolerate extreme disturbances.

Mortality across the Glaze Meadow Project Area is generally low; however, large ponderosa pines are declining and may eventually become rare (Hopkins, 1997). The effects of the drought of the 1980's and early 1990's caused many of these old (250-350 years) trees to succumb to western pine

beetle and root disease. This mortality has had the positive effect of moving toward restoring the historic snag component, much of which was removed in harvest activities over the last 50 years. However, it is also indicative of stand conditions that are placing stress on the overstory, and when drought conditions return another wave of mortality would be expected.

Fire

The historical fire regime for the ponderosa pine series, which dominates the Glaze Meadow project area, has been described by Agee (1990 and 1993). Prior to fire suppression, ponderosa pine forests within the Glaze Meadow project area experienced frequent, low-intensity surface fires. Frequent fires in the ponderosa pine type maintained surface fuels at fairly low levels, kept understory trees and vegetation at low levels preventing the formation of ladder fuels that could carry fire into the upper canopy. The high crowns and thick bark of mature trees protected them from the low-intensity wildfires common in the ponderosa pine type.

The frequent low-intensity fire regime of the ponderosa pine type led to the most stable landscape pattern of all the eastside forest vegetation types. The historic landscape pattern in the ponderosa pine type was uneven-aged at the landscape scale but even-aged at the stand or group scale that resulted in a landscape of open park-like stands of trees with the understory dominated by herbaceous vegetation. The even-aged patches within the landscape pattern were created when individual trees or small groups of trees died creating gaps in which new even-aged clumps would develop.

Insects and Disease

The roles of insects and diseases as disturbance agents in forests are very closely tied to vegetation patterns. Factors such as species composition, size structure, and density of forest stands are all very important in determining which agents are likely to be present in the forest, their abundance, and how profound their effect is likely to be on that vegetation. By their actions, forest insects and diseases sometimes alter the vegetative patterns that provided them with suitable habitat, and set the stage for new processes to occur.

The primary insects within the project area include the western pine beetle, mountain pine beetle and pine engraver beetle. Bark beetles prefer old trees in dense stands with low vigor and so may present an additional risk to large trees in the project area. Acres above the upper management zone (see section on stand density for a definition of the upper management zone) for density are considered imminently susceptible to bark beetles.

The primary disease found in the ponderosa pine plant associations in the project area is western dwarf mistletoe. However, this disease is only found in a few small isolated pockets.

Moving forest densities, structure and fuels to resemble conditions within the natural or historic range of variability is expected to reduce the risk of severe stand-replacing wildfires and widespread insect and disease outbreaks, and also reduce the intensity of effects when disturbances occur. These actions could also help maintain old-growth ponderosa pine longer. The remaining old trees may have genetically inherent survival traits that make their gene pool important and rare. They have survived centuries of droughts, fires, insect/disease outbreaks, and human impacts but are reaching the end of their lifecycle which could be extended by reducing competition, stress, and bark beetle susceptibility (Wickman, 1992).

Vegetation Management Activities

Vegetation management activities in the Glaze project area have included timber harvest, small tree thinning and prescribed fire. Table FV-3 summarizes the known past management activities within the project area.

Table FV-3. Known past management activities within the Glaze Restoration Project Area

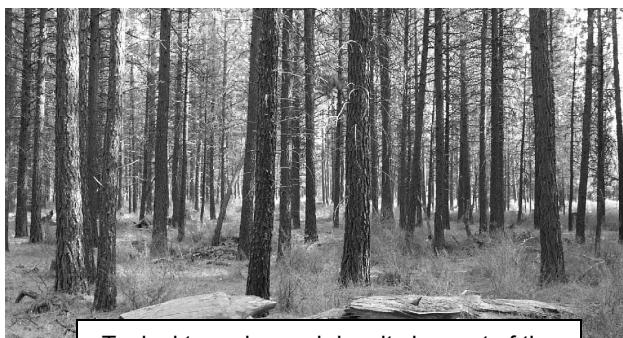
Ownership at the time of Treatment	Management Activity	Approximate Acres
Private	Overstory Removal	450
Public (Forest Service)	Overstory Removal	73
	Regeneration Harvest	12
	Larger Tree (>8" diameter) Thinning	161
	Smaller Tree (<8" diameter) Thinning	259
	Prescribed Burning	158

A portion of the project area was private land that the Forest Service acquired in a land exchange in 1940. This former privately held land includes potential treatment areas (Figure 1) 1, 2, 3, 4, 7, 8, 9 and part of 10. The forested portion of the project that was private land before the Forest Service acquired it (potential treatment units 1, 2, 3, 4, and 7) was heavily logged sometime in the 1930's. During this entry, most of the original trees greater than approximately 12" diameter were removed. This harvest resulted in a fairly dense second growth stand of trees. In the mid 1980's an overstory removal was conducted on approximately 73 acres of the lands that were formerly private lands and these lands were subsequently pre-commercially thinned. More recently (early 1990's), approximately 155 acres of this second growth was commercially thinned in two units under the Glaze Commercial Thin (CT) project.

The ponderosa pine dominated portion of the project that has always been in public ownership has experienced minor amounts of timber harvest. This includes minor amounts of high risk logging in which large trees that were deemed susceptible to bark beetles were harvested. More recently (early 1990's), a portion of this area was harvested under the Glaze CT project. The Glaze CT project in this area consisted of 3 commercial thin totaling approximately 33 acres, and 2 regeneration units (shelterwoods) totaling approximately 12 acres.

Other fairly recent (within the last 10 years) treatments in the project area have included small tree (<8" diameter) thinning on approximately 259 acres, prescribed burning on approximately 82 acres of forested lands and 76 acres of grass meadows and the cutting of conifers in some of the aspen stands.

Currently, the forests in the Glaze Meadow project area are composed of stands that are either multi-layered with large old trees present, dense to moderately dense second-growth pine where most of the original older trees were removed, or plantations resulting from regeneration harvesting (shelterwood systems) in the early 1990's. The multi-layered conditions that have developed in



Typical tree size and density in most of the 2nd growth stands in the project area

many stands favor some species such as goshawks, while having a negative effect on other species, which favor more open stand conditions typical of old growth ponderosa pine forests, such as the white-headed woodpecker and Peck's penstemon.

Historic range of Variability (HRV)

Historic range of variability is a term used by ecologists to describe the natural fluctuation of ecosystems over time. In this project, the term refers to the range of conditions and processes likely to have occurred prior to settlement by Americans of European ancestry (mid-late 1800s). The historic range of variability serves as a reference point from which change can be measured, rather than a condition that ecosystem management tries to attain. In fact, science findings suggest that such a condition could not be achieved. This misunderstanding about the historic range of variability is common, as is the tendency to equate it with “natural” conditions. American Indians altered the landscape in many ways, though nowhere near the scale of change as populations increased, land uses evolved, and technology for altering the environment was developed.” (USDA, 1996).

The historic range of variability assumes minimal disturbance by human activities and is often used as a baseline for conditions that are assumed to have existed on the landscape more than 100 years ago. In some areas, Native Americans played a large part in shaping the vegetative structure, particularly with the use of fire, and the conditions present across the landscape a century ago took hundreds of years to develop. This development took place under environmental conditions that may or may not have been similar to environmental conditions today. For these reasons, the historic range of variability is a conceptual idea of the vegetation that may have been present historically. It is not an objective used in order to recreate a precise percentage of each structural stage that may have been present at any point in time.

Structural Stages, the Historic Range of Variability and Comparison to Current Conditions

Forest structure within the project area is described according to the structural stages found in the “Eastside Screens”. The historic range of variability can be viewed as an estimate of the historical percentage of the forested area in each structural stage. The range and variability of historic conditions were established by using survey notes, site visits, fire records, type maps, historic disturbance patterns and photos. Current conditions used as the basis of comparison to historical conditions were initially derived from the 1995 Photo Interpretation layer in GIS and enhanced with stand exam data and field reconnaissance.

Approximately 73% of the project area is composed of ponderosa pine plant associations. The structure of the ponderosa pine stands across the project area can generally be described as either multi-stratum, with large trees (i.e., “Late & Old Structure (LOS)” or “Old Growth”) or stem exclusion or stand initiation, (i.e., “2nd Growth”). Late old structure is found on approximately 458 acres of the project area. The second growth is found on approximately 416 acres of the project area of which 12 acres is stand initiation. Approximately half of the acres that are identified as multi-stratum, with large trees has had small tree thinning of trees less than 8” diameter, consequently, these acres are not as multi-storied as the untreated acres and these acres have been moved somewhat toward the single-stratum, with large trees structure.

Approximately 9% of the project area is composed of aspen or mixed aspen and lodgepole pine riparian plant associations. The structure of these stands can generally be described as either stem

exclusion or understory reinitiation/stand initiation. Most of the acres in these stands are in the stem exclusion stage, however, a portion of these acres (estimated to be 16%) is in the understory reinitiation/stand initiation stage because the Aspen in this area is in severe decline and the stand has opened-up considerably. This condition is found primarily in potential treatment area 7 (see Chapter 2, Figure 9).

Table FV-4 displays the comparison of the historic range of variability and current condition of structural stages for the ponderosa pine associations found in the Whychus Watershed. This comparison is done at the watershed scale because the project area is so small that it is not representative of a landscape perspective/scale.

Table FV-4. Ponderosa Pine Plant Association Group, Structural Stage, Historic Range of Variability/ Current Condition Comparison for the Whychus Watershed.

Structural Stage		Seral Stage	Historic Range of Variability	Current % of the Plant Association Group Area	Relation to Historic Range of Variability
1	Stand Initiation	Early	10-25%	8%	Within
2	Stem Exclusion, Open Canopy				
3	Stem Exclusion, Closed Canopy				
4	Understory Reinitiation	Mid	30-65%	72%	Above
5	Multi-stratum without Large Trees				
6	Multi-stratum with Large Trees	Late (LOS)	0-7%	19%	Above
7	Single-stratum with Large Trees	Late (LOS)	25-60%	<1%	Below

The trends in structural stages for the ponderosa pine plant associations across the Whychus watershed as well as the Glaze project area are similar. As a result of fire suppression and timber harvest and, to a limited extent, wildfire, there are far more small trees and far less large trees than there were historically. Fire suppression has allowed large numbers of small trees to become established and timber harvest removed a significant percentage of the larger/older trees (generally over 21" diameter but also as small as 12" diameter). This has resulted in the mid seral structural stages (2-5) being above the historic range of variability, the multi-stratum with large trees late and old structural stage (6-LOS) being above the historic range of variability and the single-stratum with large trees (7- LOS) being far below the historic range.

Species Composition

With a few exceptions, species composition of trees across the Glaze Meadow project area has not changed dramatically from the historical range of variability as on other parts of the Sisters Ranger District. Ponderosa pine is still the dominant species within the ponderosa pine plant associations across the project area as it was historically (i.e., prior to 1900). However, there is more white/grand fir and lodgepole pine found within the ponderosa pine plant associations than there was historically.

Within the aspen plant associations the dominant species is aspen; however, in the absence of disturbance, primarily fire, these plant associations are successional to conifers such as lodgepole pine, ponderosa pine and white/grand fir. Consequently, most of these stands are experiencing encroachment of conifers, primarily lodgepole pine and ponderosa pine.

Stand Density

Different environments can support different levels of tree density (e.g. wetter, richer soils tend to be able to support more trees per acre). The maximum biomass that a plant association can sustain, before growth is suppressed and trees begin to decline in health, is the “upper management zone” (Cochran et al. 1994, Eglitis, 1997; and Maffei, 1997). High stand densities tend to increase stress and reduce vigor among all size classes, and increase the likelihood of mortality from insects and diseases, especially during droughts. High stand densities also contribute to an increase in fire hazard.



Photo points on the Sisters Ranger District that demonstrate the rate of understory growth over 38 years

Maintaining stand densities at sustainable levels is essential for promoting forest health and maintaining or creating large trees and habitats in dry areas. The upper management zone is a site-specific threshold density, above which forest health conditions and large tree health are likely to deteriorate. The primary cause is that, on any given piece of ground, there are limits to growing space or the resources available for plant growth. When these limits are reached, loss of plant growth and/or mortality can become common elements of the stand. In addition, due to stress on the existing stands, they may be at a high risk of impacts from wildfire, insects or disease.

Approximately 72 % of the project area is above the upper management zone. Of the two basic forest structure types identified in ponderosa pine plant associations, 77% of the old growth acres and 67% of the 2nd growth acres are above the upper management zone.

Forest Stand Densities: What is the “Upper Management Zone”?

The *upper management zone* is a concept described by Cochran and others (1994) and is one way to describe and analyze the density of forest stands. It is defined as a threshold density level at which a suppressed class of trees begin to develop in a stand. This is the point at which trees begin to come under stress because they are intensely competing for growing space (Oliver and Larson, 1996). Growing space is the aggregate of all the factors necessary for the growth of plants. These factors include, but are not limited to, the following: sunlight, water, mineral nutrients, suitable temperature, oxygen, carbon dioxide and physical space. Because plants have unique anatomies they need to grow to survive. The growth of plants can become limited when any one of the growth factors becomes limited. The higher stand densities are above the upper management zone, the more the growing space becomes limited and the greater the risk is of losing trees in the stand.

What is the upper management zone based on? There are certain biological limits to growing vegetation. For example, if you were to plant 1,000 carrots in a 5-gallon bucket, you would expect many of them never to survive. Of those that survived, there would be such competition for food, water and light that you would not expect the carrots to grow very well. In addition, physical space would play a factor in limiting how large the carrots could grow. However, if you were to try planting 20 carrots in the 5-gallon bucket, you could expect much less competition for food and water, much less mortality, and much larger and healthier carrots.

The forest operates on the same principles that dictate what happens with carrots in the 5-gallon bucket. The forest is limited in space, water, nutrients and light available for plant growth. These factors, along with other climate and site factors help set the limits of the type, size, and amount of forest vegetation that can be grown on a given site. If we want healthy forests with large trees, then it is important to help control how dense the forest is growing.

Scientific studies have determined certain “normal” density limits for conifer species. The upper management zone is the density level that is approximately 75% of the density of the “normally” stocked stand.

Trees per Acre versus Basal Area: There are numerous ways to characterize stand density. Two of the most common ways are trees per acre and basal area. Basal area is the surface area, in square feet, of the cross-section of the bole of a tree at 4.5 feet above ground level. When you relate the amount of basal area or trees per acre to some unit of land, an acre for example, then that tells you something about the density of trees on that acre. Trees per acre and basal area are related in that small trees have very little basal area and large trees have a relatively high amount of basal area. For example, a 5" tree contains 0.14 square feet of basal area and a 30" tree contains 4.9 square feet of basal area. Consequently, it takes about 36 5" trees to make the same basal area of one 30" tree.

Density management, regardless of the measure used (e.g., basal area, trees per acre, etc.), helps managers consider not only the quantity of trees a site can support, but also the quality, or types of trees we want to grow. If you want to grow poles for the wood products market, it may be okay to grow many more trees on an acre, than if you want to grow large trees with large limbs and well-developed crowns (the type of forest structure so important to many old-growth species).

The upper management zone relates to the density of trees (basal area, trees per acre, etc.) a forest stand can support without significant mortality from bark beetles. With information about any forest stand, an upper management zone for that site can be calculated. The upper management zone is the density level at which trees begin to come under significant stress and can become susceptible to bark beetles and perhaps other insects and diseases.

Late and Old Structure (LOS) Stands

Maintaining and enhancing late and old structure habitat (primarily by reducing the risk of wildfire, insect and disease) is an important objective in this project, and is recommended in the Whychus Watershed Analysis (USDA, 1998). The ponderosa pine plant associations are fire-climax systems. These plant associations, which are the most common in the project area, are not well suited to support species that require dense, multi-layered forests. However, there are old growth associated species that prefer these open, mature pine forests, such as white-headed woodpeckers, and these are the habitats that the Forest Service is focusing on improving and protecting in much of the fire climax forests.

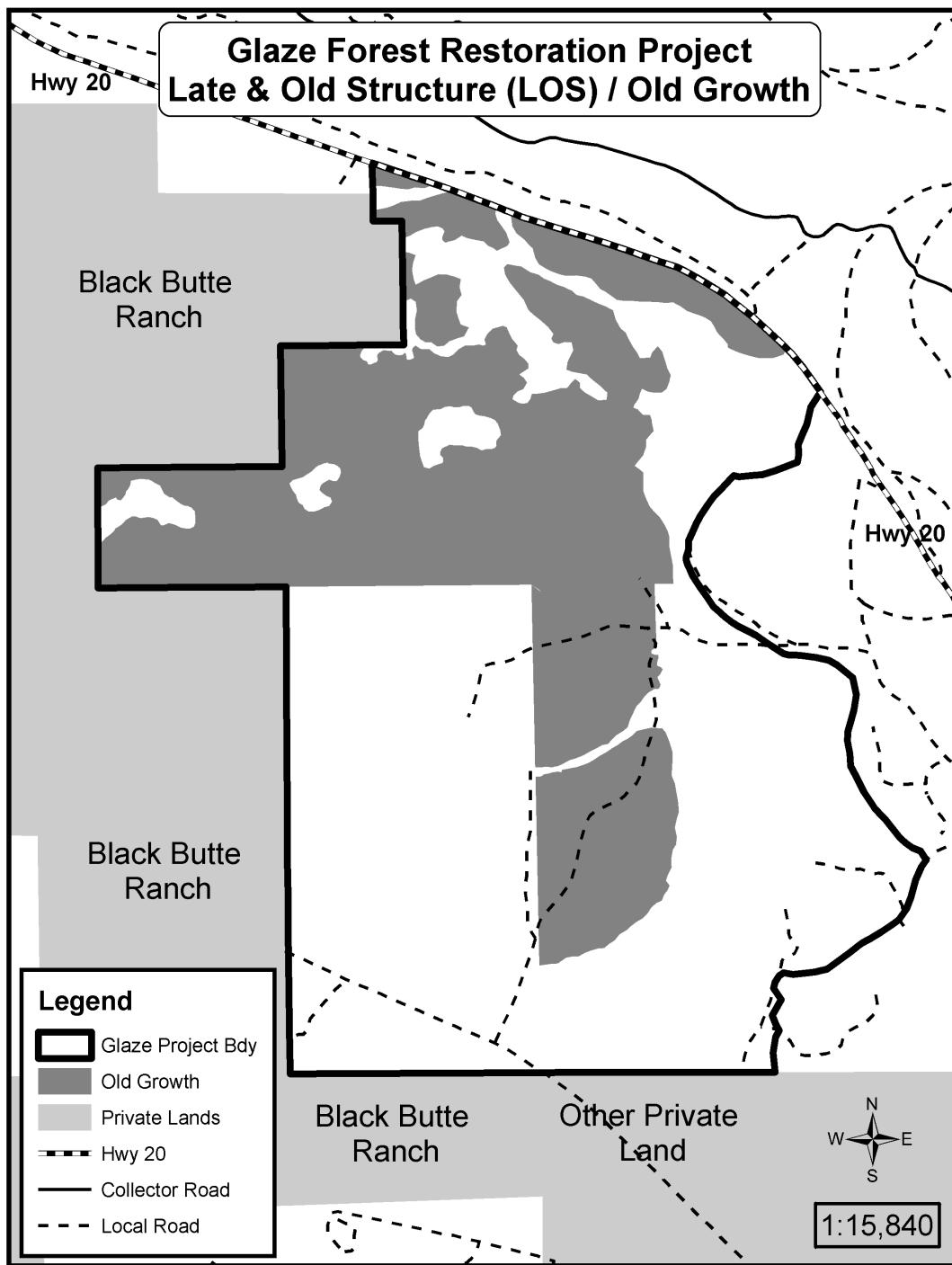


Approximately 458 acres within the Glaze project area were determined to be late old structure based on the Region 6 Interim Old Growth Definition for the Ponderosa Pine Series (Hopkins et al, 1992). These acres were determined to be late old structure based on stand exam data and/or field reconnaissance.

Table FV-5 displays the comparison of the historic range of variability and current condition of late old structure for the ponderosa pine associations found in the Whychus Watershed. This comparison is done at the watershed scale because the project area is so small that it is not representative of a landscape perspective/scale. Figure FV-2 displays the distribution of late old structure in the project area.

Table FV-5. Ponderosa Pine PAG- Late old structure & the historic range of variability / Current Condition Comparison for the Whychus Watershed.

Plant Associations	Late Old Structural Stage	Historic Range of Variability	Current % of the Plant Associations in the Whychus Watershed Area	Relation to the historic range of variability
Ponderosa Pine (Dry & Wet)	Multi-Stratum with Large Trees	0-7%	19%	Above
	Single-Stratum with Large Trees	25-60%	<1%	Below
	Total Late Old Structure	25-67%	18%	Below

Figure FV-2: Late & Old Structure (LOS) / Old Growth

The ponderosa pine plant associations in the Glaze project area have less late old structure than in the historic range of variability. However, even though the total late old structure is below the historic range of variability, the percentage of multi-stratum late old structure is above the historic range of variability while single-stratum late old structure is far below the historic range of variability.

Large old trees are the key structural components of old growth forests because of the time required for their development, their habitat functions as living trees, and because they contribute to the large snag and down wood component of these forests. However, altered successional patterns are working against the long-term survival of these large old trees. All growing sites have a fixed quantity of resources and growing space, and as inter-tree competition increases it is usually the large trees that die first (Dolph et. al. 1995, In: Fitzgerald et. al. 2000). It is thought that we may have only a few decades to deal with this situation, or we risk losing the large trees (Fitzgerald, 2002. personal. communication). Large trees would be lost at a faster rate at higher stand densities than at lower stand densities. Approximately 77% of the Late and Old Growth Structure acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality.

In the SAFR project area that is just south of the Glaze project area, medium/large ponderosa pines (trees greater than 21" diameter) were rated for vigor based on the vigor classes developed by Keen (1943). Of the 607 trees rated, 58% were rated as being in fair to poor (51%) or poor (7%) condition and 42% were rated as being in good (7%) or good to fair (35%) condition. These results indicate that a majority of the large old ponderosa pine across the SAFR project area and probably the Glaze project area are in fair to poor condition indicating a general decline in the health of these trees. Without action it is predicted that the health of these large trees would continue to decline and the loss of the large tree structure would also continue.

Desired Future Condition

Forest health in over-dense stands is declining, resulting in an increasing risk of losing late old structure habitat to wildfire, insects or disease. In addition, due to the extensive accumulation of fuels, there is a higher risk of losing the well-established old-growth ponderosa pine, which are resilient to low-intensity fires but can be lost in high-intensity fires, and which are considered a highlight of the forests in the Glaze project area. The desired future condition of the area would include variable densities of the largest and healthiest trees across the landscape based on site capability.

The desired future condition for the conifer forests in the area is a late seral or Old growth forest. Forest structure would be a mosaic pattern, open ponderosa pine forest (or "gappy, patchy, clumpy"), 70- 90% dominated by one or two storied stands of large trees, with 10-30% of the area in smaller patches of younger trees in even age clumps ((1/10-1/4 acre in size with a few larger). The forest should have both single snags, patches of snags, patches of shrubs, and large and small downed wood.

Fire should be a process that is evident and able to play more of its historic role. Shrubs and grasses should be generally young and vigorous reflecting the influence of frequent low intensity fire. Understories would be composed of native plants and no invasive plants would occur.

This type of structure would reflect the top end of the Historic Range of Variability identified for ponderosa pine stands in the Whychus Watershed Analysis (USDA, 1998). For areas where few large trees remain today this desired future condition is a long term goal and will take many years to develop.

Thinning from Below in a Mosaic Pattern

This treatment, also known as “low thinning”, is “the removal of trees in the lower crown classes to favor those in the upper crown classes.” (Helms, 1998). Thinning from below accomplishes several important management objectives including 1) reducing fire hazard and 2) improving forest health and tree growth. In general, the smallest trees at any particular location are the trees that will be removed and the largest, healthiest trees would be retained. Occasionally, a larger tree may be removed if the larger tree is in poor condition and a better smaller tree is present.

Thinning from below reduces fire hazard, and in turn, the risk of large catastrophic wildfire, by removing small diameter trees that create ladder fuels, which are capable of carrying fire from the ground fuels (e.g., woody material, forbs, grasses and shrubs) into the tree canopy. This thinning also reduces crown density and continuity to reduce the potential spread of crown fires. The resulting more open stand structure allows ground fire to move through the remaining larger tree stand, removing the build up of ground fuels without moving into the tree canopy. The remaining trees experience low levels of damage. Thinning from below improves forest health and tree growth by decreasing competition providing the remaining trees with increased moisture, nutrients and light.

Thinning from below begins the process of moving the landscape back toward the historic range of variability, where smaller trees were removed with frequent low intensity wildfire and large established trees remained on the landscape. Historically, the majority of this project area was dominated by ponderosa pine; consequently, ponderosa pine will be the preferred leave species across most of the project area. However, the objective will not be to eliminate other tree species, other species will be left for a variety of reasons. In this project area, ponderosa pine is the preferred species because it is the most resistant and resilient to wildfire, insects and disease.

Thinning from below would be conducted in a mosaic pattern to emulate the historic pattern of variability found historically in ponderosa pine plant associations (Stringer 2008). The mosaic would include four levels of tree density: no thinning, low (approx. 40 sq. ft. of basal area), moderate (approx. 60 sq. ft. of basal area) and high (approx. 80 sq. ft. of basal area). No trees over 21 inches diameter would be removed except in instances for safety or temporary road use.

Eastside Screens and Treatment of Late Old Structure (LOS)

The Eastside Screens contain standards stating that timber sale harvest is not permitted in late old structure when it is below the historic range of variability. The Glaze project area is in the Whychus watershed and the ponderosa pine plant association group in this watershed is below the historic range of variability for total late old structure (multi-strata & single strata together), however, multi strata late old structure is above the historic range of variability and single-strata is far below the historic range of variability (see section “Late and Old Structure Stands” above). The screens allow timber harvest activities to occur in late old structure stages that are within or above the historic range of variability to maintain or enhance late old structure, or to move an late old structural stage that is above the historic range of variability into the late old structural stage that is deficit (i.e., there can be no net loss of late old structure). The Glaze project proposes to move multi-strata late old structure to single-strata late old structure with no net loss of late old structure, utilizing timber

harvest activities on approximately 458 acres. No trees over 21 inches diameter would be removed except in instances for safety or temporary road construction. During temporary road use, the removal of trees 21" diameter or greater would only be used as a last resort and all other measures would be exhausted before considering the removal of a tree 21" diameter or greater.

Environmental Consequences

Background

This analysis discloses the predicted effects of tree thinning and tree harvest on forest health and sustainability. The factors that are analyzed, and that influence forest health and sustainability are forest/stand structure (i.e., tree size), stand densities, species composition, and disturbance processes. Actions that can affect these factors are the type and amount of vegetation management (e.g. tree thinning and harvesting, prescribed burning, mowing and aspen restoration), and risk of extensive disturbances.

Forest/Stand Structure

The upper limit on the size of tree that can be removed is a Key Issue under this analysis. Tree size (measured by the diameter of the trunk at 4.5 feet above the ground) is an indicator of the stage of development of old growth trees. An important structural element in the Glaze Project area forests is the large ponderosa pines. Highly valued, both socially and ecologically, there is concern about the potential removal of large trees across the project area.

There is disagreement about the maximum size of trees that should be removed to meet project objectives. Abella, et al, (2006), identified 3 different viewpoints when the size of trees that may be cut/removed is limited to 16" diameter (i.e., a diameter cap of 16" diameter). These viewpoints generally fall into one of 3 categories, supportive, neutral or opposed. The supportive viewpoints include ecological reasons such as large trees are rare, or they are the next cohort of old trees, or they are a source of future snag recruitment, or they represent important habitat features. Supportive view points also include that trees greater than 16" diameter should not be removed for economic reasons. Neutral viewpoints include reasons such as, since large trees are often rare then all "larger" trees might as well be retained or that leaving a few extra "larger" trees would be ecologically neutral or that diameter caps are OK if they help avoid controversy and project delays. Opposition viewpoints included ecological reasons such as restoration of meadows, compromising other ecosystem components, failure to achieve management objectives, multiple entries and future heavy thinning entries, residual trees grow rapidly after thinning so that densities increase quickly, and economic reasons such as offsetting project costs which can facilitate project implementation and possibly lead to treatment of larger acreages.

Scoping for the Glaze project revealed some of the same viewpoints on the size of trees to be removed/diameter caps as described by Abella, et. al. (2006). Some people feel that only "smaller" trees (under about 12" diameter) should be removed, due to concerns about the perceived limited amount of trees larger than 12" in the project area, and a concern about the loss of future old growth (they feel that most mid size trees must remain so that they can develop into the next generation of old growth). Other people who feel there should be a limit on the size of trees removed have a difficult time in defining what the "right" limit is. Common limits expressed are somewhere

between 8" and 21" diameter. However, other people feel that defining a tree size limit is arbitrary, and that the focus should be on removing the correct trees from a stand to meet the objectives of restoring old growth structure and reducing risk of severe loss from insects, disease or wildfire.

What defines a large tree is subjective, and perceptions are affected by prevailing conditions of the surrounding stands. For example, in a stand where most trees are greater than 20" diameter, trees larger than 25" diameter may be perceived as large. In a stand where most trees are 10" diameter, a tree greater than 14" diameter may be perceived as large. The Sisters Ranger District has referred to trees 21" diameter or greater as "large" tree structure in local area assessments, based on this description from the Draft old-growth guidelines (Hopkins et al., 1992) and the Eastside Screens. The Deschutes National Forest Land and Resource Management Plan refers to trees greater than 24" diameter as large. However, there is still disagreement about the definition of a large tree.

Each of the Action Alternatives analyzes the predicted effects of removing different sizes of trees. The proposed action is designed to improve the ability of existing large trees to survive, and to create conditions more favorable for the development of future large trees. One of the proposed activities is to thin dense forest stands to reduce the competition stress on remaining large trees, to improve the health and growth of smaller trees so that they may grow into the medium/large tree components sooner, and to protect these trees from wildfire by reducing fire hazard (ladder fuels, ground fuels and canopy fuels). Research shows (Tappenier et al., 1997) that low densities are a requirement for development of large "old growth" trees with large branches. It appears that large branches (an important habitat component for several old growth dependent species) can only develop if tree crowns are exposed to ample light for most of a tree's life. If existing densities are not reduced, it is predicted there would be delayed development of future large trees and an accelerated loss of existing large trees due primarily to factors related to competition related stress (e.g., bark beetles).

Old Growth Structure: Large old trees are the key structural components of old-growth forests both for their habitat functions as living trees, and because they contribute to the large snag and down wood component of these forests. Altered successional patterns are working against the long-term survival of these old-growth trees. All growing sites have a fixed quantity of resources and growing space, and as inter-tree competition increases it is usually the large trees that die first (Dolph et. al. 1995, In: Fitzgerald et. al. 2000). It is thought that we may have only a few decades to deal with this situation, or we risk losing the large trees (Fitzgerald, 2002. personal communication). Large trees would be lost at a faster rate at higher stand densities than at lower stand densities.

Recent studies have shown the ability of old growth trees to respond to reductions in density from thinning treatments, indicating an improvement in tree vigor and increased resistance to insects and pathogens. Latham and Tappeiner (2002) measured diameter growth increments of old-growth ponderosa pine, Douglas-fir, and sugar pine in the southern Cascades of SW Oregon. Ponderosa pine basal area growth was significantly greater in the treated stands than in the control stands. Fitzgerald and colleagues (2000) are testing the hypothesis that managed old-growth stands, where density and composition are maintained at historic levels, remain viable longer as old-growth habitat (Genesis Research and Demonstration Area). Stands were treated with thinning followed by underburning. Preliminary results, after 3 years of measurement, indicate that vigor of residual old-growth trees is increasing. A similar study has been initiated in the Whitehorse area of the Lolo National Forest (Hillis, et. al. 2001). The authors anticipate increased growth response of the residual old-growth trees, based on nearby research showing response of 800 year old pine to release from competition by fire.

Based on this research, it is assumed that reducing stand densities would help maintain existing large trees, and provide better conditions for the growth of future large trees.

For this project, possible late old structure/ old growth was measured as stands with sufficient number of trees 21" diameter or greater (in ponderosa pine it would be 13 trees or more per acre greater than 21" diameter, and in mixed-conifer it would be 15 trees per acre that size). No action alternatives would remove any trees 21" diameter or greater (East Side Screens). However, all action alternatives remove trees where densities or ladder fuels are high and this can benefit remaining large trees by reducing fire hazard and competition for site resources (i.e., water, nutrients and light).

There are several other characteristics of late old structure/ old growth stands (snags, down wood, multiple canopy layers, ground vegetation) that were not measured in this analysis. These other characteristics may be affected by actions that remove or potentially consume old growth elements (e.g., prescribed fire).

Stand Density

Stand density is a primary factor affecting growth and vigor of forest vegetation, and its resilience to disturbances. Different parts of the project area can support different stand densities, depending, in part, on available water, light and nutrients. For instance, forest stands on wetter, more productive sites can usually tolerate higher densities than stands on dry, low productivity sites. The Whychus Watershed Assessment (USDA Forest Service 1998) states "maintaining stand densities at manageable levels is essential for promoting forest health and maintaining or creating large tree character and habitat in dry areas (pg. 58).

Ponderosa pine is more sensitive to high stand densities than other tree species in the project area. The longer a ponderosa pine remains in overcrowded conditions, the less it is likely to reach 21" or greater diameter. Stump analyses on the Sisters Ranger District revealed that large ponderosa pine trees initially had rapid growth rates (due to little competition) for the first 50 to 100 years and less growth over time as density increased and trees aged.

The "upper management zone" is the stand density threshold above which forest conditions and large tree health are likely to deteriorate (Cochran et al, 1994). Stands that are above the upper management zone (the point at which tree mortality begins to occur due to competition) are more susceptible to severe disturbances than stands less densely stocked (see insert of upper management zone, Chapter 3).

Species Composition

Ponderosa Pine Plant Associations: An objective identified in the Whychus Watershed Assessment is to keep species within a healthy range of variability depending on the plant association, specifically referring to the amount of fire intolerant species such as western juniper, white pine and incense cedar in ponderosa pine plant associations. Species composition is a factor influencing the risk and stability of forests in the planning area. The ponderosa pine plant associations were historically dominated by ponderosa pine, which is more resistant to fire, disease, and insects than western juniper, white pine and incense cedar. A reduction of western juniper, white fir and incense cedar in this project area can help move toward species composition more within the natural range of variability.

The effects of the alternatives on species composition are difficult to quantify, but in general, the greater the diameter of the trees cut, and the more thinning done (as opposed to use of prescribed fire), the greater the shift will be towards fire-tolerant/adapted ponderosa pine.

Hardwood/Aspen Plant Associations: Much of the decline in Aspen across the western United States can be attributed to interrupted disturbance regimes, usually fire, and the subsequent succession to conifers (Bartos 2001). The aspen stands in the Glaze project area are experiencing encroachment by conifers, primarily lodgepole pine and ponderosa pine. Aspen stands can be restored and maintained by removing encroaching conifers.

Disturbance Processes

Disturbance size, intensity and patterns can be affected by the previous factors of forest structure, stand density and species composition, and relate to the sustainability of forest stands over the long-term. Disturbances are an important process in forest ecosystems because they may enhance nutrient cycles and promote diversity of habitat and species. However, the severity of disturbances tends to increase when forest conditions are outside the historic range of variability. Severe disturbances can result in the loss, amount, and quality of old-growth characteristics, such as large trees.

Factors that affect disturbance size, intensity and patterns include severe drought, stand densities, stand structure and species composition. Actions under the Alternatives that influence these factors are tree thinning, mowing, and prescribed burning. These actions are disturbances in themselves, and range in severity with thinning and prescribed burning being the most intensive and mowing the least. As with natural disturbances, these actions can both benefit (reduce competition, enhance nutrient cycling, create diversity and mosaics), and impact (compaction, loss of individual habitats, fragmentation) affected stands. However, all are considered less of an impact than a severe wildfire or insect and disease epidemic. They also begin to move ecosystem processes back toward the natural range of variability.

The severity of impacts from future disturbances can be reduced, maintaining more resistant species (i.e., ponderosa pine) with prescribed fire, increasing the distribution of single or two storied-stands, maintaining vigor by thinning to lower densities, and making treatment units as large as possible (Wickman, 1992). For instance, thinning can enhance vigor of ponderosa pine trees, which could aid them in resisting bark beetles, which is present in the project area and may become a primary disturbance agent in these stands in the absence of density reduction.

The primary biotic risk agents identified in the project area were bark beetles. Key measure of the effects of the alternatives on this agent is the following:

- Bark beetle risk reduction is measured in terms of the acres above upper management zone treated with density-reducing treatments.

Prescribed underburning is not expected to have an effect on these risk factors because it does not typically have an appreciable effect on stand densities in the types of stands where it can be successfully employed (Covington et. al. 1997). It is assumed that reduced stand densities increase vigor and reduces stand susceptibility to bark beetles.

East-side Screens and Treatment of Late Old Structure

The Eastside Screens are “Interim management direction establishing riparian, ecosystem and wildlife standards for timber sales”. The Eastside Screens were intended to maintain options for future management of late old structure. The treatment of late old structure utilizing timber sales as one of the tools for treatment fall under the ecosystem and wildlife standards. Under the ecosystem standard, the landscape is to be characterized by structural stage and then compared to the historic range of variability.

Under the wildlife standard, the 2 structural stages (from the ecosystem standard) where large trees are common (i.e., multi-stratum with large trees and single stratum with large trees) are considered late old structure. There can be no net loss of late old structure when either one, or both, of the late old structural stages fall below the historic range of variability. Additionally, timber sale harvest activities are not allowed within late old structural stages that are below the historic range of variability. Late old structural stages that are within or above the historic range of variability can be treated utilizing a timber sale to maintain or enhance late old structure. Additionally, timber sale harvest can be used to move multi-stratum late old structure to single-stratum late old structure, if this would meet the historic range of variability.

The Glaze Project area is in the Whychus watershed and this watershed is below the historic range of variability for total late old structure (multi-strata & single strata together), however, multi-strata late old structure was found to be above the historic range of variability and single-strata was found to be far below the historic range of variability. The treatment of late old structure within the Glaze Project area will move multi-strata late old structure to single-strata late old structure with no net loss of late old structure within the project area or the Whychus watershed. Consequently, the treatments proposed in late old structure in the Glaze project is consistent with the Eastside Screens.

Alternative 1 (No Action) – Ecological Trends

Key Issue: Size of Trees Removed.

Measure: Number of trees over 16 inches diameter which are removed.

Under Alternative 1, no thinning would occur in the project area, consequently no trees would be cut and removed, including trees over 16” diameter. The effects of no action (i.e., no thinning) on forest health are discussed under the measures below.

Analysis Issue: Improvements to Forest Health Sustainability and Resiliency.

Measure: Percent of the project area at higher risk of losses to insects and diseases as defined by a measure of forest density (Upper Management Zone).

Under Alternative 1, no thinning would occur in the project area. Stand densities will remain high and continue to increase in areas where they are already high. In areas where they may not already be high they will continue to increase, eventually reaching undesirable levels. Approximately 72% of the acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality. Approximately 77% of the “old growth” stands

and 67% of the “second growth” stands are above the upper management zone. These high density acres will remain susceptible to bark beetle activity and the susceptibility will increase over time. High stand densities will result in the overall reduction in tree vigor among all size classes. A reduction in tree vigor will predispose those trees to the various insects and diseases that take advantage of low vigor/weakened trees (e.g., bark beetles and root diseases). The most significant effect of high stand densities will be the gradual loss of the existing historic large-tree component at a rate that is likely to be much faster than if stand densities had been reduced to more healthy levels.

Under the No Action alternative, the large tree component, as well as smaller trees, which represent future large trees, would exhibit low resistance to bark beetle attack, and higher risk of mortality from root diseases. With continued competition from understory trees, mortality within the large tree component would be expected to increase. Losses would be especially pronounced under drought conditions. Alternative 1 would result in the slow down of the recruitment of large trees due to the continued density-related decline in tree growth and vigor. Stands would continue to decline in growth and vigor due to increasing competition and reduced crown development. Risk to insects and disease would continue to intensify. Increased bark-beetle activity would be anticipated with the next drought cycle.

Measure: Number of acres where treatments create conditions more favorable to the development of stand structure and composition similar to historic conditions.

No thinning or prescribed burning or mowing would occur within the project area under the no-action alternative. Stand structure and density under the no action alternative would continue to deviate from historical conditions in the following ways:

- Stands would continue to be dominated by small trees (greater than 21" diameter).
- Stand structure of most stands would consist of dense, multi-storied canopies, resulting in large areas of contiguous ladder fuels.
- Dead fuel on the surface would continue to accumulate in the form of decadent brush, dead material from insect and disease mortality, limbs, and needles, adding to the fuels that have accumulated since the last burn cycle.

The shift in species composition towards fire intolerant species (lodgepole pine, western juniper, white fir and incense cedar) would continue with the following effects:

- There would be more fire-intolerant species (primarily lodgepole pine, western juniper, white fir and incense cedar) on the landscape, and there would be more ladder fuels from the fire-intolerant species in the understory
- There would be more shorter-lived trees (i.e., lodgepole pine and white fir)
- There would be more stress on overstory ponderosa pine
- There would be an increased risk of future bark beetle outbreaks, which increases the fire hazard over the landscape
- Conifers would continue to encroach upon aspen stands and natural meadows under No Action, and this rare habitat may continue to decline in acres.

Measure: Number of acres and percent of the project area where treatments create conditions more favorable to the survival of existing large trees as defined by a measure of forest density (Upper Management Zone).

No management actions to treat vegetation would occur under No Action. During this time, the following effects would accrue to late old structure habitat, large trees (21"+ diameter), and second growth (<21" diameter) stands (future late old structure and large tree habitat).

Large, old ponderosa pine are the key structural components of late old structure habitats in the project area because of the time required for their development, their habitat functions as living trees and because they contribute to the large snag and down wood component of this habitat. On a stand-average basis, approximately 77% of the late old structure acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality. Under the No Action alternative, loss of the large old ponderosa pine component would likely occur at an accelerated rate due to high stand densities. These large old trees would also be at higher risk of loss due to wildfire because of the high fire hazard across the project area. Given the relative low numbers of large trees per acre compared to the smaller trees this mortality could be considered substantial. Accelerated mortality of the older pines would contribute to the ongoing structure shift to smaller trees.

The growth and crown development of the smaller trees would also be affected by No Action. Trees in the smaller size classes (<21" diameter) would remain in high density conditions that are not conducive to good growth or crown development. Good growth (i.e., 2"-3" diameter growth/decade) is desired in these smaller size classes so that these trees will grow into the large size class sooner and contribute to future late old structure sooner. Good crown development is desired so that smaller trees develop crowns that resemble crowns developed by historic old growth trees that grew under more open conditions. Keen (1943) describes the crowns of over-mature (i.e., old-growth) ponderosa pine as having large, heavy limbs that are often gnarled or crooked. Keen (1943) further described the crowns of vigorous (i.e., healthy) trees as being long (55% or more of total height), of average or wider width, crown density as being full and dense, with needles that are dense and thrifty and of average length or longer. The types of crowns developed by historic old-growth ponderosa pine did not occur under the high densities that the majority of the small trees in the Glaze project are growing under now. Altered successional patterns are working against the long-term survival of these old-growth trees.

Alternative 2 (Proposed Action) – Direct and Indirect Effects

A total of 874 acres of conifer stands (416 acres of second growth and 458 acres of late old structure) or approximately 100% of the conifer acres would be thinned (except for the 10% no thinning retention patches) and prescribed burned (mowing will be allowed prior to prescribed burning as needed to meet prescribed burning objectives) to reduce tree and shrub density, increase average tree size and reduce fire-intolerant species. The conifer thinning includes approximately 51 acres of the Indian Ford Creek Riparian Habitat Conservation Area. Approximately 79 acres of aspen stands and 236 acres of meadows would be treated to remove encroaching conifers.

Key Issue: Size of Trees Removed.***Measure: Number of trees over 16 inches diameter which are removed.***

Under Alternative 2, a mosaic-patterned variable density thin-from-below prescription would occur in which trees in all size classes up to 20.9" diameter could be removed. Without having actually marked the project area, the number of trees between 16" diameter and 20.9" diameter that would be removed is difficult to determine because the type of prescription that we intend to implement, a mosaic-patterned variable density thin-from-below, is complicated and would be difficult, if not impossible, to model with a reasonable degree of confidence. However, the project was modeled based on a straight thin-from-below prescription and this resulted in approximately 1% of the total trees being cut in the 16" to 20.9" diameter category.

This modeling exercise showed that 0 - 4 trees/acre could be cut between 16" diameter and 20.9" diameter. This would be mitigated in the following ways to address public concerns:

- All old growth trees that were well established under the historic fire regime prior to the time of European settlement (i.e., pre-settlement trees) would be retained.
- No trees 21"+ diameter will be allowed to be removed except for safety reasons and temporary road use (only as a last resort in this case).
- Thinning from below would emphasize retaining the largest trees at any particular location.
- The only instances that 16" diameter to 20.9" diameter trees would be removed would be if there were many trees in the same location that are 16"+ diameter or, on occasion, a smaller tree may be retained over a 16" diameter to 20.9" diameter tree if the smaller tree is in better condition than the larger tree.
- All trees will be retained in no-treatment clumps on approximately 10% of the project area.
- Public review and feedback on the marking prescriptions will be encouraged.
- The District Ranger will address public concerns about the prescriptions.

Analysis Issue: Improvements to Forest Health Sustainability and Resiliency.***Measure: Percent of the project area at higher risk of losses to insects and diseases as defined by a measure of forest density (Upper Management Zone).***

Management practices aimed at maintaining vigorously growing stands can considerably reduce the potential impact of insect and disease agents and enhance forest health (Hessburg, et al 1994). Under Alternative 2, thinning treatments would reduce competition stress on larger, older ponderosa pine by thinning from below. High densities and competing species (e.g. lodgepole pine, western juniper, white fir, and incense cedar) can represent a considerable component of competition with the older overstory pines. Reducing the small tree component and other competing species around older pines would provide needed growing space to keep overstory trees growing at rates that would allow them to be resistant to bark beetles.

On a stand exam plot-average basis, approximately 72% of the acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality. Under Alternative 2, the percentage of the project area that is above the upper management zone is reduced to approximately 29%.

Additionally, the use of averages to characterize stand densities can be misleading because the use of averages masks the fact that areas of stands where there is a significant component of trees greater than the thinning diameter limit (e.g., 6" or 21" diameter) that are above the upper management zone before treatment will remain above the upper management zone after treatment, even though the stand average is below the upper management zone. A higher diameter limit will allow for more acres to be thinned to sustainable densities (i.e., below the upper management zone) than a smaller diameter limit. Consequently, a tree removal diameter limit of 21" diameter will allow for better stand density reduction than a tree removal diameter limit of 6", even in stands where the average stand density is below the upper management zone.

Measure: Number of acres where treatments create conditions more favorable to the development of stand structure and composition similar to historic conditions.

Stand structure and species composition under Alternative 2 would be moved towards historical conditions in the following ways:

- On 874 treated acres, the average diameter of the remaining stands would be increased by cutting/removing smaller trees, increasing the resistance of those acres to fire.
- Stand structure of most stands would still consist of multi-layered canopies, but the density and number of layers would be reduced and large areas of contiguous ladder fuels would be broken up and crown bulk densities would be reduced.
- Dead fuel on the surface in the form of decadent brush, dead material from insect and disease mortality, limbs, and needles, would be treated along with activity created fuels

The current trend, in some portions of the project area, in species composition towards fire intolerant species (lodgepole pine, western juniper, white fir and incense cedar) would be abated with the following effects:

- More fire- and disease-resistant species would occupy the landscape, and ladder fuels in the form of shade-tolerant trees in the understory would be reduced
- Less fire intolerant species (lodgepole pine, western juniper, white fir and incense cedar) would occupy the landscape
- There would be a reduction in competitive stress on overstory ponderosa pines
- The encroachment of conifers into aspen stands and natural meadows would be reversed.
- Species diversity would be maintained by retaining some fire intolerant species in no-treatment clumps/areas and riparian corridors.

Measure: Number of acres and percent of the project area where treatments create conditions more favorable to the survival of existing large trees as defined by a measure of forest density (Upper Management Zone).

This alternative would treat approximately 458 acres of late old structure with thinning from below and associated thinning created fuels clean-up and prescribed burning (including mowing where needed). Thinned trees would be utilized to the greatest extent possible. There is uncertainty regarding future technology and markets for the disposal and utilization of the material generated by thinning, consequently, an objective of this project is to retain flexibility for the disposal/utilization of thinned material by commercial means.

All acres that were late old structure before treatment would remain so after treatment. Thinning treatments would generally move late old structure from multi-stratum toward single-stratum as

thinning from below reduces canopy layers and canopy cover. Depending on the number of large (21"+ diameter) trees present, a portion of the treated late old structure acres would continue to have an uneven-aged/sized structure. Where there are higher densities of large trees and pre-settlement trees, fewer understory/post-settlement trees would be left and those areas would appear single-storied and where there are lower densities of large trees and pre-settlement trees, more understory/post-settlement trees would be left and those areas would appear somewhat multi-storied, although not as much as before treatment.

Large, old trees are the key structural components of this habitat because of the time required for their development, their habitat functions as living trees, and because they contribute to the large snag and down wood component of these forests. Altered successional patterns are working against the long-term survival of these large old trees. All growing sites have a fixed quantity of resources—Alternative 2 would shift a portion of these resources to the large overstory pines with the objective of maintaining them on the landscape for the foreseeable future.

On a stand-average basis, approximately 77% of the late old structure acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality. Under Alternative 2, the percentage of the late old structure that is above the upper management zone is reduced to approximately 44%, as opposed to 70% under Alternative 3. Loss of the large tree component would continue to occur, but should be slowed on treated acres as trees respond to the increased growing space resulting from thinning from below.

An indirect effect of the proposed action is its effect on the growth and crown development of the smaller trees. Accelerated growth and better crown development would occur on residual smaller trees on 874 acres in all size classes below 21" diameter. By thinning up to 20.9" diameter in late old structure, the trees closest to the large (i.e., 21"+ diameter) size class would move into the large size class sooner under Alternative 2 than under Alternative 3 where no trees between 6" and 20.9" diameter can be thinned. Consequently, large tree development can be accelerated faster in late old structural stands under Alternative 2 than Alternative 3.

Alternative 3 – Direct and Indirect Effects

Alternative 3 is the same as Alternative 2, however, the difference is that thinning on 458 acres of late old structure would be limited to trees <6" diameter.

Key Issue: Size of Trees Removed.

Measure: Number of trees over 16 inches diameter which are removed.

Under Alternative 3, thinning treatments in the 2nd growth area, approximately 416 acres, would be the same as alternative 2 with the same effects. However, thinning treatments in the old growth area, approximately 458 acres would be limited to <6" diameter, consequently, no trees greater than 16" diameter would be removed in the old growth area.

Analysis Issue: Improvements to Forest Health Sustainability and Resiliency.

Measure: Percent of the project area at higher risk of losses to insects and diseases as defined by a measure of forest density (Upper Management Zone).

Thinning from below, regardless of the upper diameter limit, will reduce stand densities and thus improve conditions for tree and stand health and vigor. However, a limit on the size of trees that can be thinned will have a consequence on the effectiveness of the thinning to improve conditions for tree and stand health and vigor. Across a landscape or project area and within most stands, there can be a variety of size classes present and when a diameter limit is set, then thinning is most effective where the majority of the trees are less than the diameter limit and the density of the trees above the diameter limit is at or below the desired level.

On a stand exam plot-average basis, approximately 72% of the acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality. Under Alternative 3, the percentage of the project area that is above the upper management zone can only be reduced to 43% as opposed to 29% under Alternative 2.

Additionally, the use of averages to characterize stand densities can be a little misleading because the use of averages masks the fact that areas of stands where there is a significant component of trees greater than the thinning diameter limit (e.g., 6" or 21") that are above the upper management zone before treatment will remain above the upper management zone after treatment, even though the stand average is below the upper management zone. A higher diameter limit will allow for more acres to be thinned to sustainable densities (i.e., below the upper management zone) than a smaller diameter limit. Consequently, Alternative 2, with a diameter limit of 21" diameter will allow for better stand density reduction within late old structure stands than Alternative 3.

Measure: Number of acres where treatments create conditions more favorable to the development of stand structure and composition similar to historic conditions.

Stand structure and species composition under Alternative 3 would be the same as under Alternative 2 for 416 acres of second growth stands, 79 acres of aspen stands and 236 acres of natural meadows.

In 458 acres of late old structure, stand structure and species composition under Alternative 3 would be moved somewhat towards historical conditions of late old structure stands; however, no trees between 6" diameter and 21" diameter could be thinned. On approximately 70% of the acres of late old structure where there are a significant number of trees greater than 6" diameter, there would be no opportunities to thin these areas and they would remain at higher densities and the growth and crown development of the trees in these areas would not improve, consequently, the trees in these area would not move into the larger size classes at an accelerated rate that thinning to 21" diameter under Alternative 2 would allow.

The current trend, in some portions of the late old structure area, in species composition towards fire intolerant species (primarily lodgepole pine, western juniper, white fir and incense cedar) would be abated, especially in the size classes less than 6" diameter. However, species composition between 6" diameter and 21" diameter would not change.

Measure: Number of acres and percent of the project area where treatments create conditions more favorable to the survival of existing large trees as defined by a measure of forest density (Upper Management Zone).

This alternative would treat the same number of acres of late old structure as Alternative 2 (approximately 458 acres of late old structure with thinning from below and associated thinning created fuels clean-up and prescribed burning (including mowing where needed)) with the only difference being that no trees between 6" diameter and 20.9" diameter would be thinned under

Alternative 3. As under Alternative 2, thinned trees would be utilized to the greatest extent possible under Alternative 3 given the same uncertainty regarding future technology and markets for the disposal and utilization of the material generated by thinning.

All acres that were late old structure before treatment would remain late old structure after treatment. By limiting thinning to trees less than 6" diameter under Alternative 3, the thinning treatments would do very little to move multi-stratum late old structure toward single-stratum late old structure and most acres will remain multi-storied as thinning from below somewhat reduces canopy layers and canopy cover. However, because of the 6" diameter limit on thinning under Alternative 3 more acres would remain multi-storied compared to Alternative 2.

Large, old trees are the key structural components of late old structure habitat because of the time required for their development, their habitat functions as living trees, and because they contribute to the large snag and down wood component of these forests. Altered successional patterns are working against the long-term survival of these large old trees. All growing sites have a fixed quantity of resources- Alternative 3 would shift a portion of these resources to the large overstory pines with the objective of maintaining them on the landscape for the foreseeable future. However, under Alternative 3, this would not happen as well, on as many acres, as Alternative 2 because of the 6" diameter thinning limit under Alternative 3.

On a stand exam plot-average basis, approximately 77% of the acres of late old structure in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality. Under Alternative 3, the percentage of the late old structure that is above the upper management zone is reduced to 70%, as opposed to less than 44% under Alternative 2. Loss of the large tree component should be slightly slowed on treated acres but not near as well as under Alternative 2.

An indirect effect of Alternative 3 is its effect on the growth and crown development of the smaller trees. On 416 acres of second growth stands, alternative 3 is the same as Alternative 2. However, on 458 acres of late old structure, good growth and crown development on smaller trees would be severely limited because only trees less than 6" diameter could be thinned/removed. Alternative 3 only thins to 6" diameter in late old structure stands, consequently, good growth and crown development will not occur wherever acres are overstocked in trees greater than 6" diameter, estimated to be 70% of the acres of late old structure, and in these areas, trees will not be promoted into the larger size classes sooner and they will continue to experience poor crown development. Consequently, Alternative 3 does not promote good growth and good crown development as well as Alternative 2. Additionally, on acres of late old structure under Alternative 3, size classes between 6" and 21" diameter that are closest to moving into the large size class (i.e., 21" + diameter) would not be thinned, growth would not be improved and the trees in these size classes would not move into the larger size class much sooner than under the no-action alternative (1).

Cumulative Effects of the Action Alternatives

This analysis considers the past, present and reasonably foreseeable future actions to the forested vegetation within the Whychus watershed. These actions are listed at the beginning of this chapter. Past actions and their effects include all actions that have occurred from the time of European settlement in the late 1800's. Reasonably foreseeable future actions include those that are in the planning stage and likely to be completed in the next 10 years.

Past actions and their effects are described in the Whychus Watershed analysis (USDA, 1998) and are incorporated into the existing condition section for this project. In summary, past actions such as fire suppression and timber harvest have resulted in a watershed that has moved away from the historic range of variability in terms of stand densities, species composition and forest structure. General trends in forest vegetation across the landscape as a result of past actions include: denser stands, species composition shifts to more fire intolerant species, forest structure that is more dominated by small trees rather than medium/large trees, increased accumulation of ground fuels and denser ground vegetation. These trends in vegetation have led to changes in wildlife and plant habitat, uncharacteristic fuel profiles, increased fire hazard and increased potential for uncharacteristic wildfire.

Present actions include those projects with currently approved environmental analysis including the Black Butte Ranch Fuels Reduction Project, the Highway 20 Integrated Vegetation Management Project and the Black Crater fire salvage. Reasonably foreseeable future actions include those projects that are in the planning stage including the SAFR and West Trout projects.

Key Issue: Size of Trees Removed.

Measure: Number of trees over 16 inches diameter which are removed.

All present and reasonably foreseeable future actions are designed to reverse the trends of past actions that have led the Whychus watershed away from the historic range of variability. The present vegetation management projects and reasonably foreseeable future vegetation management projects in the Whychus watershed, under the current management paradigm, have or will be designed to minimize the loss of trees greater than 16" diameter and enhance the recruitment of trees into the medium/large-tree category by favoring growth of dominant and co-dominant trees.

Analysis Issue: Improvements to Forest Health Sustainability and Resiliency.

Measure: Percent of the project area at higher risk of losses to insects and diseases as defined by a measure of forest density (Upper Management Zone).

All present and reasonably foreseeable future actions are designed to reverse the trends of past actions that have led the Whychus watershed away from the historic range of variability. The present vegetation management projects and reasonably foreseeable future vegetation management projects in the Whychus watershed, under the current management paradigm, have or will be designed to create forest conditions that are more resistant to adverse effects of uncharacteristic wildfire, drought, insects, and disease.

Measures:

Number of acres where treatments create conditions more favorable to the development of stand structure and composition similar to historic conditions

Number of acres and percent of the project area where treatments create conditions more favorable to the survival of existing large trees as defined by a measure of forest density (Upper Management Zone).

There would be beneficial cumulative effects associated with either of the action alternatives. However, since Alternative 2 has a diameter limit of 21 inches in the old growth stands versus a 6" diameter limit under Alternative 3, Alternative 2 will have more beneficial cumulative effects than Alternative 3 because the higher diameter limit under Alternative 2 allows the stands in the project area to move toward the historic range of variability at a faster pace. Alternative 2 would have more positive cumulative effects than Alternative 3 by reducing stand densities better, reducing shade-tolerant/fire-intolerant species better, reducing the number of small trees better and moving toward a more historic, fire-tolerant stand structure better. Consequently, no negative cumulative effects from either of the action alternatives, combined with present or the reasonably foreseeable future projects would be expected.

Hydrology

AFFECTED ENVIRONMENT

Background

All federal land management activities in the Glaze Forest Restoration Project area must follow standards and guidelines listed in the 1990 Deschutes National Forest Land and Resource Management Plan (USDA Forest Service 1990), and INFISH (USDA Forest Service 1995), 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 Glaze Forest Restoration fall under the guidance of the INFISH. Additional guidance is provided by the Sisters/Whyches Watershed Analysis (USDA Forest Service 1998b) and the Interior Columbia Basin Ecosystem Management Project (USDA Forest Service and BLM 1997). Although the Interior Columbia Basin Ecosystem Management Project has not officially been finalized, the science within the document is recommended and may amend INFISH in the near future.

INFISH

The Deschutes National Forest Management Plan was amended in 1995 by the Decision Notice and Finding of No Significant Impact for the Inland Native Fish Strategy (INFISH). The interim direction is in the form of riparian management objectives, standards and guidelines, and monitoring requirements. Riparian Management Objectives describe good habitat for inland native fish and anadromous fish and interim guidance would apply where Watershed Analysis has not been completed. The Sisters/Whyches Watershed Analysis applies to the Glaze Forest Restoration project area but does not refine the interim Riparian Management Objectives. INFISH provides standards and guidelines for Riparian Habitat Conservation Areas that prohibit or regulate activities that retard the attainment of Riparian Management Objectives at a watershed scale. The action alternative design in the Glaze Forest Restoration Project complies with the standards and guidelines in INFISH. The primary focus of monitoring is to verify that the standards and guidelines were applied during the project implementation.

Priority watersheds were identified to help prioritize restoration, monitoring and watershed analysis for areas managed by INFISH. All portions of subwatersheds in the Glaze Forest Restoration project boundary are “non-priority watersheds.” Another essential piece of INFISH is the delineation of Riparian Habitat Conservation Areas (RHCAs) which “include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of the aquatic ecosystems by (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams, (2) providing root strength for channel stability, (3) shading the stream, and (4) protecting water quality” (USDA 1995). The Sisters/Whyches Watershed Analysis refine Riparian Reserve widths under the Northwest Forest Plan based on average maximum tree height, 100 year floodplain, extent of riparian vegetation, and unstable and potentially unstable lands. These same adjustments to Riparian Reserves in the Northwest Forest Plan area should also be applied to Riparian Habitat Conservation Areas for subwatersheds in the Sisters/Whyches analysis area that follow under the guidance of INFISH (Table H-1).

Table H-1. Riparian Habitat Conservation Area widths in the Glaze Forest Restoration Project area.

Category	Stream Class	Description	Riparian Reserve width (slope distance (ft) from edge of channel)
1	1 & 2	Fish-bearing streams	300 ft
2	3	Permanently flowing non-fish-bearing streams	150 ft
3	NA	Ponds, lakes, reservoirs, and wetlands > 1 ac	150 ft
4	4	Seasonally flowing or intermittent streams, wetlands < 1 ac, landslides, and landslide-prone areas	70 ft

Clean Water Act

The State of Oregon, as directed by the Clean Water Act 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 Whychus Creek watershed is listed in Table H-2. To show that water quality is being protected, states are required by the Clean Water Act 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 Clean Water Act and are used to meet water quality standards. Waterbodies within the Glaze Forest Restoration Project area that do not meet the State Standards for water quality are discussed in this report within the Water Quality – 303(d) Listed Stream section.

Table H-2. Beneficial uses within the Glaze Forest Restoration Project area and water quality parameters that will be analyzed for effects to water quality from the Glaze Forest Restoration project.

Beneficial Use	Water Quality Parameter
Public and Private Domestic Water Supply	Turbidity, Flow
Irrigation	Flow
Livestock Watering	Flow
Fish and Aquatic Life	Dissolved Oxygen, Sedimentation, Temperature, Flow
Wildlife and Hunting	Flow
Fishing	Temperature
Water Contact Recreation	Dissolved Oxygen
Aesthetic Quality	Turbidity

Watershed Setting

The Glaze Forest Restoration Project area is 1192 acres and is located on USFS land within portions of Upper Indian Ford and Lower Indian Ford subwatersheds within the Whychus Creek Watershed (Table H-3). It is primarily located west of Hwy 20, south of Black Butte Ranch, east of Five Mile Butte, and north of the Sisters Area Fuel Reduction Planning Area. The hydrology analysis area for the Glaze Forest Restoration Project includes the entire subwatershed area of Upper and Lower

Indian Ford Creek subwatersheds. The only significant tributary to Indian Ford Creek is Trout Creek, but the connection is ephemeral. The Trout Creek subwatersheds were not included in the analysis area because Trout Creek only ephemerally connects to Indian Ford Creek and the connection is less than a mile from the confluence of Indian Ford Creek and Whychus Creek.

The existing condition and environmental effects for the hydrology analysis area are described in this document. In addition, both of these subwatersheds were analyzed in the Sisters/Whychus Watershed Analysis (USDA Forest Service 1998b).

Table H-3. Acres by subwatershed for subwatersheds that are within or partially within the Glaze Forest Restoration Project area.

Watershed (5 th field)	Subwatershed (6 th field)	SWS Acres	NF acres in SWS	Acres in Project Area Boundary
Whychus Creek	Upper Indian Ford	12,103	8,016	1,147
Whychus Creek	Lower Indian Ford	23,661	17,156	45
Total				1191

Hydrologic Processes

Precipitation

Precipitation in the analysis area ranges from 40 inches a year at the head of Upper Indian Ford Creek subwatershed to 14 inches a year in Sisters, Oregon, with an average of 17 inches per year in the project area. Elevations in the project area range from 3,800 ft to 4,200 ft; therefore, the entire project area is within the rain-on-snow zone (approx. 3,500-5,000 ft). Within the project area, approximately two-thirds of the precipitation occur between October and March and mostly falls as low intensity rain or snow. During this time, a less common occurrence can be large runoff events caused by rain-on-snow, resulting in high, short spikes in the hydrograph. A secondary peak of precipitation occurs between May and June and falls as high intensity thunder showers. Although portions of these subwatersheds experience a significant amount of precipitation and some high intensity storms, there is very little surface channel flow. Also, the project area is only approximately one mile downstream of the headwater springs of Indian Ford Creek, making drastic changes in the hydrograph within the project area unlikely.

Overland Flow

The low drainage density and abundance of wetlands in these subwatersheds are due to the soils, topography, and underlying geology. Soils in the analysis area are primarily volcanic ash with rapid infiltration rates. In portions of the analysis area these soils overlie highly permeable fractured rock and cinders. These coarse materials allow water to move quickly through the soil and rock profile and down into the groundwater. In other areas, volcanic ash overlies less permeable glacial outwash. As water moves through the soil profile in these areas, it may become perched and move laterally across the outwash and emerge as springs, which is the case in the project area. Permeability rates for the majority of soils in the analysis area exceed the 2 yr, 30 minute rainstorm intensities for the same area (permeability for most soils in project area = 20 in/hr, 2 yr, 30 min rain = 0.30 in/hr) (Soil code = 5, GT, GS). As a result of rapid infiltration and high permeability rates in the soil code GT

and GS soils, and high infiltration and high water storage capacity in the wetlands (soil code 5), overland flow is rare in the analysis area. Although drainage density in the hydrology analysis area is low, there are an abundance of wetlands and wetter soil types.

Within the analysis area, overland flow does not generally occur from a reduction in evapotranspiration when trees are harvested because infiltration and permeability rates often exceed precipitation rates. However, overland flow can occur in areas where infiltration rates are reduced, such as compacted areas or frozen areas. Within the analysis area, rain-on-snow events can occur which provide a surface for water to flow overland to the creek; however, much of the drainage area is flat, allowing time for snow to melt and infiltrate. The greatest influence on overland flow in the analysis area is roads and trails (USDA Forest Service 1998b).

Road density in the Indian Ford Creek subwatersheds is considered high, according to the document, "Determining Risk of Cumulative Watershed Effects Resulting from Multiple Activities" (USDA Forest Service 1993). Although road density is high, only roads adjacent to streams, crossing streams, or hydrologically connected to streams via road ditches have an influence on streamflow or water quality (Table H-4) (USDA Forest Service 1998b). Road miles in Riparian Habitat Conservation Areas and stream crossings are low in the Indian Ford subwatersheds; however, there are some additional riparian trails and crossings not reflected in these numbers.

The Glaze Forest Restoration Project area is under an area closure and no motorized vehicles are allowed in the area except for administrative purposes. However, despite the closure, there is still evidence of illegal off road vehicle use. Within the project area there is a special-use permit for guided horse rides and there are approximately 6 miles of permitted horse trails associated with this special use permit. Many of these trails are adjacent to Indian Ford Creek or cross the creek, usually at bridges.

Within the Glaze Forest Restoration Project area, there is approximately 1 mile of system road and approximately 4 miles of non-system roads or trails within the Riparian Habitat Conservation Areas. Only two roads in the project area cross waterbodies: 1) the 2000-300 road, which is a ford across Indian Ford Creek, and 2) the 2000-345 road, which crosses a backwater area created by a new beaver pond. When the area was closed the bridge across Indian Ford Creek was removed. Due to vehicle-use and horse-use at the ford, the stream is slightly over-widened at the crossing. This area continues to be a potential sediment source to Indian Ford Creek, especially when vehicles use the ford. The beaver pond was created in the winter of 2007 and does not appear to be causing any road erosion, especially since this road is closed to the public.

The other system roads in the project area within the Riparian Habitat Conservation Areas are the 1012-300 and the 1012-335. After the 1012-300 road crosses Indian Ford Creek it follows the northern, outer-most end of the Glaze Meadow Riparian Habitat Conservation Areas. This segment of road does not interact with the wetland. Just west of the junction with the 1012-335 rd and outside of the Riparian Habitat Conservation Areas, a seasonal seep can make the 1012-300 road wet for approximately 100 ft. The 1012-335 road crosses a wetland arm of Glaze Meadow. This is a low profile, dirt road that is mostly level with the surrounding wetland. Although this area is already compacted, it does not appear to be significantly disconnecting the wetlands on either side because water can freely flow across the road. The road bed currently does not trap or divert the water stored

in the wetland because the road bed is not incised or gullied and the topography does not drain away from the wetland. A non-system road also crosses the western end of this wetland arm, but does not appear to be disconnecting the wetland.

Table H- 4. Road density and stream crossings in the Glaze Forest Restoration Project Hydrology Analysis Area.

Subwatershed (6 th field)	System Road Miles	Road density (mi/mi2)*	Riparian Habitat Conservation Areas roads (mi)*	Number of stream crossings
<i>Upper Indian Ford</i>	123	6.7	9.4	1
<i>Lower Indian Ford</i>	214	5.8	5.6	5
Total in Project Area	5.2	2.3	5	1

* including the 4 miles of non-system road in the Glaze project area.

Streamflow

Indian Ford Creek, Captain Jack Creek, an unnamed perennial tributary, and an unnamed intermittent tributary are the only streams in the Glaze Forest Restoration hydrology analysis area; however, there are numerous wetlands. Trout Creek, a tributary to Indian Ford Creek, was not included in the hydrology analysis area because it is only ephemerally connected and its confluence is near the mouth of Indian Ford Creek, which is downstream of the project area. Indian Ford is a 12 mile spring-fed stream that originates from Paulina Springs and Captain Jack Springs approximately 1 ½ miles upstream of the west boundary of the project. It flows as three distinct channels on private land. The northern most channel flows through a series of man-made ponds within a golf course. The middle channel is Indian Ford Creek, and the southern most channel is Captain Jack Creek and both flow through Big Meadow and converge at the bottom of the meadow.

As Indian Ford Creek leaves the private land it flows southeast through Black Butte Swamp, through forests and large wet meadows visible from Indian Ford Road and ultimately into Whychus Creek near the town of Sisters, Oregon. As Indian Ford Creek flows out of Black Butte Swamp it becomes a single-thread channel and the project boundary follows the center-line until Indian Ford Creek turns east and heads across Hwy. 20. This single-thread channel of Indian Ford Creek is perennial within the project area and riparian vegetation is mostly confined along the banks. Historically numerous channels flowed through Glaze Meadow; however, now after various hydrologic manipulations (diversions, ditches, ponds, etc...) only a short intermittent stream flows from the northeast edge of Glaze Meadow into Indian Ford Creek. This channel is fed by Glaze Meadow and numerous inactive ditches within the meadow that converge at the northeast end of the meadow.

Streamflow in Indian Ford Creek is extremely stable due to its spring influence and interaction with wetlands. Throughout much of its length it is surrounded by wetlands. As it flows through these flat wetlands the channel becomes multi-thread and it is difficult to discern a main channel. Streamflow in Indian Ford is reduced near the headwater springs because approximately 7 cfs is diverted for use on Black Butte Ranch. In addition, the stream has been impounded to create scenic ponds throughout Black Butte Ranch. Downstream of the project boundary streamflow is further reduced by a small diversion (approx. 1 cfs) at Sundowner Ranch. As a result of these diversions, Indian Ford Creek

usually goes dry in July downstream of the project area and approximately 3.5 miles before reaching its confluence with Whychus Creek.

Hydrology in the area may have also changed over time with cycles of moisture and natural disturbances such as beaver activity. Hatton (1996) reported that in the late 1800's the Glaze/Black Butte area had a lake, approximately ½ mile in length, just west of the small butte (Jaybird Ridge) south of Hwy 20 about one mile east of the entrance of Black Butte Ranch. In 1880, 1881, 1885 and 1951, large springs burst from the ground on the northern edge of Black Butte swamp and sent out such a volume of water it flowed northward into Lake Creek, a tributary of the Metolius River.

Channel and Wetland Condition

Indian Ford Creek

Indian Ford Creek is primarily a spring-fed, single-thread E5 channel (Rosgen 1996), but becomes multi-channel when it flows through larger wetlands like Black Butte Swamp or the wetland downstream of the project area and southeast of the 2058 road (Pine Street). Stream type E5 is associated with low width-to-depth ratios, low gradients, high sinuosity, mostly glide features, connection to the floodplain, and sand dominated substrate.

Paulina Springs, Captain Jack Springs and their associated wetlands are the headwaters for Indian Ford Creek and they are privately owned by Black Butte Ranch. The wetland within the private land, Big Meadow, has been significantly altered to make golf courses, ponds, and home sites. As a result, much of the riparian vegetation has been removed and now three distinct channels flow through the wetland: 1) a channel connecting a series of man-made ponds, 2) Indian Ford Creek, and 3) a tributary called Captain Jack Creek. Historically, Indian Ford within wetland on the private land was probably an extensive multi-thread stream throughout the wetland, more similar to Black Butte Swamp downstream on public land.

Indian Ford Creek flows through the Glaze Forest Restoration Project area on public land for approximately 1.9 miles. As Indian Ford Creek enters the public land it is still within the wetland but the riparian vegetation is intact, which allows the wetland to function as more of a swamp. As a result, Indian Ford Creek spreads out across the wetland, called Black Butte Swamp (Treatment area 15 and 12 in Figure 1), as numerous small channels. As the wetland in Black Butte Swamp narrows a single channel forms.

When Indian Ford Creek leaves Black Butte Swamp it is a single-thread channel and the riparian vegetation is mostly confined to the area within 10 ft of either side of the stream. It remains mostly single-thread with a narrow riparian band for approximately 0.9 miles within the Glaze Forest Restoration Project area. Stream banks along this reach are extremely stable due to the consistent spring-fed flow, instream wood, and robust riparian vegetation, which includes aspen, alder, willow, and sedges. Conifers have encroached on this narrow riparian band, although riparian plant vigor, composition, and diversity is still good. The Glaze Horse and Cattle Allotment, which extended into this area, was closed in 1997 because mitigation to reduce resource damage caused by the grazing was too costly. Monitoring during the grazing period showed that streambanks along Indian Ford were trampled, riparian vegetation was heavily browsed, and the new vegetation could not get established.

In the 10 years since the allotment was closed riparian vegetation has reestablished and the streambanks are stable. A Proper Functioning Condition assessment was conducted in this area on May 31, 2007, and an interdisciplinary team determined that this reach was properly functioning. The only potential issues identified by the team were the encroachment of conifers in the riparian area and high percent fines in the riffles.

Once Indian Ford leaves the project area it remains mostly single thread and on public land for approximately another mile until it reaches Sundowner Ranch. At this point the valley opens up and Indian Ford historically would have meandered through a series of wetlands and meadows. Much of the valley in the private land has been cleared and is now open pasture with mostly a single-thread channel.

Downstream of Sundowner Ranch on public land Indian Ford wetlands are intact and densely vegetated with riparian species, although there is significant conifer encroachment. Due to the abundant riparian vegetation and low gradient, Indian Ford is multi-thread as it meanders through these wetlands.

The 85 acre Indian Ford Cattle Allotment is located in one of these wetlands just downstream of the 2058 rd (Pine St.). Although 50 yearlings or 23 cow/calf pairs are allowed inside the riparian area within the Allotment on the public land, browse levels are within the permitted levels. The allowed grazing season is short and restricted to the early summer months when Indian Ford Creek is usually still flowing. In the early summer more of the allotment outside of the riparian vegetation is still green and more palatable, which generally helps keep the cattle from grazing on the riparian shrubs and trees. A Proper Functioning Condition assessment was also conducted within this allotment on May 31, 2007. Again the team determined that the wetland within the allotment was properly functioning; however, woody riparian vegetation vigor and age-class diversity were poor. Due to browse, either from cattle or wildlife, and a lack of disturbance from fire, new woody seedlings were minimal.

In most years from the allotment downstream, Indian Ford Creek goes dry in the summer. The private land immediately downstream of the special-use permit area on the public land is also used for grazing by the same permittee; however, there is no longer any riparian vegetation and the stream has been channelized. The remaining 3.5 miles of Indian Ford run through private property to its confluence with Whychus Creek. Most of the creek has been manipulated at some point; however, some reaches are in a state of recovery such as the Deschutes Basin Land Trust property immediate downstream of the private cattle allotment and upstream of Camp Polk road. This property was previously grazed, leaving Indian Ford channelized and mostly void of riparian vegetation. In the last 20 years, riparian vegetation has reestablished and streambanks have stabilized.

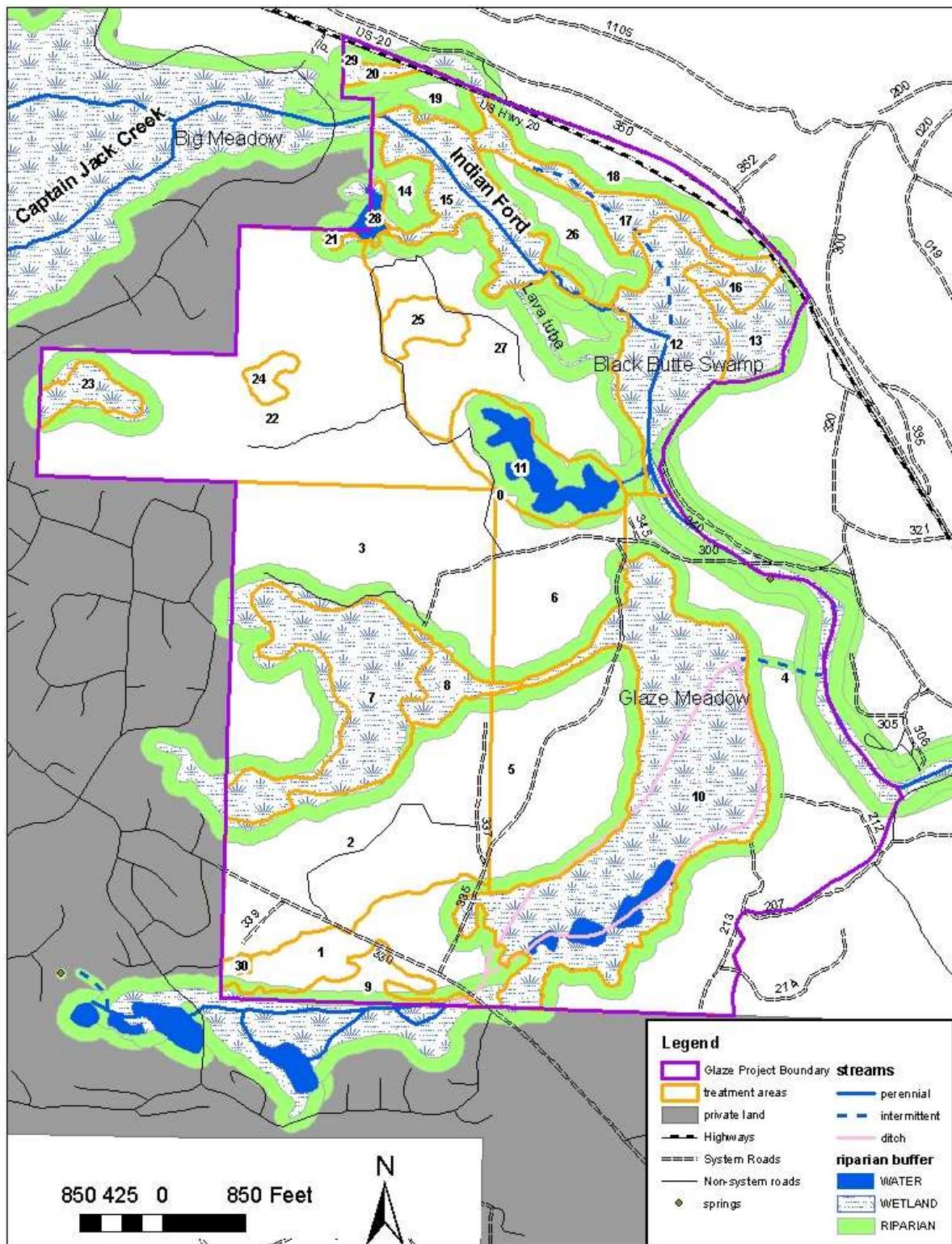


Figure H-1. Map of Glaze Forest Restoration Project area and proposed treatment areas in relation to Riparian Habitat Conservation Areas

Wetlands

Wetlands are extremely important for providing cold water and late season flows. Compaction or diversion of flows in these areas can negatively impact water storage. Wetlands identified in this report are areas with riparian vegetation. They are not necessarily jurisdictional wetlands. Soils and hydrology in these polygons have not been evaluated to the degree necessary to make a jurisdictional determination. Wetlands identified in this report are protected based on INFISH buffers.

Big Meadow is the headwaters for Indian Ford Creek and it is privately owned by Black Butte Ranch. Big Meadow has been significantly altered to make ponds and much of the riparian vegetation has been removed. As mentioned previously, three distinct channels flow through the wetland. The wetland extends downstream of the private land onto public land as does Indian Ford Creek. As Indian Ford Creek enters the public land it flows into Black Butte Swamp. The riparian vegetation within the wetland on public land is intact, which allows the wetland to function as more of a swamp.

Black Butte Swamp is within the northern end of the Glaze Forest Restoration Project area. The wetland adjacent to the perennial channel of Indian Ford within Black Butte Swamp stays wet throughout the year; however, the wetland adjacent to the intermittent channel is only wet subsurface during a short season in the winter/spring (Treatment areas 17 & 20; Figure H-1). Development and instream water diversions has likely reduced the amount of saturation and duration of saturation in these wetlands. The edges of the wetland are much drier (Treatment areas 13, 16, 17, 20 in Figure H-1) and conifer encroachment is much more prevalent. In addition, wild fire has been excluded in this area for the last century. Although there is an abundance of healthy riparian vegetation such as sedges, willows, alders, bog birch, and aspen, there is also an obvious decline in large willow clumps.

In an attempt to regenerate the large decadent willows, the eastern end of the Black Butte Swamp was burned in a prescribed fire in 1999. Since the swamp had a thick organic layer the fire burned long and hot and most of the organic layer was removed. Although the burn did not regenerate the large decadent willows, it did encourage new willows to get established.

The small wetland arm of downstream of Black Butte Swamp to the west is a new wetland created in 2007 by a beaver dam. Historic survey accounts from the 1870's and aerial photos from 1943 show that this area was wet and this also may have also been caused by beaver activity. This new wetland is filled with pre-settlement conifers because it has not been a wetland for many decades. If this area stays inundated then the conifers will die.

Glaze Meadow is the large wetland in the southern end of the project boundary, and like Black Butte Swamp, the upper end of the wetland is privately owned by Black Butte Ranch. Springs originating on Black Butte Ranch originally feed the meadow; however, the flow has been altered by impoundments and ditches, and as a result, much less, if any, flow from the upper wetland reaches Glaze Meadow within the project boundary. The reduced flows within the wetland have made Glaze Meadow within the project boundary more of a dry meadow. There are no stream channels in Glaze Meadow within the project boundary and all the relic ditches and ponds are dry. The northern end of Glaze Meadow and the arm and wetland to the west (Treatment areas 7 and 8 in Figure H-1) are more seasonally wet and have riparian vegetation such as sedges and aspen. Historic photos, soil

profiles, and antidotal accounts suggest that historically Glaze Meadow stayed wet longer than presently. Comparison of historical aerial photos show that conifers are encroaching on the meadow edges and sporadically within the meadow. Also, conifers have significantly encroached in the wetlands as a result of fire suppression within Treatment Areas 7 & 8, and there are many pockets of dead and dying aspen and lodgepole. Many of the conifers and aspen are dead and jack-strawed giving this area a high fuel load.

The small wetland in the western most corner of the project boundary (Treatment area 23) has only seasonally wet soils. Dominant riparian vegetation is aspen and sedges. Significant conifer encroachment has occurred. The majority of trees are small diameter (< 12" diameter) ponderosa pine and lodgepole that have established as a result of fire suppression.

The Riparian Habitat Conservation Areas surrounding the wetlands in the Glaze Forest Restoration Project area generally extend 150 ft from the edge of the wetland. Most of the Riparian Habitat Conservation Areas surrounding the wetlands are comprised of densely populated upland species.

Water Quality

The Whyshus Watershed Analysis discusses how the State designated beneficial uses of the Deschutes Basin apply to waterbodies in the Whyshus analysis area (USDA Forest Service 1998b). Water quality parameters associated with beneficial uses for waterbodies in the Glaze Forest Restoration Project analysis area that have been altered from historic conditions are flow, temperature, dissolved oxygen, and sediment.

303(d) Listed Streams

The State of Oregon is required by the Clean Water Act, Section 303(d), to identify waters that do not meet water quality standards. Indian Ford Creek, throughout its length, is listed on the Oregon 2004 303(d) list for water quality exceeding the State standard. Indian Ford Creek has exceeded the 7-day average maximum water temperature standard for salmon and trout rearing and migration which is 18° C (ODEQ 2007).

States are required to develop Total Maximum Daily Load allocations, which include Water Quality Management Plans for 303(d) listed waters. The Upper Deschutes River Subbasin Total Maximum Daily Load and Water Quality Management Plans are scheduled for completion in 2008 and covers all the subwatersheds in the Glaze Forest Restoration Project boundary. A Memorandum of Understanding signed May 2002, between Oregon Department of Environmental Quality and the U. S. Forest Service, designated the Forest Service as the management agency for the State on National Forest Service lands. To meet Clean Water Act responsibilities defined in the Memorandum of Understanding, the Forest Service is responsible for developing a Water Quality Restoration Plan, which is now in draft form (USDA Forest Service 2004). Activities proposed in the Glaze Forest Restoration Project area are in compliance with the draft Water Quality Restoration Plan.

Temperature

The Sisters/Whychus Watershed Analysis analyzed stream temperature data in the Glaze Forest Restoration analysis area (USDA Forest Service 1998b). In addition, temperature monitoring in the project area has continued on Indian Ford Creek (Table H- 5). Water temperature in Indian Ford Creek immediately downstream of Black Butte Ranch has been consistently near or above the State Water Quality standard. The 2000 Forward Looking Infrared survey shows a dramatic spike in temperature as Indian Ford Creek leaves the private land. Stream temperatures at the springs in Big Meadow were measured at 6.5°C on July 28, 2000, and measured at 19.1°C just 1.3 miles downstream (Watershed Sciences 2000).

Insufficient in-stream flows and water ponding have been the main reason for high water temperatures in Indian Ford Creek. Approximately 8 cfs is diverted during the summer low flow season, reducing water depths and causing the stream to dry up at least 3 miles before it's confluence with Whychus Creek. Reduced low flows increases the amount of time water is exposed to solar radiation and reduces the amount of water available for riparian vegetation. The lack of sufficient riparian vegetation also exacerbates channel erosion and widening, leading warmer stream temperatures from increased surface area. Stream flow is also heated near the headwaters where streamflow is impounded and water surface area is exposed to solar radiation.

Table H-5. Water temperature monitoring in the Glaze Forest Restoration Analysis Area.

Stream	Period of record	Max 7-day ave. max. temperature	2003 Water Temperature standard
Indian Ford Creek at headwater springs	July 28, 2000	6.5° C**	18° C
Indian Ford Creek at Black Butte Ranch*	1996-1997	19.3° C	18° C
Indian Ford Creek below Glaze Allotment*	1993, 1994, 1996-2001, 2003	20.9° C	18° C
Indian Ford Creek at 025 Rd at lower end of USFS boundary	2000, 2003	18.4	18° C
Indian Ford Creek at 2058 Rd	1998 - 2002	19.4° C	18° C

* within Glaze Forest Restoration Project area

** one time recording

Dissolved Oxygen

Dissolved oxygen is directly related to water temperature and biological activity and was analyzed in the Sisters/Whychus Watershed Analysis (USDA Forest Service 1998b). Indian Ford Creek has reached dissolved oxygen levels as low as 8.2 mg/L and 90% saturation in summer low flow months. Although dissolved oxygen in this stream has not been measured according to the State protocol, it could be below State standards (USDA Forest Service 1998).

Sedimentation

The amount of fine 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 administrative rules addresses sediment through a turbidity standard that 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). For this report, sedimentation, including turbidity and fine sediment in substrate, will be analyzed because of the effects on channel morphology and aquatic species. The Sisters Ranger District has monitored turbidity, percent fine sediment in spawning gravels, cobble embeddness, and bank stability, all of which are parameters associated with fine sediment.

The Sisters/Whychus Watershed Analysis analyzed sediment in Indian Ford Creek (USDA Forest Service 1998). Although percent fines in spawning gravels were above 35% in Indian Ford Creek on USFS lands, sedimentation within the project area is not a concern. Turbidity levels in Indian Ford Creek on USFS lands are only 1 FTU or JTU. Percent fines are high in Indian Ford Creek on USFS lands primarily because of it's natural flow regime and geology which makes it a spring-fed, sandy-bottom “E” channel type (Rosgen 1996). Roads and trails adjacent to or that cross Indian Ford within the project area may contribute some sediment; although efforts to mitigate these effects have been made. The bridge at the stream crossing within the project area was removed and the crossing is within the area closure and rarely used. Also, bridges at horse trail crossings have been constructed to reduce sedimentation.

Most excess sedimentation in Indian Ford Creek is located downstream of the project area on private land where removal of riparian vegetation has cause streambank erosion. Overland flow can increase sedimentation, although in the Glaze Forest Restoration hydrology analysis area, overland flow is rare. Certain roads and trails in riparian areas, and primarily roads/trails at stream crossings, were determined to be the only source of overland sediment input to streams in the Glaze Forest Restoration hydrology analysis area (see “Hydrologic Processes –overland flow” section of this report).

ENVIRONMENTAL CONSEQUENCES

Under the Action Alternatives, density management and other treatments on overstocked stands is being proposed on approximately 1192 acres within old growth stands, second growth stands, and Riparian Habitat Conservation Areas. The project proposes treatment on managed stands that are pre-settlement and are designed to accelerate the improvement of stand conditions toward healthy and/or late seral forest conditions.

Under INFISH Standards and Guidelines for timber management, density management thinning treatments and/or commercial extraction within Riparian Habitat Conservation Areas should only be considered if needed to acquire desired vegetation characteristics to attain Riparian Management Objectives. Situations in which timber harvest may be needed to move toward attaining Riparian Management Objectives include thinning in over-stocked Riparian Habitat Conservation Areas in order to improve long-term shade, vegetation diversity, and other characteristics having to do with overall health and vigor of the stand. A healthy stand has greater potential to provide shade within

riparian areas and has a greater potential to grow into a late seral forest, thus providing late-successional habitat. In addition, reducing fuel loads in and around Riparian Habitat Conservation Areas helps reduce the risk of catastrophic fire within the riparian area which could prevent the attainment of Riparian Management Objectives.

Within the Glaze Forest Restoration Project area many riparian areas are showing signs of excessive density, resulting in slowed vegetative growth, deterioration and reduced regeneration of aspen stands, and increased risk from pathogens and catastrophic fire. Activities that could affect the water resource are density management and associated treatments within Riparian Habitat Conservation Areas. Approximately 551 acres of activities would occur in Riparian Habitat Conservation Areas in the action alternatives. Activities occurring in Riparian Habitat Conservation Areas to reduce conifer encroachment in aspen stands and/or remove fuels include between 197 and 237 acres of hand-thinning, 314 and 354 acres of ground-based thinning, between 241 and 281 acres of mowing, and up to 551 acres of underburning and/or pile burning (Table H-6).

Only 1 mile of haul would occur on existing system and temporary roads in Riparian Habitat Conservation Areas and effects would be mitigated. Only one haul route could cross Indian Ford Creek and it would be over a temporary bridge. Temporary roads would be located on existing road beds of non-system roads and they would all be closed and waterbarred and/or subsoiled after harvest and associated activities are completed. Extensive project design elements (or criteria) were developed to maximize the effectiveness of treatments and to minimize adverse hydrologic effects to Riparian Habitat Conservation Areas.

Table H- 6. Treatments acres in Riparian Habitat Conservation Areas (RHCA) in the Glaze Forest Restoration Project area by alternative. GB = ground-based; TA = treatment area.

Treatment	Indian Ford Creek Treatments (acres) Alt. 2	Indian Ford Creek Treatments (acres) Alt. 3	RHCA surrounding wetlands (acres) Alt. 2 & 3	Treatments within wetlands (acres) Alt. 2 & 3	Total Riparian Habitat Conservation Areas treatment (acres) Alt 2 / 3	
Thinning - GB	40	0	241	73 (TA# 7, 8)	354	314
Hand thinning	11	51		186 (TA, 9, 10, 13, 16, 17, 20, 23)	197	237
Mowing	40	0	241	0	281	241
Underburning and/or pile burning	51	51	241	259 (7, 8, 9, 10, 13, 16, 17, 20, 23)	551	551
Total Riparian Habitat Conservation Area treatment	51	51	241	259	551	

Alternative 1 (No Action) – Ecological Trends

Key Issue- Intensity and Methods of Riparian Thinning

Streamflow

Measure: acres of compaction in Riparian Habitat Conservation Areas

No activities would take place in Riparian Habitat Conservation Areas; therefore, streamflow would be unaffected by this alternative. Water diversions would remain the primary human caused influence on instream flows.

Channel and Wetland Condition

Measure: Stream - Alteration of stream bank and bed stability measured by changes in streamflow, sedimentation, riparian vegetation, and large wood recruitment.

Specific stream measures include:

Parameters	Measures
Streamflow (see Streamflow Effects)	Acres compacted in Riparian Habitat Conservation Areas
Sedimentation (see Sedimentation Effects)	Acres of soil detrimentally impacted in Riparian Habitat Conservation Areas
Riparian vegetation	Trees killed along streambanks
Large wood recruitment	Acres harvested within primary wood recruitment area (100 ft of a stream)

Measure: Wetlands – Acres compacted within the wetland; acres of riparian vegetation converted to other species or no vegetation

No activities affecting channel condition parameters such as streamflow, sedimentation, or large woody debris recruitment would occur as part of the project. Water diversions would remain the primary human influence on channel condition. Although upland species would continue to encroach upon aspen stands and change riparian vegetation and complexity, this would not affect channel stability. However, channel condition could be adversely affected in the future because the risk of deteriorating stand health and catastrophic fire in the Riparian Habitat Conservation Area would not be abated by thinning. Therefore, channel condition would be unaffected by this alternative in the short-term and potentially negatively affected over the long-term.

Infiltration would not be affected in this alternative because no thinning or burning would occur. Conifer encroachment would continue in this alternative and wetlands such as treatment areas 7, 8, 13, 16, 17, 20 and 23 could become dominated by upland species and higher risk for wildfire. In addition, open meadows could become smaller due to conifer encroachment such as treatment areas 9 and 10. If all these treatment areas were to become dominated by upland species then approximately 260 acres could be affected. Encroachment by conifers would reduce the amount of

this special habitat and potential water storage capacity. Therefore, the no action alternative could have a negative effect on wetland habitat.

303 (d) Listed Streams / Temperature

Measure: Number of trees felled in the primary shade zone

Stream temperatures would be unaffected under the No Action Alternative and Indian Ford Creek would remain on the 303(d) list for exceeding State water temperature standards. In addition, improvements to forest health from thinning such as growing larger trees, healthier trees and reducing the risk of stand replacement fires would not occur; therefore, potential long-term increases in stream shade along Indian Ford Creek would not occur. Regardless, improvements to future shade in the project area may not have a significant effect because the limiting factor for water temperature is instream flow and shade upstream of the project area.

Sedimentation

Measure: Acres of soil detrimentally impacted in Riparian Habitat Conservation Areas

No activities would occur in this alternative; therefore, no additional acres would be detrimentally impacted and no log haul would occur. Detrimentally impacted soils associated with past activities would continue to recover (see Soils report). Sedimentation effects from roads would stay the same. Fuel loads would continue to increase as would the risk of stand replacement fire and associated sedimentation. Improvements to the 2000-300 road ford across Indian Ford Creek would not occur and short-term increases in turbidity from animal and administrative vehicle use would continue.

Alternative 1 (No Action) – Ecological Trends

The hydrology cumulative effects analysis area for the Glaze Forest Restoration Project is the same as the analysis area used for existing condition and direct and indirect effects because it encompasses the entire Indian Ford drainage area. Cumulative hydrology effects different from natural conditions would continue as a result of past or on-going activities or events such as irrigation diversions, fire suppression, roads in riparian areas, and compaction in riparian areas from past logging and recreation use (i.e. dispersed camping, off-road vehicle use).

Future projects in the hydrology cumulative effects analysis area include the Sisters Area Fuels Reduction (SAFR) Project, the Indian Ford Allotment Management Plan renewal, and the Black Butte Ranch Welcome Center development. The SAFR Project would be approximately 33,000 acres and located in Deep Creek, Three Creek, Fourmile Butte, Lower Indian Ford, Lower Trout Creek, Middle Whychus Creek, Upper Indian Ford, and Upper Whychus Creek subwatersheds. The SAFR Project would focus on improving Forest health by promoting the growth of big trees and reducing catastrophic fire risk. The Indian Ford Allotment Management Plan has recently renewed the existing permit for grazing on the 85 acre riparian allotment in the Lower Indian Ford subwatershed. It would authorize a maximum of up to 50 yearlings for 46 days, or 35 cow/calf pairs for 46 days, or the equal equivalent of cattle in a grazing period that is not to exceed 66 days. The development of a Welcome Center at Black Butte Ranch is planned near Big Meadow and Indian Ford Creek just west of the project area in the Upper Indian Ford Subwatershed. The development

would occur more than 300 feet from Indian Ford Creek, would not remove riparian vegetation, would not impact hydrologically connected wetlands, and storm water would be treated on site.

Although approximately 3,600 acres of the SAFR project would occur within Upper and Lower Indian Ford Creek subwatersheds, none of the activities would be within a half mile of Indian Ford Creek because most of that area is on private land owned by Black Butte Ranch. There are no hydrological effects from the SAFR project therefore, this project would not add to the cumulative hydrology effects (McCown 2007). Likewise, there are no hydrology effects from the Indian Ford Allotment Management Plan; therefore, its renewal will not add to the cumulative hydrology effects (Press 2007).

Alternatives 2 and 3 – Direct and Indirect Effects

Key Issue- Intensity and Methods of Riparian Thinning

Streamflow

Measure: Acres of compaction in Riparian Habitat Conservation Areas

The Action Alternatives would not negatively affect streamflow because overland flow would not be increased by thinning conifers. Reducing the amount of evapotranspiration by thinning conifers in riparian areas could have a slight beneficial effect on summer base flows. Compaction and/or hydrophobicity would not be significant and it would not occur in areas likely to direct flow to Indian Ford Creek. Underburning would not affect streamflow because no new fire line would be constructed within Riparian Habitat Conservation Areas and burn severity would not be at a level to cause hydrophobic soils (soils which repel water). In addition, mortality of brush and small trees from the underburn would not alter streamflows because geology and soils are the primary influence of overland flow in the project area and not evapotranspiration (see Existing Condition – Streamflow).

As mentioned earlier, overland flow in the project area does not generally occur from a reduction in evapotranspiration when trees are harvested because infiltration and permeability rates often exceed precipitation rates. In addition, all stands proposed for thinning are over-stocked and thinning would help move the stand toward more historic conditions.

Thinning in Riparian Habitat Conservation Areas within 50 ft of Indian Ford Creek would not cause compaction or hydrophobicity because conifers would be felled by hand and hand piled at least 100 ft. from the stream. Thinning in the Riparian Habitat Conservation Area between 50 ft and 300 ft. from Indian Ford Creek would occur by hand (Alt. 3) or with the use of low impact equipment over frozen ground (Alt. 2). A study conducted on the Deschutes National Forest showed that skid trails created from harvester forwarder machinery (considered low impact) over frozen ground are not to a degree that would be considered detrimental (Craig and Howes 2007). Likewise, monitoring of units harvested using an “all season vehicle” (ASV – low impact) showed that soil effects were not detrimental (USDA Forest Service 2006). Although some compaction would occur it would be on a flat, bench above Indian Ford Creek and at least 50 ft. away. In addition, mitigations such as driving over slash and designing skid trails parallel to the creek would be implemented to prevent overland flow from reaching Indian Ford Creek (see Project Design Criteria and Mitigation).

Thinning in the wetlands and the Riparian Habitat Conservation Areas surrounding the wetlands would not affect streamflow because if any compaction occurred it would be minimal, non-contiguous, and a far enough distance from Indian Ford Creek to not increase peak flows or reduce low flows. In addition, most of the thinning in the wetlands would be done by hand and would not cause any compaction. Due to the dense conifer encroachment in treatment areas 7 and 8, these wetlands would be treated with low impact equipment over frozen ground. This treatment has proven effective in protecting soils, as mentioned above, and would likely be even more effective in these areas because the dense sedge mat and downed dead vegetation would further reduce ground pressure from the equipment.

Compaction would not increase from haul because only already compacted areas would be used as haul routes. In the long-term, compaction in the project area would be reduced by subsoiling the non-system roads in the old-growth area that were used for haul.

Under the burn piles minimal, non-continuous hydrophobic soils could develop in the short-term (2 to 5 years). There would be more burn piles in Alternative 3 than in Alternative 2 because more wood would be left on-site. This is because equipment would not be used in of Riparian Habitat Conservation Areas in Alternative 3 that could haul it away. Any hydrophobic soils that developed under burn piles would small in size, spread out between piles, and would be far enough from a stream to allow any overland flow to infiltrate before reaching the stream. Piles would be less than 100 ft² in size, as recommended in the Soils Handbook 2500, and would occur at least 100 ft. from the stream channel to mitigate any possible overland flow effects from burn piles (USDA Forest Service, et al. 2006).

Channel and Wetland Condition

Measure: Streams - Alteration of stream bank and bed stability measured by changes in streamflow, sedimentation, riparian vegetation, and large woody debris recruitment.

Measure: Wetlands – Acres compacted within the wetland; acres of riparian vegetation converted to other species or no vegetation

The Action Alternatives would not negatively affect channel condition because no undesirable effects to streamflow, sedimentation, riparian vegetation, and large woody debris recruitment would occur within Riparian Habitat Conservation Areas. Streamflow and sedimentation effects are discussed separately in the Effects section of this report. Riparian vegetation diversity, vigor, and abundance may increase as a result of thinning encroaching small conifers. Although channel bed and banks are currently stable, increasing riparian vegetation would help insure properly functioning channel systems in the future. Channel stability would not be compromised by the proposed activities because only small trees (generally less than 8" diameter) would be felled within 50 ft. of Indian Ford Creek and no trees would be felled within 12 ft. of stream banks to protect the tree root influence area. In addition, large wood recruitment would not be affected because large wood (considered to be 12" diameter at the height of the tree that would reach the stream) would not be harvested within the primary wood recruitment area. In Riparian Habitat Conservation Areas only small trees (generally < 8" diameter) would be removed between 12 ft. -50 ft. from Indian Ford Creek and only trees less than 16" diameter in Alt. 2 and 12" diameter in Alt. 3 would be removed

between 50 ft. – 100 ft.. Because there are no debris slide or landslide prone areas within the project area, the primary wood recruitment areas in the Glaze Forest Restoration project area is approximately 100 ft. on each side of a channel (Benda et al. 2002).

The installation of a 50 ft. long temporary Acrow bridge at the Indian Ford Creek crossing on the 2000-300 road would not reduce riparian vegetation, bank stability, or floodplain habitat. The bridge would be located outside of the bankfull channel, it would be mostly within the existing road footprint, and no live vegetation would be removed to install the bridge. In addition, when the bridge is removed in approximately 5 years, the existing ford would be improved to reduce stream bank erosion. Therefore, the temporary bridge would have no negative effects on channel or wetland condition and actions associated with its removal would have a slight beneficial effect to channel condition.

Thinning in the wetlands and the Riparian Habitat Conservation Area surrounding the wetlands would not negatively affect wetland condition because compaction within the wetlands would not be at a magnitude to affect wetland function (i.e. hydrology or vegetation). Most of the wetlands treated would be done by hand and no compaction would occur. Due to the dense conifer encroachment in treatment areas 7 and 8, these wetlands would be treated with low impact equipment over frozen ground. This treatment has proven effective in protecting soils, as mentioned above, and would likely be even more effective in these areas because the dense sedge mat and downed dead vegetation would further reduce ground pressure from the equipment.

Burning piles and underburning in wetlands (treatment areas 7, 8, 9, 10, 13, 16, 17, 20, & 23) would be monitored to insure that riparian vegetation is not negatively impacted. Piles were burned in treatment area 23 in the 1990s and monitoring showed that these areas recovered and support aspen regeneration without significant noxious weed introduction. In addition, mitigations such as limiting the amount and size of piles would reduce the risk of creating continuous hydrophobic soils in the short-term. Prior to underburning wetlands, small test plots would be conducted to insure that the desired vegetation response is occurring.

Both thinning and burning in and surrounding wetlands would reduce the amount of acres of riparian vegetation or meadow habitat that would be converted to upland species over time. Approximately 260 acres of wetlands could be maintained by reducing conifer encroachment from thinning and burning.

Haul on system roads and temporary roads would not affect streamflow, sedimentation, riparian vegetation, or large wood recruitment. This is because all haul would be on existing roads and would not reduce riparian vegetation or large wood recruitment.

303 (d) Listed Streams / Temperature

Measure: Number of trees felled in the primary shade zone

The Action Alternatives would not affect water temperature because thinning, burning, and the installation of a temporary bridge would not remove the shade component along any stream channels. For the same reason, there would be no effect on the 303(d) listing status of streams listed for exceeding State temperature standards. Only 51 acres of thinning activities would occur within

the Indian Ford Creek Riparian Habitat Conservation Area and it would all be outside the shade producing area (Table H-6). In addition, no changes to channel condition are predicted; therefore, morphological channel changes which could affect stream temperature would not occur.

Guidance, set forth by the Region with the support of Oregon Department of Environmental Quality would be followed to insure that trees within the primary shade producing zone along Indian Ford Creek would remain (USDA Forest Service and BLM 2005). The concepts and models used in the temperature strategy for the Northwest Forest Plan area would be applicable to the Glaze Forest Restoration Project area. The temperature strategy, put forth by the Region, defines the width of the primary shade zone based on tree height, distances from the stream, and slope. In Riparian Habitat Conservation Areas only small trees (height varies based on distance from stream – see Riparian Habitat Conservation Area Design Criteria and Mitigation Measures) would be removed between 12 ft. -50 ft. from Indian Ford Creek. No trees would be felled within 12 ft. of Indian Ford Creek.

The installation of an Acrow bridge at the 2000-300 road crossing of Indian Ford Creek would not impact shade because the bridge would mostly impact the existing road footprint. The bridge may be slightly wider than the existing footprint at the footers and wing-walls but field reconnaissance showed that no shade producing vegetation would be impacted. During the life-span of the bridge at the site, shade would be increased at the ford, but would return to pre-project conditions once the bridge is removed.

Treatments within the Riparian Habitat Conservation Areas of intermittent streams and wetlands would not affect stream temperature because shade is not the limiting factor on these systems. Intermittent streams in the project area do not contribute to high temperatures because they are dry during the hottest period of the year. In addition, temperature in the wetlands within the project area is a result of groundwater storage and not shade.

Sedimentation

Measure: Acres of soil detrimentally impacted in Riparian Habitat Conservation Areas

Sedimentation in Indian Ford Creek from activities associated with the Action Alternatives would be negligible because minimal detrimental soil acres would occur in Riparian Habitat Conservation Areas and haul road effects would be mitigated.

Throughout much of the project area Indian Ford Creek is buffered by wetlands. No ground-based machinery would be allowed in wetlands surrounding Indian Ford Creek in the Action Alternatives; however, approximately 51 acres would be thinned and potentially 40 acres mowed, underburned and/or hand piled and burned in the Riparian Habitat Conservation Areas adjacent to the single-thread reach of Indian Ford Creek (approx. 1.2 miles) under both Action Alternatives (Table 6). Under Alternative 2, low impact ground-based equipment may be used over frozen ground in the outer portion (at least 50 ft. from Indian Ford Creek) of the Riparian Habitat Conservation Areas of Indian Ford Creek on approximately 40 acres. Hand thinning would be utilized within the 11 acres between 12 ft. and 50 ft. from Indian Ford Creek. Under Alternative 3, no ground-based equipment would be used within 300 ft. of each side of Indian Ford Creek and all thinning in the Indian Ford Riparian Habitat Conservation Areas would be done by hand. As a result, less trees may get thinned under Alternative 3 in order to keep burn piles under the required sizes and spacing.

Although minimal disturbance and compaction could occur in the Riparian Habitat Conservation Areas from low impact ground based equipment, it would not be to the magnitude, extent, or duration to cause sedimentation in Indian Ford Creek. The allowable impacts of equipment that could be used for thinning are described in the Soils Design Criteria Section of this report. Monitoring of soil effects on the Sisters Ranger District of the Deschutes National Forest, showed that low impact equipment did not cause much soil disturbance and that it was not to a degree that would be considered detrimental within the same soil types as those in the Glaze Project area (Craig and Howes 2005; USDA Forest Service 2006). In addition, soil disturbance in the Glaze Forest Restoration Project area would be unlikely to reach Indian Ford Creek because of project design elements and mitigations (see Project Design Criteria and Mitigation Measures for Riparian Habitat Conservation Areas). For example, if any soil disturbance occurred in the Indian Ford Riparian Habitat Conservation Area it would be on flat bench above the creek, on an equipment trail parallel to the creek, at least 50 ft. away from the creek, and it would be covered by slash.

The soils report predicted that under Alternative 2 approximately 53 acres of soil would be detrimentally impacted (including compaction) across the entire project area and it would be concentrated at trails and landings. Very little of this disturbance would occur within Riparian Habitat Conservation Areas because landings would occur outside of the Riparian Habitat Conservation Areas. Thinning with low-impact equipment would only occur along approximately 1.2 miles of Indian Ford Creek Riparian Habitat Conservation Area (approx. 40 ac) over frozen ground under Alternative 2 (Table 6). Soils would not be exposed long because slash would be piled on the trails as the trees are being cut. Slash on the trail would reduce raindrop impact, compaction from equipment, and overland flow potential. In addition, working over frozen ground would reduce compaction and soil disturbance.

Other fuels treatments in the Riparian Habitat Conservation Area of Indian Ford Creek include hand thinning, mowing of brush, underburning, and pile burning. Mowing of brush would potentially occur on 40 acres in Alt. 2 and would only be allowed on frozen ground and on the flat bench above Indian Ford Creek and at least 50 ft. away from the creek. No mowing would occur under Alt. 3. Hand thinning would occur at least 12 ft. away from Indian Ford Creek in both action alternatives and would not increase sedimentation to the creek. Hand thinned trees would be piled and burned and piles would be located at least 100 ft. away from Indian Ford Creek. Sedimentation effects from pile burning and underburning would be negligible because the size, extent and location of the burn areas would be limited by project design measures (see Project Design Criteria and Mitigation Measures for Riparian Habitat Conservation Areas).

Soil effects from low impact ground-based equipment (including mowing), underburning, and/or pile burning within the Riparian Habitat Conservation Area surrounding wetlands and within selected wetlands (treatment areas 7, 8, 16, 17, 20 and 23) is not expected to cause sedimentation in Indian Ford Creek or to create excessive sedimentation in the wetlands. Approximately 241 acres of Riparian Habitat Conservation Areas surrounding wetlands would be thinned with low impact equipment and 73 acres within selected portions of wetlands (treatment areas 7 and 8) would be thinned with low impact equipment over frozen ground (Table H-6). As mentioned earlier, soil effects from low impact equipment are not at a magnitude to cause excessive sedimentation in the

wetlands. Wetlands in the project area serve as filtering areas for Indian Ford Creek; therefore, any sediment reaching the wetlands would be captured there and would not reach Indian Ford Creek.

Log haul would not cause sedimentation in Indian Ford Creek because no new roads would be constructed, all temporary roads would be located on existing road surfaces, no haul roads would ford any creeks or perennial waterbodies, and no landings would be constructed in Riparian Habitat Conservation Areas. The only road that could cross a stream or waterbody would be the 2000-300 road crossing of Indian Ford Creek. The 2000-300 road crossing of Indian Ford Creek would only be used if conditions do not exist for safe use of the 1012-335 road and if a temporary bridge was installed across Indian Ford Creek so as to minimize sedimentation from haul.

The installation of the bridge at the 2000-300 road would require crossing Indian Ford Creek approximately 14 times and would result in a short-term (less than 20 minutes per pass) minor increase in stream turbidity. To reduce short-term turbidity all bank disturbance and fill would be outside of the active channel; therefore, no additional fine sediment would be added to the stream and only existing silt from the streambed would be mobilized. In addition, the ford would be improved when the bridge is removed so as to reduce turbidity in the long-term when animals or the occasional administrative vehicle ford it. Improvements would include narrowing the channel to natural channel width at the ford and lining the ford with clean gravel to reduce turbidity. During installation and removal of the bridge, turbidity could increase in the short-term (< 20 minutes per pass) as equipment fords the stream; however, turbidity levels would not exceed the State standard.

Alternatives 2 and 3 – Cumulative Effects

Hydrology effects from the activities proposed in the Glaze Forest Restoration Project would not incrementally add to cumulative effects because no effects to any hydrology parameters are predicted.

The hydrology cumulative effects analysis area for the Glaze Forest Restoration Project is the same as the analysis area used for existing condition and direct and indirect effects because it encompasses the entire Indian Ford drainage area. Cumulative hydrology effects different from natural conditions would continue as a result of past or on-going activities or events such as irrigation diversions, fire suppression, roads in riparian areas, and compaction in riparian areas from past logging and recreation use (i.e. dispersed camping, off-road vehicle use).

Cumulative hydrology effects from past activities would be the same as those discussed in the No Action Alternative. Although activities proposed in the Glaze Forest Restoration Project could occur in areas that have had past activities, the proposed activities are not predicted to cause any hydrology effects (see Effects Analysis). No future foreseeable activities would occur within the Glaze Forest Restoration Project boundary; however, some could occur within the hydrology analysis area. The development of a Welcome Center at Black Butte Ranch is planned near Big Meadow and Indian Ford Creek just west of the project area in the Upper Indian Ford Subwatershed. The development would occur more than 300 feet from Indian Ford Creek, would not remove riparian vegetation, would not impact hydrologically connected wetlands, and storm water would be treated on site.

As a result of the Glaze Forest Restoration Project, the SAFR project, and the Indian Ford Allotment Management Plan renewal, up to 13 percent of the Indian Ford Creek drainage could receive

vegetation removal treatments in the next 5 years. Hydrology effects are not expected from the timber and fuels projects because activities are focused outside of Riparian Reserves or Riparian Habitat Conservation Areas, no new roads are proposed, and harvest would focus on small tree removal (i.e. thinning). Hydrology effects are not expected from the renewal of the Allotment Management Plan because there have been no hydrology effects from the existing grazing permit (Press 2007).

Although, evapotranspiration could be reduced in the watershed by the cutting of trees, it would not be at a magnitude or in a location that would have an effect on streamflow or sedimentation. Likewise, streamflow in these project areas is not highly sensitive to reduction in evapotranspiration due to high infiltration rates, wetland storage, and low annual precipitation. All cutting or harvest of trees would be for stand health and fuels reduction, thereby leaving the majority of trees. Although approximately 26% of the Riparian Habitat Conservation Areas in these subwatersheds would be thinned or grazed (no Riparian Habitat Conservation Area treatments in the Indian Ford subwatersheds are proposed in the SAFR project), increases in surface runoff and sedimentation are unlikely because compaction in areas that would direct the flow to streams would be minimal due to design elements or mitigation measures.

Fire Hazard

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Fire and Fuels Specialist Report for this project (Pitman, J. 2008). Additional information is contained in the full specialist report.

Introduction

Fire is a disturbance process that historically played an important role in shaping the landscape of eastside ponderosa pine forests. After a century of successful fire suppression practices, today portions of the Glaze Forest Restoration Project area contain fuel loads which are moderate, increasing to high, and present a risk of moderate to high wildfire severity. Recent assessments of fire risk for this area and its surroundings are located in the 2006 Greater Sisters Country Community Wildfire Protection Plan <http://www.projectwildfire.org/cwpp.html>. Also, see Community Risk Assessment findings under the values at risk section.

Existing Condition

The ponderosa pine forests in the Sisters area have undergone significant changes over the last 100 years which may not be apparent to the casual forest visitor. Fredrick Colville's 1898 report, "Forest Growth and Sheep Grazing in the Cascade Mountains of Oregon", reveals that forest composition was quite different a century ago. In his description of ponderosa pine forests he says "The individual trees stand well apart and there is plenty of sunshine between them." Colville also recognized the role of fire. "The scant grass and underbrush do not make a destructive burn."

Stands that were once open and park-like are now more densely stocked with small trees, they are more multi-storied, and have far fewer large fire resistant trees in the overstory than in the past. The

Whychus Watershed Analysis (USDA Forest Service 1998) found that historically and even as recently as 1953, 97% of forest acres in ponderosa pine forests in the watershed were dominated by trees over 21" diameter. By 1998 only 9% of forest acres were dominated by large pine. This is because large trees were removed by timber harvest practices and many more small trees have grown in with the exclusion of fire and now dominate forest areas.

The condition of forested land has a direct impact to safety and protection. The dense and multiple forest fuels layers which can be found in parts of the project area increase the probability of high to extreme wildfire behavior, increase the risk of a wildfire spreading faster, increase the difficulty and danger in controlling a wildfire, and increase the danger to the public and firefighters. Not only is there a risk of a fire starting within the project area, there is also a risk of a fire starting on private lands and moving onto adjacent public lands.

At this site, fire exclusion has increased the fire return interval and the expected fire intensities. The specific effects of fire exclusion were described by Agee (1992) as altering the pattern of tree cohorts, or clumped groups of even-aged trees, allowing regeneration to survive not just in openings but under mature clumps. Dog-hair thickets of young trees under older trees create competition for nutrients, stress, and reduce resilience. They also create a continuity of vertical and horizontal fuels allowing surface fires to develop into mid-level or crown fires under less severe weather conditions. At the same time that average fire intensity, due to fuel buildup, is increasing, so that the average fire tolerance of stands has dramatically decreased.

The existing air quality within the Glaze Forest Restoration Project and Black Butte Ranch area is generally excellent with some local emission sources and fairly consistent wind dispersion. Existing sources of emissions in the area include occasional construction equipment, vehicles, road dust, residential wood burning, wood fires, and smoke from thinning slash disposal and prescribed landscape underburning.

Fire Regime & Condition Class

The role fire would play across a landscape in the absence of human intervention is called a "fire regime". There are five natural fire regimes which are classified based on the average number of years between fires (fire frequency or Mean Fire Interval (MFI)) combined with the severity of the fire (the amount of vegetation replacement) and its effect on the dominant overstory vegetation. Table F-1 gives a description of how each of the five regimes is determined. The five regimes often do not describe a specific stand or ecosystem but provides a broad overview in which management decisions can be made.

Table F-1: Five natural fire regimes used by the Forest Service. Developed by Hardy and others (2001) and Schmidt and others (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001).

Regime	Description
1	0 - 35 year frequency and low severity (most commonly associated with surface fires) to mixed severity (in which less than 75% of the dominant overstory vegetation is replaced)
2	0 - 35 year frequency and high severity (stand replacement: greater than 75 percent of the dominant overstory vegetation is replaced)
3	36 - 200+ year frequency and mixed severity
4	36 - 200+ year frequency and high severity
5	200+ year frequency and high severity

A combination of Fire Regime and Condition Classes (FRCC) measure the degree of departure from reference conditions, possibly resulting in changes to key ecosystem components, such as vegetation characteristics (species composition, structural stage, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances, such as insect and disease mortality, grazing, and drought (Schmidt and others 2002).

Table F- 2 illustrates how fire condition classes are classified and how specific trends are identified.

Fire Regime	Description	Potential Risks
Condition Class		
Condition Class 1	Within the historic range of variability (pre-European settlement about 1600-1900) of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.	<p>Fire behavior, effects, and other associated disturbances are similar to those that occurred prior to fire exclusion (suppression) and other types of management that do not mimic the natural fire regime and associated vegetation and fuel characteristics.</p> <p>Composition and structure of vegetation and fuels are similar to the natural (historical) regime.</p> <p>Risk of loss of key ecosystem components (e.g. native species, large trees, and soil) are low</p>
Condition Class 2	Moderate departure from the the historic range of variability (pre-European settlement about 1600-1900) of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.	<p>Fire behavior, effects, and other associated disturbances are moderately departed (more or less severe).</p> <p>Composition and structure of vegetation and fuel are moderately altered.</p> <p>Uncharacteristic conditions range from low to moderate;</p> <p>Risk of loss of key ecosystem components are moderate</p>

Condition Class 3	<p>High departure from the historic range of variability (pre-European settlement about 1600-1900) of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.</p>	<p>Fire behavior, effects, and other associated disturbances are highly departed (more or less severe).</p> <p>Composition and structure of vegetation and fuel are highly altered.</p> <p>Uncharacteristic conditions range from moderate to high.</p> <p>Risk of loss of key ecosystem components are high</p>
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In Table F-2 the condition class description relates directly to fire intensities which can be analyzed using standard fuel models and are described in the effects analysis of this document. Condition Class 1 describes a condition which will support a surface fire with flame lengths 4 feet and less. Condition Class 2 describes a condition which will support a surface fire > than 4 feet, with some torching and possible crowning. Condition Class 3 will support a surface fire > than 4 feet, torching, crowning, and stand replacing wildfire conditions.

Fire Regime & Condition Class in the Project Area

The predominant Fire Regime in the project area is Fire Regime 1 which is characterized by high frequency, low severity fires. The meadows are Fire Regime 2, a high frequency and high severity regime which is relatively rare on the Sisters Ranger District because grasslands are rare. Structural data alone places the ponderosa pine stands in the area in Condition Class 2 and places the riparian areas in a Condition Class 3. When missed fire cycles and changes in current fire severity are added, the Fire Regime Condition Class across the entire project area increases to 3.

The area has missed approximately five to nine natural fire cycles. These missed fire cycles create a build-up of forest fuels that can support moderate to high severity fire behavior if an unplanned ignition were to occur.

Natural fuel reduction treatments have been implemented within and adjacent to the project area to change condition class in ponderosa pine stands adjacent to the wildland urban interface communities and to reduce the risks from wildfire. Projects implemented around Black Butte Ranch include the 3,600 acre, 1996 Black Butte Ranch Fuels Reduction Project and the 9,300 acre, 1997 Highway 20 Project. Portions of the Black Butte Ranch Fuels Reduction Project are within the Glaze Forest Restoration Project boundary. Both projects included small tree thinning, shrub mowing (mastication), and controlled burning and are near completion and scheduled for maintenance underburn cycles.

Past Fire History

Fire history may be established from fire scars and age-class evidence on trees, from plants that appear to have germinated after fire, in past fire reports from initial attack operations and from charcoal found in the surface soil. Preliminary analysis of fire scars on several old tree stumps in the project area indicated that historically fires burned through the area on an average of every 12 years. This is consistent with other studies (USDA Forest Service, 1998 Whychus Watershed Analysis,). Two stumps showed 6-9 separate fire scars at intervals of 11.25- 13 years apart (Waltz. A. 2007 Memo). Initial attack fire reports from 1980 – 2007 show that 75% of recent fires within the project area boundary were human caused (Table F-3).

Table F-3: Fire history and occurrence in the project area.

YEAR	CAUSE	ACRES
1980	Lightning	0.1
1985	Human	0.1
1985	Human	0.1
1988	Human	0.4
1989	Human	0.1
1992	Human	0.1
1993	Human	0.1
1994	Human	0.1
1995	Human	0.1
1998	Lightning	0.1
2006	Lightning	0.1
2007	Human	9

Six large wildfires have threatened Black Butte Ranch and other nearby communities in the past 5 years. Approximately 2 miles west of the western edge of the Glaze project boundary, fire scars from the 2002 3,800 acre Cache Mountain Fire are still evident. This fire was lightning caused and consumed two homes within Black Butte Ranch. More recently, fresh fire scars are visible from the 2007 7,400 acre GW Fire. Both incidents required evacuation of the Black Butte Ranch community. Other significant wildfires that have threatened the Black Butte Ranch community in the past five years include: the 2003 3,600 acre Link Fire, the 2003 90,000 acre B&B Complex Fire, the 2006 9,400 acre Black Crater fire, and the 2007 5,500 acre Lake George Fire.

Fire Risk and Values at Risk

Wildfire risk in the area has been rated as moderate to high by modeling done under this analysis, community fire protection plan development and analysis, and professional judgment.

The Greater Sisters Country Community Wildfire Protection Plan Risk Assessment found that in general, all of the lands within the Sisters area and outlying communities were classified as having medium-high to extreme risk based on fire ignition rates between 1994 and 2003. Black Butte Ranch, west of the project area was rated as a high risk and Tollgate east of the project was rated as extreme. The western and southern perimeter of Black Butte Ranch has areas of both high and extreme hazard.

Values at risk identified in the Greater Sisters Country Community Wildfire Protection Plan include residences and businesses within the communities at risk as well as ecological, cultural, and recreational values on National Forest lands. The Fire Protection District within the plan boundary protects 14 identified at risk communities with the exception of the northern portion of Whychus Creek Canyon Estates. A wildfire which starts in the project area could spread and threaten these communities.

Values at risk in the project area identified by the Forest Service include public and fire fighter safety, property and developments, riparian areas associated with Indian Ford Creek, and important rare old growth forests including both species and habitat.

A combination of risk, hazard, values protected, structural vulnerability, and protection capability were used to calculate a risk assessment score for the 14 communities in the Greater Sisters analysis area (Table F-4). Scores over 170 are considered extreme risk. These results illustrate the importance of focusing efforts to reduce hazardous fuels in and around communities at risk.

Table F-4: Calculated risk assessment score based on Greater Sisters Country Community Wildfire Protection Plan analysis.

Community	Average Score	Risk Assessment
Tollgate	193	Extreme
Crossroads	191	Extreme
Panoramic View Estates	187	Extreme
Camp Sherman	183	Extreme
Sage Meadow	179	Extreme
Sisters Area	178	Extreme
Indian Ford Meadows	172	Extreme
Whychus Creek Canyon Estates	169	High
Black Butte	168	High
Cascade Meadows	154	High
Forked Horn Estates	137	High
Suttle Lake	133	Medium-High
Plainview Estates and Area	132	Medium-High
Aspen Lakes	116	Medium-High

Fuels Modification for Fire Hazard Reduction

The silvicultural prescriptions and fuels reduction treatments proposed for the Glaze Forest Restoration Project follow scientifically based principles of vegetation/ fuels modification designed to reduce fire behavior (Arno and Fiedler, 2005; Finney and Cohen, 2003; Mason and others 2006) These principles of fire resistant forests are summarized from Brown et.al.(2004) in Table F-5. The project has been designed to incorporate the objectives below.

Table F-5: Principles of fire-resilient forests (Brown, et. al. 2004)

Objective	Effect	Advantage	Concerns
Reduce surface fuels	Reduces potential flame length	Fire control easier, less torching	Surface disturbance less with fire than other techniques
Increase canopy base height	Requires longer flame length to begin torching	Less torching	Opens understory, may allow surface wind to increase
Decrease crown density	Makes independent crown fire less probable	Reduces crown fire potential	Surface wind may increase, surface fuels may be drier
Increase proportion of fire-resistant trees	Thicker bark, taller crowns, higher canopy base height	Increases survivability of trees	Removing smaller trees is economically less profitable

There are several examples on the Sisters Ranger District where fire hazards were identified and treated achieving the objectives described in Table F-5. These treatments subsequently proved effective during wildfire events by reducing the intensity of fire behavior, allowing fire fighters to light backfires or burn out to slow fire spread, and reduced impacts to natural resources.

The most notable examples of effective fuels treatments modifying wildfire behavior are associated with the 2002 Cache Mountain Fire and the 2007 GW Fire. Thinning, underburning and reduction of ladder fuels adjacent to the forest-urban interface boundary worked to modify fire behavior. Both wildfires approached the Black Butte Ranch community from the west, burning through stands of second growth ponderosa pine with abundant ground fuels. Fire behavior was extreme with active crowning and long range spotting. When the fire reached the treated areas it dropped out of the crowns to the ground, allowing fire fighters to safely construct control lines and protect the adjacent community. Unfortunately during the Cache Mtn. Fire two private homes were lost due to fire brands which ignited wood shake shingle roofs and wood decks with pine needle accumulations.

A third local example was the B&B fire during the summer of 2003. Fire fighters were able to safely light backfires and burn out to reduce fuels in front of the main wildfire along Road 12 in the Metolius basin. This was possible because crown densities had been reduced, canopy base heights had increased and the ground fuels had been treated. This prevented the fires easterly from spreading west into Camp Sherman. Structures around Camp Tamarack, Camp Davidson and nearby summer camps were also protected by backfiring and burn out in treated forest stands.

Environmental Consequences

Important Interactions

A goal of the project is to restore dry ponderosa pine forests and other vegetation types in the area utilizing treatments that support the fire regime and condition class guidelines and reduce the risk of wildfire to nearby communities. Strategically placed treatments can reduce high fire behavior potential, help to facilitate the suppression of wildfires, protect valuable resources, and allow the reintroduction of fire as a natural disturbance process.

Both natural and human caused fires will continue to occur on the landscape. The goal of forest fuels management treatments is not to preserve and eliminate the process of disturbance caused by fire but to increase the resilience of forest ecosystems to fire.

The desired structure of treated stands is a forest canopy that does not sustain a crown fire under high to extreme fire danger conditions. Aspects of this structure include reductions in: 1) canopy bulk density (the mass of available canopy fuel per canopy volume unit) and 2) fuel continuity (the horizontal and vertical spacing of fuels). Vegetation such as shrubs would be maintained at a height that would reduce the potential for spread of fire into the crowns of trees. In order to reduce the risk of crown fires it is recommended that trees within stands need to have live crowns that are several feet above the shrub canopy. By increasing the scale of treatments on forested lands it can reduce risk of high intensity wildfire, restore, and conserve fire prone forests for future generations.

General Assumptions

Environmental effects are based on the following assumptions:

- The earth has entered an era of rapid environmental change and global warming that present unknown challenges (Millar and others 2007).
- Lightning will remain a source of potential ignitions.
- Population growth and increased use of National Forest lands will result in the potential of more human caused fires.
- An increase in average tree diameter of the stand reduces fire severity. Larger trees have thicker bark and are more resistant to flame scorch from surface fuels. The more acres thinned, the greater the average diameter of remaining trees.
- Silvicultural treatments will shift stand composition towards more fire resistant species.
- Treatments of surface fuels generated from silvicultural treatments will prevent an increase in fire severity. Activity fuels treatments will follow all thinning treatments.
- Treatment of natural surface fuels will reduce fire severity.

Analysis Measure

Issue: Improve forest health, sustainability, and resiliency and promote the development of old growth forest stands and large trees by reducing the uncharacteristically high levels of competing live vegetation and reintroducing the more natural role of low intensity ground fire.

MEASURE: The number of acres moved from high intensity wildfire fuel conditions to moderate or low intensity wildfire fuel conditions.

Background on Modeling

Wildfire susceptibility is defined and discussed in terms of the hazard and the risk of a wildfire as it relates to fuel types and arrangements. Hazard relates to the availability of fuels to sustain the fire and the amount of loading, arrangement and continuity of fuels through the area. The changes that occur in the loading, arrangement or continuity of the fuels change the predicted fire behavior and associated fire effects. The risk of fire occurrences relates to the probability that an ignition could occur under conditions that will result in a wildfire. These changes are modeled in the effects analysis using Fuel Models and calculated through a program called BEHAVE (Andrews et. al 2005).

Fuel Models are a scientific way to assess forest fuel loadings and potential fire behavior. The prediction of fire behavior has become more valuable for controlling fire and for assessing potential fire damage to resources. Each fuel model is described by the fuel load and the ratio of surface area to volume for each size class. In the effects analysis, 1-hour fuel moisture content is used as an input to represent grass and needle fuels as they are the number one carrier of fire with more surface area to volume ratio. Fuel load and depth are significant fuel properties for predicting whether a fire will be ignited, its rate of spread and its intensity.

The collections of fuel properties that have become known as fuel models can be organized into four groups: grasses, shrub, timber, and slash models.

The 13 Fuel Models (FM) include:

- FM's 1-3 represent grass fuels
- FM's 4-7 represent shrub fuels
- FM's 8-10 represent timber fuels
- FM's 11-13 represent slash fuels

Three of these fuel models out of 13 are used in this effects analysis (FM 6, 9, and 10).

A quantitative basis for rating fire danger and predicting fire behavior became possible with the development of mathematical fire behavior models using Rothermels spread model in a program called BEHAVE. The mathematical models require descriptions of fuel properties as inputs to calculations of fire danger indices or fire behavior potential.

Project effects are analyzed using BEHAVE. Fire intensities likely to be encountered at the fireline are modeled in rates of spread, flame length and scorch height in relation to 1-hour fuel moistures. The fire behavior estimations are for the peak period of the fire season when wildfires pose greater control problems for fire fighters and its impact to land resources.

Modeling Constraints and Limitations

Constraints of BEHAVE, are that it can only model two separate fuel models at once. There is uncertainty with all modeling exercises, the results are best used to compare the relative effects of the alternatives, rather than as an indicator of absolute effects.

Alternative 1 (No Action) – Ecological Trends

Under this alternative current management strategies would continue. Trees would be removed if they restricted motorized travel along open or administrative use forest roads. Fuels would follow the current trend of a condition class 3, with more ladder fuels and result in continuous canopy cover. Fires would continue to be suppressed as long as firefighter safety is not compromised. The ability to hold a wildfire outside of private land would continue to be difficult and escape routes for local residents would be marginal. Fire regime condition classes would continue to depart from their natural regime, and species composition would change over time. Goals and desired conditions mentioned in the Greater Sisters Country Community Wildfire Protection Plan would not be achieved.

Past forest fuels treatments such as small tree thinning, slash pile burning, and prescribed underburning have reduced fuels in some areas but condition class would continue to deviate from historic levels and stands would remain at higher fire risk from large fire events.

Meadows will continue to be invaded by small trees in the absence of fire and be reduced in size. Riparian plants such as willow and aspen which require bare mineral soil to regenerate will continue to decline.

BEHAVE modeling evaluated the forest with and without a shrub fuel model since both conditions can be found within the project area. The project area was represented by two timber fuel models (FM 10 & FM 9). Areas where bitterbrush shrub exist in connection with the timber crown base were represented by FM 10 & FM 6.

Interpretation of BEHAVE Modeling of the existing forest without a shrub layer

- 1) Rate of Fire Spread - With typical summer fuel moistures a wildfire would spread between 6.6 to 8.4 mph with as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) fire would spread from 22.5 to 29.9 mph.
- 2) Fire Flame Length – With typical summer fuels moistures wildfire flame lengths would be between 4.5 to 5.4 feet with as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) flame lengths would increase to 7.9 to 9.4 feet.
- 3) Fire Scorch Height – With typical summer fuel moistures, scorch heights would be between 30 to 41 feet in as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) scorch heights would increase to 46 to 68 feet.

These results indicate a high risk of torching and crown fire initiation where crown base heights are at 30 ft. or less. Projected flame lengths combined with projected rates of spread would not be conducive to hand crew suppression efforts if wind speeds are > than 7 mph. The type of fire behavior would require mechanized equipment and aerial support to achieve fire containment and control.

Interpretation of BEHAVE Modeling of the existing forest with a shrub understory

- 1) Rate of Fire Spread - With typical summer fuel moistures a wildfire would spread between 10.9 to 14.9 mph with as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) fire would spread from 36.1 to 49.5 mph.
- 2) Fire Flame Length – With typical summer fuels moistures wildfire flame lengths would be between 4.6 to 6.1 feet with as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) flame lengths would increase to 7.9 to 10.5 feet.
- 3) Fire Scorch Height – With typical summer fuel moistures, scorch heights would be between 31 to 50 feet in as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) scorch heights would increase to 47 to 85 feet.

These results indicate an extreme risk of torching and crown fire initiation where crown base heights are at 30 ft. or less. Projected flame lengths combined with projected rates of spread would not be conducive to hand crew suppression efforts if wind speeds are > than 5 mph. This type of fire behavior would require mechanized equipment and aerial support to achieve fire containment and control.

Conclusion For Alternative 1 – Modeling indicates a high potential for crown fire initiation on 1193 acres of the project area if no action is taken. Fuels would follow the current trend of a condition class 3, with more ladder fuels and result in continuous canopy cover. Fire regime condition classes would continue to depart from their natural regime, and species composition would

change over time. Current forest fuel conditions are moderate to high intensity and indicate there is an elevated wildfire risk to forests and riparian area in the project areas as well as to adjacent communities such as Black Butte Ranch to the west and Tollgate and other communities to the east and southeast. The goals and desired conditions in the Greater Sisters Country Community Wildfire Protection Plan would not be achieved.

Alternative 2 (Proposed Action) – Direct and Indirect Effects

This alternative will thin concentrations of small and medium diameter trees to decrease the connection from the younger trees crown base height to the older trees crown base height. This space between tree crowns will decrease torching and crowning as well as increase growing space for the larger diameter trees. Low canopy base heights are the primary contributors to torching and crown fire initiation.

Post thinning and slash biomass removal and prescribed underburning will further reduce fuels to decrease rate of spread, flame length and duff mound build up and reduce high intensity fire behavior to lower intensities, more typical under a Condition Class 1.

Thinning treatments reduce canopy cover and may result: in increased wind speeds, higher temperatures, and lower humidities for a given time and place compared to no action. This lowers fine fuel moisture, which is the amount of moisture in grasses and pine needles. Lowering fine fuel moisture will facilitate the spread of low-intensity surface fire, such as a prescribed fire, and will help maintain low levels of surface fuels and ladder fuels and decrease the probability of crown fire.

Mowing shrub concentrations around the base of desirable trees where needed will decrease the forest floor fuel connection to the crowns by reducing small trees and brush (fine ladder fuels). By reducing ladder fuels, mowing facilitates the reintroduction of prescribed fire and mitigates the effects of smoke on air quality during prescribed fires. By reducing shrubs mowing will also temporarily reduce wildlife hiding cover and browse quality, however, regenerating shrubs will be more vigorous and palatable. Mowing leaves behind ground organic mulch and generally produces little visual impacts.

Riparian treatments under this alternative around Indian Ford Creek would allow removal of trees with equipment over frozen ground more than 50 feet from the creek. Removal of larger wood would reduce fuels in the stream corridor and facilitate the use of prescribed fire. Fuels reduction along the creek, along with thinning in other Riparian Habitat Conservation Areas, the removal of conifers in aspen groves and meadows, will promote regeneration of fire dependent species such as riparian aspen and willows and reduce the potential for damage from higher intensity wildfire.

Prescribed burning would remove primarily fine fuels (< 3 inches in diameter) and with varied prescription conditions will create a mosaic of effects. This reintroduction of fire would reduce competition for nutrients and water by killing some undergrowth and will increase short term nutrient cycling. Prescribed fire will result in a charred appearance of lower tree boles and shrub skeletons for 1 to 3 years post burning. Scorch heights will result in a red or brown color to the lower limbs and needles of remaining trees, these effects will gradually disappear within a 1 to 3 year period. If prescribed fire is designed to thin or kill small trees, the area would have pockets of

dead residual trees. Prescribed burning would allow bare soils to promote the regeneration of some species that have evolved in a fire-dependent ecosystem.

Interpretation of BEHAVE Modeling of a thinned forest without a shrub layer

- 1) Rate of Fire Spread - With typical summer fuel moistures a wildfire would spread between 4.9 to 7.5 mph with as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) fire would spread from 21.1 to 32.6 mph.
- 2) Fire Flame Length – With typical summer fuels moistures wildfire flame lengths would be between 2.1 to 2.9 feet with as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) flame lengths would increase to 4.2 to 5.7 feet.
- 3) Fire Scorch Height – With typical summer fuel moistures, scorch heights would be between 7 to 13 feet in as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) scorch heights would increase to 11 to 22 feet.

These results indicate a low risk of torching and crown fire initiation where crown base heights are at 30 ft. or less. Projected flame lengths combined with projected rates of spread are conducive to hand crew suppression efforts if wind speeds are < than 10 mph. This type of fire behavior would not necessarily require mechanized equipment and aerial support to achieve fire containment and control.

Cumulative Effects for Alternative 2

This cumulative effects analysis considers the past, present and reasonably foreseeable future actions of vegetation management to the fire regime and condition class of the Indian Ford subwatershed. Past, present, and future foreseeable actions and their effects include logging and forest fuel treatments that have occurred since fire suppression policy began during the early 1900's to about ten years in the future. Reasonably foreseeable future actions includes the Sisters Area Fuels Reduction (SAFR) project which is in the planning stage. The SAFR Project is a 17,500 acre thinning and fuels reduction project located near the southern boundary of the Glaze Project area.

Past actions including fire exclusion and timber harvest that have moved conditions away from historic more resilient fire regime as discussed earlier in this report. The removal of large fire resistant trees dramatically changed forest structure from more open fire resilient forests to those dominated by smaller, less fire resistant trees. This trend, as it relates to wildfire behavior has led to forests throughout the subwatershed changing from a frequent, low severity fire regime to an atypical less frequent, moderate to high severity fire regime.

Recent fuels reduction projects have helped reduce small trees and brush, reintroduce the natural role of fire, and break up the connectivity of fuels across the landscape. Projects such as the 3,600 acre, 1996 Black Butte Ranch Fuels Reduction Project and the 9,300 acre, 1997 Highway 20 Project concentrated on reducing the risk of high intensity wildfire in the subwatershed and providing fuel breaks round roads and subdivisions. Both projects consisted of treatments such as small tree thinning, shrub mowing, and controlled burning. Black Butte Ranch has also worked for the last decade to reduce fuels around homes and common areas. Reasonably foreseeable future actions such as the SAFR project, and maintenance underburn cycles in the Highway 20 and Black Butte

Ranch Fuels Reduction Project area in conjunction with this project are designed to reverse the trends of past actions that have led the Indian Ford sub-watershed away from a more resilient and natural fire regime.

There is uncertainty about what will occur with climate changes in the future. One scenario may be that fires seasons start earlier and last longer. Modeled parameters would likely not change for extreme fire hazard conditions.

Approximately 45-50% of the Indian Ford subwatershed has been treated to reduce fuels in the past decade. This project will treat an additional 4 % of the subwatershed in an area where many unplanned ignitions occur. This will cumulatively reduce high intensity fuels conditions. This is a beneficial cumulative effect because high intensity fuels conditions can cause undesirable property and resource damage in a wildfire event.

Conclusion for Alternative 2- Modeling and professional judgment indicate that 874 treated acres would be moved from high intensity wildfire fuel conditions to low intensity wildfire fuels conditions under Alternative 2. Riparian areas, meadows, and aspen areas totaling 551 acres would move from a high to moderate fuels conditions. Alternative 2 will best modify the forest fuel profile because it will allow for more thinning in old growth forest areas and more riparian treatment which will significantly reduce torching and crowning within the project area, it will reduce the risk of sustaining a crown fire if one is initiated outside the project area. This alternative will result in a trend toward Condition Class 1, however to reach Condition Class 1 it will require a series of maintenance underburns at 3-12 year intervals. There are no anticipated negative cumulative effects, but rather beneficial effects when considered with other landscape treatments to reduce the forest fuel loads and intensity of wildfire in the subwatershed. This alternative best meets the goals and desired conditions in the Greater Sisters Country Community Wildfire Protection Plan.

Alternative 3 - Direct and Indirect Effects

This alternative treats second growth pine in the same manner as in Alternative 2. Aspen and meadows would also be treated as in Alternative 2. However, Old Growth ponderosa pine stands would be thinned up to only 6" diameter.

Riparian treatments under this alternative would allow hand-thinning of trees from 12 to 300 feet from the stream. Removal of larger wood could be considered over frozen ground to protect vegetation and soil with very low impact methods such as line pulling, ATV plus arch skidding, or limited use of All Service Vehicle grappling. Prescribed burning is allowed outside of the 12 foot no treatment zone but no construction of fireline is allowed. Existing trails, roads, or wet line would be used to contain prescribed fire operations. Mowing of shrubs would be allowed between 300 feet from Indian Ford Creek.

Fuels conditions in second growth areas would be reduced to low intensity as in Alternative 2. Effects would be similar to those described above. However, in old growth areas where only 6" diameter trees are removed, fuels conditions would remain at higher intensities. This is because canopy base heights are primary contributors to torching and crown fire initiation and smaller trees have lower canopy base heights. The above modeling shows that with typical summer fuels

moistures wildfire flame lengths would be between 2.1 to 2.9 feet with as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) flame lengths would increase to 4.2 to 5.7 feet. With typical summer fuel moistures, scorch heights would be between 7 to 13 feet in as little as a 4 mph wind. With higher afternoon winds, typically 10 mph (with higher gusts) scorch heights would increase to 11 to 22 feet. This type of fire behavior could easily engulf small trees 8" diameter and larger and carry fire into the tree canopies. Riparian areas would receive less treatment than in Alternative 2 because fuels cannot be easily removed by hand and thus fuels conditions would remain at higher intensities.

Cumulative Effects for Alternative 3

The cumulative effects of Alternative 3 are similar to those discussed above under Alternative 2. However because there is less intensive thinning in old growth and riparian areas, the fuels condition will remain at higher intensity on approximately 458 acres of old growth forests and moderately higher on 551 acres of riparian areas. The uncertainty regarding climate changes is similar to that discussed in Alternative 2.

This alternative would continue to cumulatively reduce fuels in the subwatershed and this is a beneficial cumulative effect because high intensity wildfire fuels conditions can lead to undesirable property and resource damage. However about half the project area would remain at higher intensity fuels conditions than under Alternative 2. This leaves sensitive riparian areas and rare old growth stands at high to moderate risk (Table F-6).

Conclusion for Alternative 3 - Modeling and professional judgment indicate that Alternative 3 will be less effective in reducing fire intensities in old growth stands and riparian areas and will have similar effects in second growth stands as Alternative 2. Second growth areas would move toward Condition Class 1, however to reach Condition Class 1 they will require a series of maintenance underburns at 3-12 year intervals. Old growth areas totaling 458 acres would remain in high intensity wildfire fuel conditions and remain in Condition Class 2. Riparian areas, meadows, and aspen areas totaling 551 acres would move from a high to moderate intensity wildfire fuel conditions. The amount of acres effectively moved from high to low intensity wildfire fuel conditions would be 416 acres. The ladder fuels that contribute to torching and crowning fire behavior will not be decreased at a level conducive to old pine restoration and sustainability as described for achieving a more natural fire regime. There are no anticipated negative cumulative effects, but less beneficial effects when considered with other landscape treatments to reduce fire intensity in the subwatershed. This alternative meets the goals and desired conditions in the Greater Sisters Country Community Wildfire Protection Plan on about half the project area.

Summary of Effects to Wildfire Fuel Conditions - Analysis Measure

Table F-6: Project area acres classified by wildfire fuel conditions and expected fire intensity

Fire Behavior	Alternative 1	Alternative 2	Alternative 3
Rates of spread Flame Lengths Scorch Heights	No action (existing condition)	Thin up to 21" diameter	Thin up to 6" diameter in Old growth Thin up to 21" diameter in Second growth More limited in riparian
LOW		458 Acres- Old growth 416 Acres- 2nd growth	416 Acres- 2 nd growth
MODERATE		551 acres of aspen/meadows /riparian areas around Indian Ford Creek	551 acres of aspen/meadows/ riparian areas around Indian Ford Creek
HIGH	1192 Acres		458 Acres- Old Growth

NOTE Acres exceed 1192 because riparian areas overlap forest areas.

Other Effects

Air Quality- Clean Air Act

Alternative 1 (No Action) – Ecological Trends

Without fuels reduction treatments wildfires will eventually burn in the project area. Negative effects on air quality resulting from a wildfire are expected to be far greater than that from prescribed burning. Analysis of potential air quality impacts in Oregon, Washington and Idaho has found that wildfire impacts would be significantly greater in magnitude than prescribed burning impacts over the same area. This analysis concluded that wildfires reduced visibility substantially more than prescribed burning. This was due to wildfires typically consuming more forest fuel per acre burned than prescribed fire. Analysis also concluded that predicted concentrations or particulate matter from prescribed fires would be substantially lower than that from wildfires due to: 1) higher fuel moisture levels during management ignited prescribed fire, 2) better smoke dispersion conditions existed during prescribed fires in the spring and fall, than typical conditions during summer wildfires, and 3) prescribed fires are dispersed across the landscape spatially and temporally, rather than concentrated in a few locations. The Sisters area does not have site specific smoke receptor data to analyze currently.

Drift smoke from a wildfire could affect recreationists and the adjacent community of Black Butte Ranch and other Sisters communities by reducing visibility and views of the surrounding forest and

mountains. Visibility could be reduced from the normal 20+ miles to less than 3 to 5 miles. This impact could last weeks or months during wildfire season (typically June thru September).

Alternative 2 and 3 - Direct and Indirect Effects

Prescribed fire would be conducted in compliance with National Ambient Air Quality Standards and under the Oregon Smoke Management Plan regulations and restrictions to track smoke produced and monitor emissions. There is a need to meet standards for air quality in adjacent Class 1 Airsheds, which includes all wilderness. Burning would only be conducted when prevailing and predicted wind patterns would result in negligible effects to the Sisters area and the Three Sisters Wilderness Class 1 Airshed. Since prevailing winds within the project area are out of the west and away from the wilderness, prescribed burning is not expected to result in an incursion in the Class 1 Airshed more than 5% of the prescribed burn time for either Alternative 2 or 3. Any smoke intrusion into Class 1 Airsheds would be mitigated either by avoidance or through dispersion.

Potential impacts of prescribed fire smoke include visibility of smoke and potential health affects of small air borne particles. Heavy smoke would be generated on the day of the prescribed burn, haze is expected for 2 to 4 days following ignition. In this particular analysis area, smoke would generally be transported north and east into the Indian Ford Creek drainage. Drift smoke from a prescribed fire could affect recreationists and the community of Black Butte Ranch by reducing visibility and views of the surrounding forest and mountains. Visibility could be reduced from the normal 20+ miles to less than 3 to 5 miles. This impact could last from a few hours to several days from prescribed fire.

Implementation of the action alternatives, based on the mitigation measures included to reduce emissions and to disperse smoke during favorable conditions, is expected to protect air quality in Sisters, Black Butte and adjacent communities while having no visible effects to the Three Sisters Wilderness area. Compared to Alternative 1, fuels treatments included with action alternatives would limit potential wildfire size per occurrence and emissions produced.

Alternative 2 and 3 – Cumulative Effects

This analysis considers the past, present and reasonably foreseeable future impacts to air quality within the Sisters area and the Three Sisters Wilderness Class 1 Airshed. Past, present, and future foreseeable actions and their effects include forest fuel treatments and wildfires that have occurred since fire suppression policy began during the early 1900's to about ten years in the future. Reasonably foreseeable future actions include the Sisters Area Fuels Reduction (SAFR) project which is in the planning stage.

The cumulative effect on air quality from prescribed burning included in Alternative 2 or 3 is zero. Because of the ephemeral nature of smoke, past smoke producing events including wildfires do not cumulatively impact air quality when the project area is burned by prescribed fire. Current air quality in the area is excellent with no point sources of air contamination nearby. As stated above, burning would be conducted in compliance with National Ambient Air Quality Standards and Oregon Department of Environmental Quality regulations and restrictions to ensure no cumulative effects on air quality.

Because of the goal to restore the fire regime and condition class in the project area, prescribed fire would likely need to occur every 3 to 15 years although the actual frequency is speculative and not foreseeable. Future burning in this project or in the adjacent SAFR project would be subject to the same restrictions, requirements and regulations as discussed above and would not have an additive negative effect to air quality within Central Oregon communities.

Wildlife

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Wildlife Report and Biological Evaluation for this project (Gregg, M. 2007). Additional information is contained in the full specialists report.

Setting the Scope of the Effects Analysis for Threatened, Endangered, and Region 6 Sensitive Species, Late and Old Structure Habitats, Management Indicator Species, Landbird Focal Species, and Birds of Conservation Concern

The following analysis examines projects that have occurred across the Sisters Ranger District over the past 15 years which implemented similar treatments as the Glaze Forest Restoration Project and may have had measurable effects. Direct and indirect short-term impacts are addressed looking out 20-30 years while long-term impacts are addressed looking out more than 30 years.

For this project proposal, activity area boundaries are considered to be the smallest identified area where the potential effects of different management practices would occur. The project area proposes treatments to low elevation ponderosa pine and aspen stands within the “Eastside Screens” land allocation on the Sisters Ranger District and thus will define the “zone of influence.” The discussion of wildlife effects will be focused on the units proposed for treatments and their incremental impacts in combination with the past, present and reasonably foreseeable project within the “zone of influence”.

The timeframe examined for the cumulative effects analysis are projects which have occurred within the past 15 years or projects that will be implemented within the next 5 years. The zone of influence used to discuss cumulative effects are the habitats in the project areas listed below associated with treatments in lower elevation ponderosa pine, and any aspen or riparian enhancement projects. There are no other plant association groups within the project area, therefore only these habitat types will be discussed in the cumulative effects analysis.

The cumulative effect of the loss of large old trees since European settlement is not addressed in cumulative effects because no large old trees will be removed in this project. The lack of late and old structure is considered as part of the existing condition.

The following vegetation management projects (Table W-1 and W-2) were designed to reduce stand densities in order to maintain and develop desired structure and reduce fuel loadings. Effects to wildlife species include the reduction of dense forested habitat (reduced canopy closure), fragmentation where stands resulted in open conditions, and reduction in dead wood habitat.

This list is used to discuss cumulative impacts from Forest Service Actions to Management Indicator Species, Landbird Focal Species, and Birds of Conservation Concern. Cumulative impacts are those impacts on the environment, which results from the incremental impact of each action when added to other past, present, and reasonably foreseeable future actions that overlap in time and space.

Table W-1. Past and Present District Projects within the Eastside Screens area.

Past Activities on the Sisters Ranger District	Acres in Glaze Forest Restoration Boundary	Acres on the Sisters Ranger District
Black Butte Ranch Fuels	0	390
Canal16 Thinning	0	417
Canal 16 Underburn	0	1,790
Highway 20 Thinning	201	7,833
Private Land Activities**	0	1,460
Underline Thinning	0	1,506
Whychus Creek Riparian Enhancement	0	8.5 miles

**Ownership of private lands is varied ranging from private inholdings to commercial timberlands. Activities occurring on private lands include timber harvest of fire-killed trees, developments, and land exchanges.

Table W-2. Future foreseeable projects in Eastside Screens on the Sisters Ranger District.

Future Foreseeable Projects on the District	Acres in Glaze Forest Restoration Boundary	Acres on the Sisters Ranger District
SAFR (Hazardous Fuels Reduction)	0	32,989
Flymon Stewardship Demo	0	250
Whychus Aspen	0	30

The Black Butte Ranch Fuels project, Canal 16 Thinning, Canal 16 Underburn, Highway 20 Thinning, and Underline Thinning were commercial thinning projects designed to reduce overstocked stands and treat ground vegetation to lower fuel levels. These projects were also designed to promote the growth of remaining trees. Effects to wildlife species were a reduction in habitat for species requiring dense forested habitat (e.g. sharp-shinned hawk) and a reduction in ground vegetation like bitterbrush.

The Whychus Creek Riparian Enhancement project identified 8.5 miles of stream impacted by user created roads and dispersed camping. The project was developed to remove impacts and promote regeneration of riparian vegetation along Whychus Creek. The Whychus Creek aspen project was developed from the SAFR project area and identified 30 acres of aspen along Whychus Creek. This aspen stand is declining due to conifer encroachment. Conifers less than 12" diameter will be removed within the riparian reserve and trees <21" diameter will be removed outside riparian reserves. This project is planned for 2008/2009.

The SAFR and Flymon Stewardship Demo Projects are both future projects that propose to enhance residual old growth ponderosa pine by reducing the risk of uncharacteristically large fire while reducing stand densities to accelerate the growth of younger early/mid seral ponderosa pine. Both projects propose a thinning from below and will reintroduce prescribed natural fire to dry ponderosa pine habitat types

Threatened, Endangered Wildlife Species

It is Forest Service policy to avoid all adverse impacts to threatened and endangered species and their habitats, except when it is possible to compensate adverse effects through alternatives identified in a biological opinion rendered by the U.S. Fish and Wildlife Service. Measures are to be identified and prescribed to prevent adverse modification or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species (FSM 2670.31). Through the biological evaluation/assessment process (FSM 2672.4), actions and programs authorized, funded, or carried out by the Forest Service are to be reviewed to determine their potential for effects on threatened and endangered species and species proposed for listing (FSM 2670.31).

Existing management direction is found in the Revised Environmental Assessment for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (Eastside Screens 1995) and the Deschutes National Forest Land and Resource Management Plan (1990).

The following biological evaluation analyzes the effects of the proposed action alternatives for the Glaze Forest Restoration Project. For species other than those classified as Proposed, Endangered, Threatened or Sensitive (PETS) refer to the Wildlife Report for the project. Candidate species are included in the biological evaluation.

The August 2006 – August 2009 Joint Aquatic and Terrestrial Programmatic BA established Project Design Criteria to be applied to all projects for listed and candidate species. Project Design Criteria (PDCs) are used as sideboards and a filter in the planning process, biological assessment, and streamlining consultation process with the U.S. Fish and Wildlife Service.

Species thought to occur presently or historically on the Deschutes National Forest analyzed in this document include: the Canada Lynx (*Lynx canadensis*) and the northern spotted owl (*Strix occidentalis*). The Oregon spotted frog (*Rana pretiosa*) is also included because its Endangered Species Act status is under review.

Table W-3 summarizes Threatened and Endangered Species information for the project area.

Table W-3. Threatened and Endangered Species Summary

Species	Status	Habitat	Presence
Canada Lynx	Federal Threatened	Subalpine fir with Lodgepole pine	No Habitat
Northern Spotted Owl	Federal Threatened, MIS	Old Growth Mixed Conifer Forests	No Habitat
Oregon Spotted Frog	Federal Candidate, Regional Forester Sensitive	Stream, Marsh	No Habitat

Because there is no habitat or known populations of the Canada lynx , northern spotted owl the spotted frog these species will not be addressed further in this document. The project is outside the range of the northern spotted owl and contains no habitat for the species. The Biological Evaluation (Gregg, 2008) contains more information and rationale.

The northern bald eagle was delisted as “Threatened” on August 8, 2007 and added to the Regional Forester Sensitive Species List on August 9, 2007. It is addressed in the following section as a sensitive species.

Sensitive Wildlife Species

Species classified as sensitive by the Forest Service are to be considered through the National Environmental Policy Act process by conducting biological evaluations to determine the potential effect of all programs and activities on these species (FSM 2670.32). No impacts may be allowed on sensitive species that would result in loss of population viability or create significant trends toward Federal listing. The findings of biological evaluations are to be documented in a decision notice, or, if applicable, in official files.

On January 31, 2008 the Regional Forester released an updated version of the Sensitive Species List. In the accompanying letter it states: “The updated Regional Forester Sensitive Species List is included in Enclosure 1 will apply to all projects initiated on or after the date of this letter. Projects initiated prior to the date of this letter may use the updated Regional Forester Sensitive Species List transmitted in this letter or the Regional Forester Sensitive Species List that was in effect when the project was initiated. For the purpose of this letter, “initiated” means that a signed, dated document such as a project initiation letter, scoping letter, or Federal Register Notice for the project exists.” (USDA 2008).

The Project Initiation Letter for Glaze Forest Restoration Project was signed on March 6, 2007. The Glaze Forest Restoration Project uses the Regional Forester’s Sensitive Species list that was in effect when the project was initiated. Therefore, the new Sensitive Species list does not apply to the Glaze Forest Restoration Project.

The Forest Service Region 6 Sensitive Animal List (USDA 2000) and the Update to the Regional Forester’s Sensitive Species List (USDA 2004) were reviewed for species that may be present on the Deschutes National Forest. These species are listed in Table W-2.

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:

Northern Bald Eagle	(<i>Haliaeetus leucocephalus</i>)
Bufflehead	(<i>Bucephala albeola</i>)
Crater Lake Tightcoil	(<i>Pristiloma arcticum crateris</i>)

Deschutes National Forest Land and Resource Management Plan Management Indicator Species (MIS)

The Deschutes National Forest Land and Resource Management Plan identified various species of wildlife as Management Indicator Species. These species were selected because their welfare can be used as an indicator for other species dependent upon similar habitat conditions. Management Indicator Species are used to assess the impacts of management actions on wildlife habitats. These

species are not assigned Management Areas; rather, are subject to Standards and Guidelines that are applicable Forest-wide. The species selected for the Deschutes National Forest are listed in the Deschutes National Forest Land and Resource Management Plan, Chapter 3, under the Wildlife section, Management Indicator Species.

Other species which do not have documented populations or habitats within the project area are summarized below in Table W-4 and will not be addressed further in this report. The Biological Evaluation (Gregg 2008) contains more information and rationale.

Table W-4. Sensitive Species Summary.

Species	Status	Habitat	Presence
Northern Bald Eagle (<i>Haliaeetus leucocephalus</i>)	Delisted as Federal Threatened, Sensitive, Management Indicator Species	Lakeside with Large Trees	Sightings, Roosting Habitat Along Meadow Perimeter
Bufflehead (<i>Bucephala albeola</i>)	Regional Forester Sensitive	Lakes, Snags	Sightings, use of ponds containing water seasonally.
Harlequin Duck (<i>Histrionicus histrionicus</i>)	Regional Forester Sensitive	Rapid Streams, Large Trees	No habitat
Horned Grebe (<i>Podiceps auritus</i>)	Regional Forester Sensitive	Lake	No habitat
Red-necked Grebe (<i>Podiceps grisegena</i>)	Regional Forester Sensitive	Lake	No habitat
Tricolored Blackbird (<i>Agelaius tricolor</i>)	Regional Forester Sensitive	Lakeside, Bullrush	No habitat
Yellow Rail (<i>Coturnicops noveboracensis</i>)	Regional Forester Sensitive	Marsh	No habitat
Western Sage Grouse (<i>Centrocercus urophasianus phaeios</i>)	Regional Forester Sensitive	Sagebrush Flats	No habitat
American Peregrine Falcon (<i>Falco peregrinus anatum</i>)	Regional Forester Sensitive, MIS	Riparian, Cliffs	No habitat
Pacific Fisher (<i>Martes pennanti</i>)	Regional Forester Sensitive	Mixed, Complex	No habitat
Pygmy Rabbit (<i>Brachylagus idahoensis</i>)	Regional Forester Sensitive	Sagebrush Flats	No habitat
California Wolverine (<i>Gulo gulo</i>)	Regional Forester Sensitive, MIS	Mix, High Elevation	No habitat
Crater Lake Tightcoil (<i>Pristiloma arcticum crateris</i>)	Regional Forester Sensitive	Riparian, Perennially Wet	Habitat

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 Whychus Creeks may provide the best potential suitable breeding habitat. Habitat for the harlequin duck does not occur within the project area. Implementation of the action alternatives would have **No Impact** on harlequin ducks.

Red-necked grebes and horned 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 action alternatives will 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 action alternatives will 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 2000). This specific habitat type does not occur within the project area. Implementation of the action alternatives will 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 action alternatives will 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 action alternatives will have **No Impact** on peregrine falcons.

Pacific fisher primarily use mature, closed-canopy coniferous forest with some deciduous component, frequently along riparian corridors. They are known to occasionally use cut-over areas, but this is not their optimal habitat. Their range is primarily in the west Cascade and coastal mountains (Csuti et. al. 1997). The project area is very low in elevation and does not provide the high canopy closures or extensive deciduous component within riparian zones that the fisher need. Therefore, the project area and its surroundings do not provide the habitat to sustain fishers. Implementation of the action alternatives will have **No Impact** on fishers.

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 the action alternatives will have **No Impact** on pygmy rabbits.

California wolverine occur within wilderness or remote country where human activity is limited. High elevation alpine wilderness areas appear to be preferred habitat 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). Implementation of the action alternatives will have **No Impact** on wolverines.

Northern Bald Eagle (Region 6 Sensitive, Management Indicator Species)

Existing Condition

The northern bald eagle has recently been de-listed as a Threatened species and is now being addressed as a Region 6 Sensitive Species. 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+ diameter 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 2006 confirmed the presence of 68 occupied territories of 73 territories located in the High Cascades Zone (Isaacs and Anthony 2003).

There are no bald eagle territories within the project area and the nearest territory is approximately 9 miles away. No essential bald eagle habitat exists within the project area, although there have been incidental sighting of eagles within the project area.

The project area has one fish bearing stream, but due to its small size does not provide foraging habitat. However, a wet and dry meadows exist which hold water in the spring, attracting waterfowl as well as producing rodent populations. Large trees surround both meadows providing suitable perch sites to sit and watch for prey.

Environmental Consequences

Analysis Issue: What are the impacts of the project to the bald eagle?

Measure: Impacts to habitat (large ponderosa pine) that provide perch sites along the meadows.

Alternative 1 - No Action - Ecological Trends

Under the no action alternative the project will not implement any vegetation treatment within the Glaze Forest Restoration Project area. This alternative will have No Impact to the bald eagle or any bald eagle essential habitat. However, a long term ecological trend if no action occurs is the loss of

large trees which serve as perch sites due to stress from competition with many small trees. Fewer large trees would develop in overstocked stands for the future. If a wildfire enters the area, large trees could be lost.

Effects Common to Alternatives 2 and 3- Direct, Indirect, and Cumulative Effects

The project does not propose to remove any large ponderosa pine that could provide perch sites associated with the meadows. Treatments will be beneficial to eagle habitat by decreasing stem densities reducing the risk of stand replacing fire, and reduce the competition for resources between the residual old-growth and understory stands. Alternative 3 will only thin trees 6" diameter and less and therefore will not remove as much ladder fuel or reduce competition between the residual old growth and understory as thoroughly as Alternative 2.

Overall, Alternatives 2 and 3 will have No Effect to the bald eagle or it's habitat. However, implementation of action alternatives may benefit the species by insuring the development and future of incidental perch sites.

Cumulatively, there will be No Impact to the bald eagle or it's habitat as a result of the action alternatives. The project will not remove or degrade any habitat that compounds impacts to eagle habitat across the district. From the list identifying past, present, and reasonably foreseeable projects, the SAFR project proposes to accomplish understory thinning within approximately 523 acres of eagle habitat. SAFR treatments will not remove any constituent habitat elements with the 523 acres of eagle habitat. There will be no incremental impact to eagle habitat as a result of the Glaze project. Treatments will not remove any eagle habitat but will increase the longevity of the residual old growth that provide roost trees adjacent to Glaze Meadow and Black Butte Swamp.

Conclusion

The project does not contain any bald eagle nest sites and is not within any designated Bald Eagle Management Areas, or areas identified as essential eagle habitat. As a result the proposed actions will have No Impact on the Bald Eagle or its habitat. Because there have been incidental sighting of bald eagle within the project area, the meadows could potentially provide foraging habitat. The proposed actions associated with old growth stands adjacent to the meadows could potentially be beneficial to eagles by enhancing old growth stands through fuels reduction and understory thinning, increasing the longevity of the old growth that could potentially provide perch sites adjacent to the meadows. Cumulatively, the project will not lead to a trend toward federal listing of the Bald Eagle.

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 p. 100). Buffleheads winter on sheltered bays and estuaries as well as freshwater environments (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 p. 100).

The dry meadow associated with the project area contains ponds that have seasonal water depending on the use of upstream water by Black Butte Ranch for irrigation. If Black Butte Ranch is utilizing all of the water for irrigation then there is no overflow and the ponds in the project area will remain dry. Meadow areas to the north also contain seasonal ponds. This area also has the potential to be utilized by the bufflehead in early spring. Indian Ford Creek is very small in size and is not likely to provide habitat for the bufflehead.

No surveys have been conducted for this species. Buffleheads have been documented within the Glaze Forest Restoration Project area associated with the seasonal ponds. The documentation was an incidental sighting in 1995. No known nest sites occur within the project area.

Environmental Consequences

Analysis Issue: What are the impacts of the project to the bufflehead?

Measure: Impacts to habitat, particularly snags and ponds.

Alternative 1- No Action- Ecological Trends

There are no vegetation management actions associated with the no action alternative, therefore there will be No Impact to the Bufflehead or its habitat.

Alternatives 2 and 3 -Direct, Indirect, and Cumulative Effects

The action alternatives will not remove any snags, and therefore will not pose a threat to potential nesting habitat adjacent to the areas that hold seasonal water or are associated with the identified ponds. Treatments associated with the action alternatives will thin from below reducing stem densities within the area potentially used by the bufflehead. Treatment objectives will focus on reducing the risk of catastrophic fire as well as restoring the health and vigor to the overstory old growth and accelerating the development of future old growth. The Glaze Forest Restoration project will have No Impact to the bufflehead or its habitat, therefore there will be no incremental impacts associated with the project. None of the past, present, or reasonably foreseeable projects have or will have impact to bufflehead habitat. Cumulatively, the project will not lead to a trend toward federal listing of the bufflehead.

Conclusion

The project area does not contain any known bufflehead nest sites. One incidental sighting was documented within the project area. Treatment will not remove any snags that could potentially

provide nesting habitat. Additionally, the project does not propose any treatments to ponds that provide habitat. There will be No Impact to the bufflehead or its habitat as a result of the project.

Crater Lake Tightcoil (Region 6 Sensitive)

Existing Condition

The Crater Lake Tightcoil is a Region 6 Sensitive Species, is known to occur on the Deschutes National Forest and has been identified on the Sisters Ranger District..

Duncan et. al. (2003) described habitat for the snail as follows: “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”.

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 fatal 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 is compacted over their occupied habitats. This is because if snow loses its insulative properties it can allow the litter or ground to freeze (Burke et al. 1999).

Habitat occurs within the project area and is associated within the perennially wet areas along Indian Ford Creek.

Environmental Consequences

Analysis Issue: What are the impacts of the project to the Crater Lake Tightcoil?

Measure: Impacts to streamside habitat.

Alternative 1 - No Action - Ecological Trends

There are no vegetation management treatments associated with the No Action Alternative, therefore there will be no direct impacts to the Crater Lake Tightcoil or its habitat. If a wildfire enters the area, riparian areas are likely to burn at high intensities and potential habitat could be lost. The Fire

and Fuels section of this document identifies riparian areas in the project area in Condition Class 3 with a high risk of loss of key ecosystem components because of existing fuel loads and missed fire cycles.

Alternatives 2 and 3 - Direct, Indirect, and Cumulative Effects

There are no vegetative treatments associated with any of the areas identified as mollusk habitat since all thinning and prescribed fire remains at least 12 feet or more from the creek. Alternative 2 proposes treatments within the Riparian Habitat Conservation Areas adjacent to Indian Ford Creek, however treatments will not occur within any of the perennially wet areas, and will be limited to hand work only. There is no impact to mollusk habitat from the use of temporary haul roads because they are all existing roads.

A temporary Acrow Bridge will be constructed across Indian Ford Creek on a road in an old bridge crossing site and ford. The road /ford area is highly impacted and lacks any vegetation, but riparian habitat exists adjacent to the bridge site. Surveys were conducted in potential habitat areas in 2007. No Crater Lake Tightcoils were found.

There will be No Impact to the Crater Lake Tightcoil as a result of the proposed actions and therefore are no cumulative effects.

Conclusion

No treatment will occur within any Crater Lake Tightcoil habitat as a result of the Proposed Actions, therefore there will be No Impact as a result of the Glaze Forest Restoration project.

Late Old Structure Habitat, Management Indicator Species, Landbird Focal Species, and Birds of Conservation Concern

Late Old Structure Habitat

National Forests on the eastside of the Cascade Mountains are directed to retain old-growth forest attributes at the local scale and move toward the historic range of variability (the range of forest conditions likely to have occurred before European settlement) across the landscape. This direction is called “Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales, Regional Forester’s Forest plan Amendment”, and is known as the “Eastside Screens”. The screens limit certain types of activities in watersheds where old growth forests are now less common than the historic range of variability.

A decision notice issued in May 1994 amended all eastside Forest plans to include this direction. The May 1994 decision notice was revised in 1995 and was called “Revised: Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales, Regional Forester’s Forest plan Amendment #2”, and has continued to be known as the “Eastside Screens”. Since the 1995 revision, there have been several letters of clarification from the Regional Office regarding the eastside screens.

This analysis addresses the wildlife screens of this direction which relate to Late and Old Structural stands, connectivity, snags, and down wood and certain wildlife species.

Connectivity

Existing Condition

Eastside Screen direction is to maintain or enhance the current level of connectivity between Late Old Structure stands and between all Deschutes National Forest Old Growth Management Areas by maintaining stands between them. Late old structure stands and Old Growth Management Areas need to be connected to each other inside the project area, as well as, to adjacent project areas by at least two directions (Eastside Screens 1995). Connectivity corridor stands should be those in which medium diameter or larger trees are common, and canopy closures are within the top one-third of site potential. Stand widths should be at least 400 feet wide at their narrowest point. If stands meeting this description are not available then the next best stands should be used for connections. The length of corridors between late old structure stands and Old Growth Management Areas should be as short as possible (Eastside Screens 1995).

The project area is small in size and is entirely within a designated Old Growth Management Area (MA-27 Metolius Old Growth). The adjoining lands to the east have had past timber harvest and so contain some fragmentation. Connectivity corridors were established outside the project area and link the Glaze Project Area with the old growth stands within the SAFR Project Area in two directions. These established corridors were designated as 600 feet wide to meet the intent of the Eastside Screens.

Environmental Consequences

Analysis Issue: What are the impacts of the project to Connectivity? Is the project consistent with the Eastside Screens?

Measure: Impacts to Connectivity

Alternative 1 – Ecological Trends

There are no direct or indirect impacts to connectivity associated with the No Action Alternative. However, the ecological trend in the short-term is that stands would continue to remain suppressed and at risk of a stand-replacing wildfire. Development of future old growth within ponderosa pine stands would be prolonged and the old trees within the stands would continue to be stressed, decreasing their longevity. However, stands would continue to provide habitat for wildlife species.

In the long-term, if a stand replacing wildfire or insect outbreak does not occur, trees are more likely to become diseased or vulnerable to insects due to the density of the stands and the landscape connectivity would diminish along with any remnant old growth trees. However, the long term trend would be a decline in late old structure in the project area and loss of large old trees that will require decades to replace. Densely stocked stands are more susceptible to wildfire, due to increased fuel loadings and ladder fuels from 100 years of fire suppression. With no action, the connectivity of late old structure habitat across the landscape will continue to be at risk from disturbance events. Effects

of other projects which thinned small trees such as the Highway 20 Integrated Vegetation Management project and Black Butte Ranch Fuels Reduction project are beneficial in reducing this risk adjacent to and within the project area.

Alternative 2 and 3 –Direct, Indirect, and Cumulative Impacts

There are no proposed treatments associated with connectivity corridors as a result of this project. There are no incremental impacts to connectivity corridors as a result of the project. Therefore, there are no impacts to connectivity corridors.

Consistency with the Eastside Screens- Connectivity

This project is consistent with the Eastside Screens categories 6d-3a to 6d-4 which address connectivity of old growth habitats and requirements for connectivity corridors because:

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
6d-3-a-1 – Network pattern – LOS stands and MR/Old Growth habitats need to be connected with each other inside the watershed as well as to like stands in adjacent watersheds in a contiguous network pattern by at least 2 different directions	Meets	There are 2 connectivity corridors associated with the project area. The project does not propose any treatments with the corridors.
6d-3-a-2 – Connectivity Corridor Stand Description – Stands in which medium diameter and larger trees are common, and canopy closure are within the top one-third of site potential. Stand width should be at least 400 ft wide at their narrowest point. If stands meeting this description are not available leave the next best stands. Again, each LOS and MR/Old Growth habitat must be connected at least 2 different ways.	Meets	Connectivity corridors 600 feet wide using the best available habitat have been placed connecting the project area to the adjacent LOS/old growth stands to assure adequate connectivity. Where canopy closure was not within the top 1/3 site potential, stands with the next best canopy closure were utilized per Screens direction.
6d-3-a-3 – Length of Connection Corridors – The length of identified corridors depends on the distance between LOS and Old Growth stands. Length of corridors should be as short as possible.	Meets	The corridors were developed during the SAFR Project Area linking the LOS/old growth areas in the SAFR project to the Glaze Old Growth Management area in as shortest distance as possible.
6d-4 – Harvesting within connectivity corridors is permitted if the criteria in (2) above can be met, and if some amount of understory is left in patches or scattered to assist in supporting stand density and cover. Some understory removal, stocking control, or salvage may be possible activities depending on the site.	N/A	There is no harvest within connectivity corridors associated with this project.
6d-4-b – To reduce fragmentation of LOS stands, or at least not increase it from current levels, stands that do not currently meet LOS located within, or surrounded by blocks of LOS stands should not be considered for even-aged regeneration, or group selection at this time.	N/A	Even aged regeneration or group selection are not identified as treatments under this project.

No Mitigation Measures are required.

Late/Old Structural Habitat

Currently, there are 458 acres (36% of the planning area) of late old structure ponderosa pine. The current size of trees in these stands provides enough potential habitat for species requiring larger home ranges such as the northern goshawk, in that the stands provide enough habitat for a nest core and variations of post fledging habitat (30 acre nest core and 420 acre post fledging area Reynolds 1991).

The stands are also utilized by other late old structure /ponderosa pine obligate species such as the white-headed woodpecker. This species specifically targets stands of late old structure ponderosa pine for nesting (Frenzel 2002). Historic sightings have identified white headed woodpeckers utilizing these stands.

According to Region 6 Old-Growth Definitions (USDA 1993), ponderosa pine late old structure is generally characterized as open, single-story stands of large diameter (>21 inches diameter) ponderosa pine with about 13 large diameter trees per acre. The Whychus Late Successional Reserve Analysis determined that the watershed is below the historic range of variability for single strata late old structure. The 458 acres of late old structure occurs within Management Area 27 Metolius Old Growth (Glaze and Lower Black Butte) and requires special management as outlined in the Deschutes Land and Resource Management Plan (1990) to provide habitat for wildlife species associated with old growth forests.

Environmental Consequences

Analysis Issue: What are the impacts of the project to late old structure? Is the project consistent with the Eastside Screens?

Measure: Impacts to Late Old Structure.

Alternative 1 - No Action - Ecological Trends

There are no direct or indirect impacts associated with the No Action Alternative. However, the ecological trend in the short-term is that stands would continue to remain suppressed and at risk of a stand-replacing wildfire. Development of future old growth within ponderosa pine stands would be prolonged and old trees within stands would continue to be stressed, decreasing their longevity. However, stands would continue to provide habitat for wildlife species.

In the long-term, if a stand replacing wildfire or insect outbreak does not occur, trees are more likely to become diseased or vulnerable to insects due to the density of the stands and the multi-storied structure would diminish along with any remnant old growth trees. A high density of snags within these areas would benefit both Williamson's sapsucker and black-backed woodpeckers. However the long term trend would be a decline in late old structure in the project area and loss of large old trees that will require decades to replace. Densely stocked stands are more susceptible to wildfire

due to increased fuel loadings and ladder fuels from 100 years of fire suppression. With no action, late old structure habitat will continue to be at risk to disturbance events. Effects of other projects which thinned small trees, such as the Highway 20 Integrated Vegetation Management project and Black Butte Ranch Fuels Reduction project are beneficial in reducing this risk within and adjacent to the project area.

Alternative 2- Direct and Indirect Effects

The late old structure stands in the project area create a denser, multi-layered canopy that provides habitat for interior forest species such as the hairy woodpecker, Williamson's sapsucker, and to a lesser degree, white-headed woodpeckers. These stands also provide nesting and foraging habitat for raptors within the accipiter family (e.g. goshawk, Cooper's and sharp-shinned hawks).

Understory lodgepole pine removal and understory ponderosa pine thinning in late old structure ponderosa pine stands would maintain some density and an overall result would be a reduced risk of catastrophic fire. Understory thinning would occur within trees 20.9" diameter and less. Thinning treatments would change stand structure to a "Single Stratum with Large Trees" (i.e. SS7 Classification in the Eastside Screens)

As defined by Eastside Screens, Single Stratum with Large Trees stands consist of a single dominant canopy of medium sized or large trees. One or more cohorts of trees may be present and an understory may be absent or consist of sparse or clumpy seedling or saplings. Grasses, forbs, or shrubs may be present in the understory.

In the long-term, treatments would maintain and benefit habitat for species such as white-headed woodpeckers and potentially the northern goshawk. These species utilize old growth ponderosa pine for nesting as well as clumps of patchy regeneration for foraging (in the case of the goshawk). Habitat would still be present for the hairy woodpecker. Currently 72% of the acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality.

The use of averages to characterize stand densities can be misleading because it masks the fact some areas have a significant component of trees greater than the thinning diameter limit (e.g. 6" or 21") that are above the upper management zone before treatment. These stands will remain above the upper management zone after treatment, even though the stand average is below the upper management zone. A higher diameter limit will allow for more acres to be thinned to sustainable densities (i.e., below the upper management zone) than a smaller diameter limit. Consequently, Alternative 2, with a diameter limit of 21" will more thoroughly reduce stand densities than Alternative 3. Treatments will minimize competition between residual old growth and the understory enhancing the longevity of these trees, while providing better growing space for the understory to maximize growth potential for future old growth development.

Mowing and prescribed natural fire will be implemented to reduce ground fuels that also create ladder fuels to the understory, in the event of a uncharacteristically large fire. Mowing these stands will initially reducing the ground fuels to implement prescribe natural fire. Overall mowing and prescribed natural fire will regenerate grasses, forbs and shrubs providing a higher diversity of plants

to be utilized by wildlife, but also reducing the needle/organic build up at the base of the larger trees to minimize scorching the roots and killing these trees in the event of an uncharacteristically large fire.

Stands which already provide late old structure habitat would be converted from higher density multi-storied stands with large trees to lower density multi-storied stands with large trees. In a 30 year study of the “Growth of Ponderosa Pine in Central Oregon”, Cochran and Barrett displayed growth rates of the 20 largest trees per acre were reduced by competition from smaller trees.

Treating these stands would reduce the density to promote healthier stands that would be able to persist over time. However, to ensure adequate foraging habitat for both northern goshawk and white-headed woodpecker approximately 10% of the existing old growth area will remain in a mosaic of small untreated clumps of densely stocked stands up to $\frac{1}{2}$ acre in size.

Alternative 3- Direct and Indirect Effects

Under Alternative 3, the percentage of the project area that is above the upper management zone is reduced to 38%. This alternative does not reduce stand densities as thoroughly as Alternative 2 which reduced the percentage of the project area above the upper management zone to 25%.

Treatments in late old structure will also thin from below under this alternative. However, trees thinned will only be 6” diameter and smaller. The differences in densities are as follows: Due to high stand densities under this alternative, the treatment will not release the residual old trees in the stand and stress to these trees will remain. The longevity of late old structure may diminish due to the high stand densities as well as the risk of stand replacing fire. See the discussion on upper management zone above under Alternative 2.

Alternative 2 and 3: Cumulative Effects

Prior to the late 1980s, loss of suitable old growth was primarily due to timber harvest. More recent harvest activities have been aimed at reducing risk to existing habitat and promoting desired species composition to develop and maintain habitat.

Black Butte Ranch Fuels, Canal 16 Thinning, Canal 16 Underburn, Highway 20 Thinning, and Underline Thinning were commercial thinning and underburning projects designed to reduce overstocked stands and treat ground vegetation to lower fuel levels. These projects were also designed to promote the growth of residual trees. These projects did not remove any late old structure habitat but treated approximately 11,936 acres to maintain existing old growth and accelerate the development of future old growth.

Alternatives 2 and 3 will not cause any incremental impacts that reduce current late old structure. Treatments under both alternatives move the late old structure from multiple story to single story stands in the short-term by changing stand composition and potentially altering species use. However, there will be no net change to late old structure acres post treatment. Prescriptions will be designed to perpetuate or enhance the current conditions for the long-term, which will ensure long-term habitat for species that utilize open grown late old structure such as white-headed woodpeckers

and the northern goshawk. Alternative 3 will not thin the understory as thoroughly as Alternative 2 and may leave the stand susceptible to disease, infestation, and wildfire.

Cumulatively, neither action alternative will reduce late old structure habitat because of the reasons described in the following table.

Consistency with the Eastside Screens

This project and alternatives are consistent with the Eastside Screens category 6d-1 and 6d-2 which address retaining and/or changing Late Old Structure (LOS) because:

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
6d-1 – It is allowable to manipulate one type of LOS to move stands into the LOS stage that is deficit if this meets historical conditions.	Meets	Single strata LOS is currently below HRV based upon the Whychus Watershed Analysis (1998). Treatments within LOS will move some LOS from multi strata to single strata LOS. There will be no net loss of LOS within the project area.
6d-2-a – Maintain all remnant LOS structural live trees (greater than or equal to 21 inches diameter) that currently exist within stand proposed for harvest activities.	Meets	No trees greater than 21 inches diameter will be removed.
6d-2-b – Manipulate vegetative structure that does not meet LOS conditions in a manner that moves it towards these conditions as appropriate to meet HRV.	Meets	All treatments will thin from below moving stands that do not currently meet LOS conditions in that direction.
6d-2-c – Maintain open, park like stand conditions where this condition occurred historically. Manipulate vegetation in a manner to encourage the development and maintenance of large diameter, open canopy structure.	Meets	All treatments will thin from below moving approximately 458 acres of LOS stands currently classified as multi-strata LOS to single strata.

No mitigation measures are required.

Consistency with the Deschutes Land and Resource Management Plan

Standard and guidelines for the Old Growth allocation (M-27) were assessed. The project is consistent with the Deschutes Land and Resource Management Plan as described in the table below:

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
Within Allocated Old Growth (M15)		
General Theme of M27 – This old growth forest will be managed to provide: large trees, abundant standing and downed dead trees, single canopy old growth stands and where appropriate vertical structure (multiple vegetative canopy heights)	Meets	No large live trees, snags, or downed wood are targeted for removal.
M27-7 There will be no programmed harvest or wood removal in these areas during this planning period, however, vegetative manipulation including removal may occur to perpetuate or enhance old growth characteristics.	Meets	Vegetative manipulations identified in this allocation are designed to perpetuate and enhance old growth characteristics. Thinning from below and no removal of trees over 21 inches diameter will occur.
M27-12 Snags and live trees needed for future snags will be maintained at 100% of the maximum population potential of primary cavity nesting birds using the Deschutes National Forest Wildlife Tree Implementation Plan. Dead and down trees will be managed to maximize biological diversity.	Meets	No snags are targeted for removal in the proposed action. Future snags (GTR's) will be left in accordance with the Wildlife Tree Implementation Plan (see snag and dead wood discussion). Down wood is also not targeted for removal.

No mitigation measures are required.

Snags/Coarse Woody Material/Green Tree Replacement and associated MIS Species

Numerous species of animals use snags and coarse woody material for foraging, nesting, denning, roosting, and resting. A snag is defined as a dead tree over 10 inches diameter and taller than 10 feet. Coarse woody material is considered to be dead and down material that is greater than 5 inches in diameter (Ohmann and Waddell 2002, Mellen et. al. 2006). The most notable species that use snags and coarse woody material are the primary cavity nesters (e.g. woodpeckers and nuthatches), which are all considered Management Indicator Species in the Deschutes National Forest Land and Resource Management Plan. These species that excavate nest cavities in decayed wood in standing trees. On the Deschutes National Forest 10 species of woodpeckers excavate cavities that are used by 33 other species of cavity-nesters incapable of excavating their own cavities. Vacated cavities are subsequently used by many other birds and small mammals (i.e. secondary cavity users).

Desired conditions of snag and coarse woody material habitat were determined using current direction and new research, including DecAID (Decayed Wood Management Advisor, Mellen et. al. 2006). The DecAID Advisor is a planning tool intended to help specialists manage snag and log levels best suited for their management area and associated wildlife species. This tool uses the best available science and most recent research for species dependent on snags and coarse woody

material. Densities are given in the form of wildlife species tolerance levels at the 30%, 50%, and 80% levels. DecAID tolerance levels “may be interpreted as three levels of “assurance”: low (30% tolerance level), moderate (50% tolerance level), and high (80% tolerance level)” (Mellen et al. 2006). The higher the tolerance level, the higher the “assurance” that snag habitat is being provided.

Wildlife Data Tolerance Level

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. 2006). The following is an example that uses data from the wildlife species curves for white-headed woodpeckers in small and medium tree, ponderosa pine/ Douglas-fir habitat types.

Snag density (≥ 10 "dbh) for white headed woodpeckers:

30% tolerance level = 0.3 snags/acre

50% tolerance level = 1.7 snags/acre

80% tolerance level = 3.7snags/acre

- Areas with <0.3 snags/acre would be expected to be used for nesting by only 30% of the individuals within the population of white headed woodpeckers, and conversely 70% of the population would be expected to nest in areas with ≥ 0.3 snags/acre.
- Half the individuals within the population would be expected to nest in areas with <1.7 snags/acre and the other half would be expected to nest in areas with ≥ 1.7 snags/acre.
- 80% of the individuals within the population of white headed woodpeckers would be expected to nest in areas with <3.7 snags/acre and conversely 20% of the population would be expected to nest in areas with ≥ 3.7 snags/acre.

DecAID synthesized data from research studies to create density related use of snags in various habitat types for wildlife species (Table W-6).

DecAID was applied to the project by matching Plant Association Groups found in the project area to comparable habitat types in DecAID. The habitat types described in DecAID are derived from the ten forested wildlife habitat types listed in the Wildlife-Habitat Relationships in Oregon and Washington (Chappell et al. 2001). One of ten habitat types is present in the Glaze Forest Restoration Project Area, the ponderosa pine/Douglas fir habitat type. Existing conditions within the project area can then be correlated with the research information found in the DecAid tool.

The DecAid advisory tool also divides each forest habitat type into small/mid-structure stands(>10 "dbh) and late-structure stands(>20 "dbh). In some tables the data for small/medium trees and larger trees are identical if the data was collected in both structural condition classes.

While DecAID provides data on wildlife use of snags and down wood it does not measure the biological potential of wildlife populations. The habitat types and structural classifications from DecAID will be used in the analysis of Management Indicator Species.

DecAid was intended to review snags and coarse woody material on a landscape scale as it applies to watershed-sized landscapes. DecAid was used for the Glaze project solely as a comparison to describe the existing condition of snags and coarse woody material in the project area. DecAid was

also used to compare the existing condition of the project area with habitat needs for species reflected in current research.

The following table displays the current structure classes of forested condition on national forest lands in the Glaze Forest Restoration Project Area:

Acres of Ponderosa Pine habitat type by structure stage in the Glaze Forest Restoration Project.

Habitat Type	Small and Mid-Structure	Late-Structure
Ponderosa Pine	416 acres	458 acres

Snags

Table W-5 is a summary of the existing snag levels followed by a summary of the wildlife data (selected species are Management Indicator Species that are known to occur the project area) in the ponderosa/Douglas fir habitat type (Table W-6). This information was compiled from plot data taken within several stand conditions and 100% snag counts associated with late old structure unit number 5 and 27.

Table W-5. Estimated Snag Densities from plot data taken from several stands within the Glaze Forest Restoration Project.

Wildlife Habitat Type by seral Class	Snag Diameter at Breast Height (diameter) DecAID Categories		
Ponderosa Pine	>10 inches (All snags including those >20 inches)	>20inches	Total Snags Per Acre
Late (Stand Exam Plot Data)	4.61 per acre	1.80 per acre	4.61 per acre
Early/Mid (Stand Exam Plot Data)	3.82 per acre	.42 per acre	3.82 per acre
100% Tally on 141.5 acres (Units 5 and 27) Late	3.4 per acre	1.5 per acre	3.4 per acre

The table is intended only to display the range of snag densities by diameter class to estimate what is present within the Glaze Forest Restoration Project. One hundred percent tallies were completed in two old growth units to show how accurately the stand exam data portrayed what existed in units containing late seral conditions. Comparing the two methods shows the plot data estimates are a little higher in overall snags however, the amount of snags >20 inches diameter is similar between both sets of data. The numbers are most likely conservative. Snag data was collected utilizing methods outlined in the Region 6 Stand Exam Program. One of the most noted findings was the scarcity of snags greater than 20 inches in diameter within the early/mid habitat type. This is a result of logging that occurred 60-80 years ago, which has created this mid seral habitat.

The following table displays the average snag diameter used by snag dependent species by tolerance level and forest habitat type taken from DecAid.

Table W-6. Snag densities for wildlife species at 30, 50, and 80 percent tolerance level for snags >10" diameter and >20" diameter based on wildlife data in DecAID (Table PPDF_S).

	30% Tolerance level (#snags/acre)			50% Tolerance level (#snags/acre)			80% Tolerance level (#snags/acre)		
	>6" dbh	>10" dbh	>20" dbh	>6" dbh	>10" dbh	>20" dbh	>6" dbh	>10" dbh	>20" dbh
Ponderosa Pine Douglas Fir									
Black-backed woodpecker)	-	2.5	0	-	13.6	1.4	-	29.2	5.7
Cavity-Nesting Birds	-	1.2	0	-	4.7	1	-	10	2.8
Long-legged Myotis	-	3.8	-	-	17	-	-	37.1	-
Pygmy Nuthatch	-	1.1	0	-	5.6	1.6	-	12.1	4
White-headed woodpecker	1.1	0.3	0.5	4	1.7	1.8	8.2	3.7	3.8
Williamson's sapsucker	-	14	3.3	-	28.4	8.6	-	49.7	16.6
Current Direction for Ponderosa Pine¹		3	1						

1 Current Direction (in the eastside screens/wildlife screens) is provided by habitat type and densities >10" and >20". It is not broken down into tolerance levels but rather represents a 100% biological potential which has been determined to be a flawed technique (Rose et al. 2002).

Tolerance levels are used to describe the percent of the population utilizing snags in a particular habitat type. From the above ponderosa pine/Douglas fir portion of the table, 30% of the population of white-headed woodpeckers utilize habitat with 0.3 snags/acres >10 inches diameter and habitat with 0.5 snags/acre >20 inches diameter, but 50% of the population could be accommodated if the snags/acre >10 inches diameter increased to 1.7. The correlation would be similar for the other species in this forest type. Generally speaking, higher tolerance levels provide habitat for a greater percentage of the individuals within a population. The data in the above table indicates that increasing the snag diameter reduces the number of snags per acre needed to accommodate the same percentage of the population.

Looking at the relation of snag diameter and tolerance level, according to the cumulative species curves for nesting, denning/roosting, and foraging within the DecAid Advisor (Mellen et al. 2006 within the habitat type (PPDF_S. sp-1, 2, and 3), these species tend to select for snags >20" for nesting and/or roosting, with the smaller snag sizes being used at the lower tolerance levels. Smaller diameter snags were more often used for foraging as reflected in the 10-20" diameter range of snags being in the 80% tolerance level for foraging.

Acknowledging the current data available for snag levels is conservative, the project area is on a very small scale, and provides habitat within the 30% tolerance level for various cavity nesting birds, such as pygmy nuthatches and white-headed woodpeckers. The existing low density of snags within the 416 acres of second growth, coupled with the importance of large diameter snags for many Management Indicator Species, emphasizes the need to retain all existing snags if possible in the project area, as well as creating conditions that will favor the recruitment of large snags. This could be done by retaining untreated patches within denser habitat and by reducing stand densities to allow trees, such as ponderosa pine, to increase their growth to provide for the larger snags in the future.

In comparing the existing data with the DecAID data, snag habitat is being provided, but at lower levels than may be optimal for many MIS species. The project area is likely capable of providing more habitat than is currently present. This project area is also very small and only provides habitat for very limited numbers of wildlife species, therefore only local populations may remain limited due to the current availability of habitat.

Environmental Consequences

Analysis Issue: What are the effects of the project on snags? Is the project consistent with the Eastside Screens?

Measure: Impacts to snags

Alternative 1 - No Action - Ecological Trends

There are no direct or indirect impacts to snags if no action occurs. Currently large snags are limited to the remnant areas of late old structure habitat. Increased fuel loadings from 100 years of fire suppression have put the area at risk of a large high intensity fire. These large stand replacement events create snags, however the pulse of snags is short lived. With the loss of live trees there is a long lag time until snags are again available on the landscape. Under the no action alternative, snags will continue to be at an increased risk to wildfire.

In addition, there are few large trees within the second growth areas to provide future large snag habitat. Many of the trees that will become snags in the future occur within overstocked stands, which increases the amount of time the trees will take to get to the desired height and size, if ever.

Competition will continue in overstocked stands with no action and smaller snags are expected to increase across the landscape along with a reduction of large snags over the long-term. On a stand exam plot-average basis, approximately 72% of the acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality (Forest Vegetation Section). Bark beetle attack will increase the recruitment of small snags in the short-term and decrease large snag recruitment through the long-term due to the lack of the development of large trees.

Alternative 2 Direct and Indirect Effects

Treatments within the project area will break up fuel continuity and reduce the risk of a wildfire event, which should reduce the risk to individual large snags and trees. Green trees 21 inches and greater (future large snags) will not be removed. Snags will not be targeted for removal, but there is a possibility for incidental loss of snags during treatments. Generally, snags would be avoided during treatments, but due to safety regulations, snags posing a hazard may be need to be felled. Levels of live tree retention in all treatments will provide adequate numbers of green tree replacements to provide future snag and down log levels.

Future large snags are a concern in second growth areas. In these overstocked stands trees may take a long time or never reach desired size and height. Thinning overstocked stands will reduce competition which should increase growth rates to the remaining trees. Cochran and Barret (1999) were able to show 30 years after thinning there were large differences in average tree sizes among different group stocking levels. They also showed the growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees.

Reintroducing prescribed fire will convert some large snags into down wood. Burning prescriptions and pre-ignition fuels reduction will help reduce the chance of losing large snags. However, it is assumed a percentage of large snags will be affected by prescribed burning. Randall-Parker and Miller (2002) found fall prescribed fire in Arizona resulted in 20% of the snags becoming down wood.

On a stand exam plot-average basis, approximately 72% of the acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality (Forest Vegetation Section). Approximately 77% of the old growth stand and approximately 67% of the second growth stands are above the upper management zone. This includes areas with conifer encroachment such as riparian areas within Riparian Habitat Conservation Areas along Indian Ford Creek and aspen stands. Under this alternative the percentage above the upper management zone is reduced to 25%. This alternative will allow for thinning higher diameter limits allowing for better stand density reduction. This will promote crown growth and crown development moving trees into larger size classes sooner and in the long-term recruiting more large snags and down logs into the area.

Alternative 2- Cumulative Effects

The discussion of cumulative effects to snags in Alternative 2 is found in the analysis for Coarse Woody Materials or downed wood section.

Alternative 3- Direct and Indirect Effects

Treatments to the 416 acres of second growth are the same under Alternative 2 and 3. Within the 458 acres of late old structure, thinning will be limited to trees 6" diameter. There would be less thinning done within the Riparian Habitat Conservation Area because it would be done by hand and handpiled. Therefore, some of the replacement trees within stands will remain densely stocked and

the competition for resources among these replacement trees may prolong the time it takes them to reach desired sizes and heights to replace the existing old growth in the stand.

On a project area basis the percentage of the project area above the upper management zone is reduced to 38% as opposed to 25% in Alternative 2. Ladder fuels may not fully be removed from the understory of the old growth leaving old-growth stand susceptible to crown fire, disease, and infestation. Averages to characterize stand densities can be misleading. By averaging stands it does not fully display areas of stands having a significant component of trees greater than the thinning diameter limit (e.g. 6" or 21") above the upper management zone, remaining above the upper management zone after treatment, although the stand average is below upper management zone. A high diameter limit will allow for more acres to be thinned to sustainable densities (i.e. below the upper management zone). Consequently, Alternative 2, with a diameter limit of 21" inches will allow for a more stand density reduction within late old structure stands than Alternative 3.

Alternative 3- Cumulative Effects

The discussion of cumulative effects to snags in Alternative 3 is found in the analysis for Coarse Woody Materials or downed wood section.

Coarse Woody Materials (CWM)

Down wood is an important component on the landscape and as a component of wildlife habitat is also referred to as coarse woody material, or downed woody material interchangeably. It provides organic and inorganic nutrients in soil development, microhabitats for invertebrates, plants, amphibians, and other small vertebrates, and 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).

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, where 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).

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. Brown et al. (2003) is used to help determine acceptable downed wood levels to realize benefits to wildlife while managing for acceptable fire risk.

Optimum levels of down woody material that allow 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 and 10 to 20 tons per acre for cool Douglas-fir types (Brown et al. 2003).

To analyze downed woody material habitat, two sources were used. DecAID was used to compare the average diameters of logs used by wildlife (ant species) and distribution of downed woody material over an area. The DecAID advisory tool gives downed log densities in terms of size and percent of area covered by downed material. Eastside Screens direction specifies pieces per acre of certain sizes to be retained according to habitat type. Table W-7 compares the existing levels with these two measurements. Data for existing down wood was derived from the same sources as the snag data.

The numbers below are estimates taken from 100% counts within implementation unit 5 that consisted of old growth. Higher levels of down wood may be present in other old growth stand than what is shown in Table W-7. As a result of ocular estimates, it is believed those stands that are mid seral (black bark) will not contain much large down wood due to stands being intensively logged in the 1930's. However, there may be some newly recruited smaller diameter down wood within the black bark stands, due to the high stem densities, the competition for nutrients, and the susceptibility to insects and disease. Stands not previously treated contained higher densities of downed woody material than those previously treated (i.e. old growth vs. black bark stands). Also, in stands that have not been treated, downed woody material often occurs in clumps as well as scattered.

Table W-7. Comparison of Existing Condition with DecAID Habitat Type, and Directed Levels.

Habitat Type	DecAID	Existing in Project Area	Directed Level of CWM (Eastside Screens)
Ponderosa Pine/Douglas-Fir	DecAid percent cover of down wood by tolerance level on unharvested inventory plots. PPDF_S/L.sp-10 30% = 1.3% cover 50% = 1.8% cover 80% = 4.1% cover	CWM 5-9.9" diameter 0.59% Cover .11 pieces/acre 5-9.9" diameter (averaging 7" diameter and 14 ft. long) CWM 10-19.9" diameter 0.93% Cover .31 pieces/acre 10-19.9" diameter (averaging 15" diameter and 14 ft. long) CWM <u>>20"</u> diameter 1.8% Cover .33 piece/acre <u>>20"</u> diameter (21" diameter and 57 ft. long)	3-6 pieces in Ponderosa Pine <u>≥12"</u> diameter (small end) and >6 feet long

According to the data in Table W-7, old growth Unit 5 is below minimum levels of downed woody material guidelines in the ponderosa pine habitat type identified in the Eastside Screens (USDA 1995). Only one unit had a 100% tally of downed woody material completed, but due to ocular

estimates within other old growth units it is felt that it is representative of what is expected to occur with the other old growth units. Existing levels of downed woody material are low in all habitat types when compared to the regional averages in DecAID and the associated literature.

DecAID provides information on woodpeckers as a group, and ants upon which several of the MIS species forage. The following table is information combined from DecAID Table PPDF_S/L.sp-21. This table is the result of synthesized data for wildlife use of down wood sizes (diameter) for denning, resting, ant colonies, foraging and occupied sites from studies for the various habitat types.

Table W-8. Synthesized Data For Wildlife Use of Down Wood Sizes From Various Studies By Forest Type, Small and Large Diameter Size and Tolerance Level From DecAid.

Habitat Type	Ponderosa Pine/Douglas-Fir		
Species	30% t.l. Down Wood Diam. (in.)	50% t.l. Down Wood Diam. (in.)	80% t.l. Down Wood Diam. (in.)
Large ant species	6.9	9.6	13.6
Small ant species	7.7	10.2	13.9
Woodpeckers	7.8	10.1	13.9

Often species that utilize large downed logs also utilize large snags. Limited availability of either or both features reduces the quality of available habitat.

Overall existing downed woody material conditions are providing habitat at minimal levels for some Management Indicator woodpecker species including the white-headed woodpecker, hairy woodpecker, and northern flicker for foraging purposes.

Environmental Consequences

Analysis Issue: *What are the effects of the project, particularly prescribed fire on down woody material?*

Measure: *Impacts to downed woody material*

Alternative 1 - No Action - Ecological Trends

Within the approximately 874 acres of black bark and Old Growth stands, Riparian Habitat Conservation Areas associated with Indian Ford Creek, and aspen stands, small diameter down wood will continue to be created as competition for nutrients and water make trees more susceptible to insects and disease. Within the 458 acres of old growth stands large trees may be recruited as down wood sooner due to stand competition for resources and stand densities. Within the 416 acres of black bark stands, there are also limited large trees (i.e. over 21 inches diameter) available for future large down wood recruitment. Many of the larger trees occur in densely stocked stands, which will increase the amount of time the trees will take to get to the desired size. High density stand will deteriorate recruiting high levels of small trees in the short-term. This will add to the fuel loading putting the area at a high risk of uncharacteristically large fires potentially consuming coarse woody material.

Alternative 2– Direct and Indirect Effects

Green trees 21 inches and greater (future large snags) will not be removed. Down wood is not targeted for removal, but there is a possibility for incidental loss of during prescribed fire. Generally, downed woody material would be avoided during treatments, however due to safety regulations snags posing a hazard may be felled and left as down wood which will incidentally recruit downed woody material.

Future large down wood (from currently small and large green trees) is a concern. Overstocked stands will increase the time it takes the trees to reach the desired size and height. Thinning overstocked stands will reduce competition which should increase growth rates to the remaining trees. Cochran and Barret (1999) were able to show 30 years after thinning there were large differences in average tree sizes among different group stocking levels. They also showed the growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees. Thinning is expected to reduce down wood recruitment in the short-term, however in the long-term there will be more large trees that can be recruited into down wood.

Within the areas where prescribed fire is used more down wood may be recruited from snags which catch fire and fall or are felled. Burning prescriptions and pre-ignition fuels reduction should reduce the chance of losing large snags. However, it is assumed a percentage of large snags will be affected by prescribed burning. Randall-Parker and Miller (2002) found that fall prescribed fire, within similar ponderosa pines stands as the Glaze project, in Arizona resulted in 20% of the snags becoming down wood. In addition, down wood that is on the ground is at the risk of being consumed. The same study by Randall-Parker and Miller (2002) found 50% of the down logs were consumed in the Arizona prescribed fires.

In areas where prescribed fire does not occur, all current down wood will remain where it exists and small down wood will be avoided as much as possible by mowing equipment.

Alternative 3 – Direct and Indirect Impacts

Treatments to the 416 acres of second growth are the same under Alternative 2 and 3. Within the 458 acres of late old structure, thinning will be limited to trees 6”diameter. There would be less thinning done within the Riparian Habitat Conservation Area because it would be done by hand and handpiled. Therefore, some replacement trees within stands may stay densely stocked and the competition for resources amongst these replacement trees may prolong the time it takes them to reach the desired size and height to replace the existing old growth in the stand. In turn this will result in short-term recruitment of much smaller down wood, rather than recruitment of large down wood over time. On a project area basis the percentage of the project area above the upper management zone can only be reduced to 38% as opposed to 25% in Alternative 2. Overall, trees will remain at higher stocking levels and over the long-term. Some of the stands will not develop into the large size classes, limiting the amount of large trees that could potentially be recruited as downed woody material in the future due to the high stocking levels.

Alternative 2 and 3 - Cumulative Effects for Snags and Down Woody Material

Timber harvest and fire suppression have impacted the distribution and density of snags and down wood across the project area. These activities have created the existing condition of dead wood habitats today.

Within the last 10 years approximately 201 acres of vegetation management activities have occurred within the project area, consisting of understory thinnings associated with the Hwy 20 project. This thinning has promoted the development of large ponderosa pines snags and down wood within the project area for the future.

Past harvest has occurred within the project area dating back to the 1930's. The 416 acres of black bark (mid seral) ponderosa pine within the project area as well as parts of the Riparian Habitat Conservation Area is a result of clear cutting that occurred in the 1930's. The 458 acres of old growth that occurs today is remnant old growth that was not cut. Harvest activities occurring during the 1930's did not retain any snags, as a result, the 416 acres of black bark is deficient in snags that are greater than 20" diameter. Within the old growth stands there is sufficient snag habitat that provides habitat for various primary and secondary cavity excavators and nesters.

Shelterwood harvest prescriptions (1975 to present) retained 8 to 20 live overstory trees providing for some future large snag and log habitat as the younger stand develops into a mature stand, but would have eliminated the understory and mid-story cover and feeding substrate. Removal of snags does not normally occur with this treatment; however, incidental removal occurs due to safety reasons. There are two shelterwood harvest units totaling approximately 12.5 acres within the Glaze project boundary.

Within the lower Whychus Watershed two wildfires occurred in the early 1990's; the Delicious(2041 acres) and Stevens Canyon (1079 acres) fires. These events created pulses of snag and down wood densities that were greater than would normally occur with natural succession. These high density snag rich areas are short-lived on the landscape with most snags falling down within 25 years.

Danger tree activities include the routine removal of snags along roads, high use recreation areas, and facilities. This activity occurs approximately 160 feet (one site potential tree height) either side of roads and from high use areas. Snag habitat remains in these areas, however as they pose a danger to the public or facilities they are removed, therefore these areas are not managed to retain this habitat component. An annual danger tree removal project occurs focusing on recreation areas like campgrounds. Snag levels continue to decline around these facilities.

The Black Butte Ranch Fuels Project, Canal 16 Underburn, Highway 20 Thinning, and Underline Thinning have all had prescribed fire associated with them. This was to reintroduce the important natural process of fire and promote development of early/mid seral ponderosa pine stands, while minimizing competition of resources to residual old growth. However, during prescribed fires, some trees were lost and snags were created in the process. Generally, these were smaller snags, but these projects promote the development of future old growth to recruit larger snags in the future. Approximately 4,680 acres of prescribed burning has been completed within these project areas.

Future vegetation management projects include the SAFR and Flymon projects, which will focus on reducing understory vegetation to reduce risk of loss from wildfire. It is assumed snags will not be impacted however, smaller sized down woody material may be lost dependent on the treatments proposed. Overall, these impacts are expected to be minor and snags and down wood for future recruitment will be available in the remaining stands.

Alternatives 2 and 3 will not target snags or down wood for removal and in the long term will create more robust levels of snags and down wood than currently are present. However, these alternatives will cumulatively add to small short term losses of snag habitat because of the potential of losing snags and down wood during prescribed fire activities and the loss of snags for safety reasons. To minimize the loss of snags for safety reasons, landings will be designated in areas to reduce conflict with snags and other mitigation measures will be required (See Mitigation Measures).

Consistency with the Deschutes Land and Resource Management Plan and Eastside Screens

Wildlife standard and guidelines WL-37 and WL-38 were assessed. The action alternatives associated with this project are consistent with the Deschutes Land and Resource Management Plan for the following reasons:

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-37 – As amended by the Eastside Screens, snags will be maintained to provide 100 percent of potential population levels of cavity nesting species. In addition live replacement trees will be left during any harvest to assure 100 percent of population potential through the rotations.	Meets	No snags are targeted for harvest. In addition the project is thinning from below and sufficient retention trees will be provided for future snags.
WL-38 – Specific guidance will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan.	Meets	No snags are targeted for harvest. In addition the project is thinning from below and sufficient retention trees will be provided for future snags.
WL-38 – As amended by the Eastside Screens, 20 to 40 lineal feet per acre in ponderosa pine and 100-140 lineal feet per acre in mixed conifer will be retained	Meets	No down wood is targeted for removal. In addition snags identified as hazards will be felled and left as down wood.
Eastside Screen – Fire prescription parameters will ensure consumption will not exceed 3 inches total (1 ½ inches per side) of diameter reduction in the 20 to 40 lineal feet per acre of ponderosa pine and the 100-140 lineal feet per acre of mixed conifer.	Meets	Mitigation measures have been placed to ensure the required lineal feet of down wood remains post prescribed fire.

Mitigation measures are required. See Section on Mitigation Measures.

Management Indicator Species

The Deschutes National Forest Land and Resource Management Plan (USDA 1990) identified a group of wildlife species as Management Indicator Species. These species were selected because they represent other species with similar habitat requirements. Volunteers from the East Cascades Bird Conservancy were utilized to monitor landbird communities within the project area. Management Indicator Species for the Deschutes National Forest are displayed in Table W-9 below.

The following Management Indicator Species are discussed in the Threatened, Endangered, or Sensitive Species sections: northern bald eagle, northern spotted owl, peregrine falcon, and California wolverine. As discussed in the section on Sensitive Species, the peregrine falcon, and California wolverine have no habitat in the project area and will not be discussed further.

Table W-9. Management Indicator Species and Species of Concern Summary.

Species	Status	Habitat	Presence in Project Area
Northern Goshawk (<i>Accipiter gentilis</i>)	MIS	Mature and old-growth forests; high canopy closure and large trees	Habitat present and historic nesting
Coopers Hawk (<i>Accipiter cooperii</i>)	MIS	Similar to goshawk, can also use mature forests with high canopy closure/tree density	Habitat present but no known nesting
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	MIS	Similar to goshawk in addition to young, dense, even-aged stands	Habitat present, known occurrences, but no known nesting
Great Gray Owl (<i>Strix nebulosa</i>)	MIS	Mature and old growth forests associated with openings and meadows	Habitat present but no known nesting
Great Blue Heron (<i>Ardea herodias</i>)	MIS	Riparian edge habitats including lakes, streams, marshes and estuaries	Presence but no known nesting
Golden Eagle (<i>Aquila chrysaetos</i>)	MIS	Large open areas with cliffs and rock outcrops	No presence/No habitat
Waterfowl	MIS	Lakes, ponds, streams	Presence of a variety of species/seasonally
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	MIS	Large snags, open country interspersed with forests	Presence and historic nesting
Osprey (<i>Pandion haliaetus</i>)	MIS	Large snags associated with fish bearing water bodies	No Presence/No Habitat
Neotropical Migrants/Land Birds	Ecological	Various habitats	Presence of a variety of species
Western Big-eared Bat	MIS	Cave habitat used for hibernacula. Caves, mines, and bridges for roosting.	No habitat/no presence
American Marten (<i>Martes americana</i>)	MIS	Mixed Conifer or High Elevation late successional forests with abundant down woody material	No presence/No habitat
Elk (<i>Cervus elephas</i>)	MIS	Mixed habitats	Known presence

Mule Deer (Odocoileus hemionus)	MIS	Mixed habitats	Known presence
Cavity Nesters (Woodpeckers) (See Snag and Log Analysis)	MIS	Snags and down woody material	Known presence

The project area does not contain habitat for the following species and there are no occurrences within the project area. These species will not be discussed any further.

Osprey - The project does not contain any osprey habitat. Although Indian Ford Creek is a fish bearing stream it does not provide enough open water for foraging habitat for osprey.

Golden Eagle - This species occurs on the eastern edge of the district and habitat is found in areas associated with more arid shrub-steppe, agriculture, and canyons. Habitat for this species does not occur within the project area.

Townsend's Big-eared Bat - No hibernacula or roost sites occur in the project area.

American Marten - The project area is very low in elevation and does not provide habitat for the marten.

Other Species of Concern

Additional species of concern include Birds of Conservation Concern (chipping sparrow, Brewer's sparrows, olive-sided flycatcher, brown creeper, and hermit thrush) and bats (California myotis, western small-footed bat, Yuma myotis, little brown myotis, long-legged myotis, long-eared myotis, silver-haired bat, big brown bat, hoary bat, and pallid bat).

Management Indicator Woodpecker Species

White-headed Woodpecker

White-headed woodpeckers utilize both live and dead ponderosa pine. They forage on both live and dead trees and need large diameter pines because they often have more seeds and provide more suitable nesting habitat. These woodpeckers are poor excavators and generally select for moderately decayed or softer snags in which to nest (Dixon 1995). The species will utilize smaller trees and snags if larger snags are uncommon. Fire suppression has resulted in more shrub cover which has led to an increase in small mammal and avian predation on white-headed woodpeckers (Frenzel 1999). This woodpecker species habitat can also be an indicator of goshawk, flammulated owl, pygmy owl, and white-breasted nuthatch habitat. The white-headed woodpecker is considered a focal species (Altman 2000).

The entire project area is dominated by the ponderosa pine plant association group excluding meadow habitat, riparian areas and aspen. There are approximately 874 acres within the project area that provides habitat for the white-headed woodpecker. Snag levels in this habitat are generally low with approximately 4 snags per acre greater than 10" diameter and 1 snag per acre greater than 20"

diameter (USDA Forest Service Stand Exam Plot Data). Habitat is currently being provided at the 30% tolerance level for this species.

A partnership was developed with East Cascades Bird Conservancy (ECBC) to establish monitoring plots to determine landbird occurrences within the project area by species. Results of the bird monitoring conducted by the ECBC identified white-headed woodpecker in the area through both observations and vocalizations. Nesting was not determined as part of the monitoring.

Williamson's sapsucker

The Williamson's sapsucker is a focal species identified in the Conservation Strategy for Land Birds of the East Slope of the Cascade Mountains for mixed conifer habitats (Altman 2000). Williamson's sapsuckers will often utilize ponderosa pine habitat, however, unlike the white-headed woodpecker, this species will also use mixed conifer habitats. Similar to the white-headed woodpecker, this species will utilize dead and live trees for foraging and select for large (greater than 20" diameter) snags for nesting (Bull et al. 1986).

The 458 acres of old growth stands provide habitat for this species and Williamson's sapsuckers have been documented within these areas by bird monitoring efforts by the East Cascades Bird Conservancy. Habitat is provided for the Williamson's sapsucker within the 30% tolerance level.

Black-backed woodpecker

The black-backed woodpecker is a focal species identified in the Conservation Strategy for Land Birds of the East Slope of the Cascade Mountains for lodgepole pine habitats and recent post fire habitats (Altman 2000). Black-backed woodpeckers are found in most types of conifer forests. These forests include ponderosa pine, lodgepole pine, and mixed conifer, and species occurrence increases with the number of dead trees. They are associated with stands that are susceptible to attacks by bark beetles, and mature and over-mature stands with high tree densities.

Black-backed woodpeckers are best known from and apparently abundant in recently burned forests (Dixon and Saab 2000). Goggans et al. (1989) conducted a study of these woodpeckers on the Deschutes National Forest. Their study showed individual bird home ranges, ranged from 178 acres to 810 acres during the breeding season. The data also showed the woodpeckers selected for single-storyed mature/over mature sawtimber and against single storied-seedlings, saplings, poles, plantations and small sawtimber. They also determined 89 % of the black-backed nests were in lodgepole pine stands. Both living and dead trees are used for nests, but birds may require trees with heart rot in order to excavate nest cavities (Goggans et al 1989). Nest trees are often smaller than those used by other cavity nesters. (Marshall et. al. 2003).

Suitable habitat in the project area occurs in encroaching lodgepole pine associated with ponderosa pine and aspen stands within mid to late structural stages. There are approximately 50 acres of forested stands that meet the definition of suitable black-backed woodpecker habitat. Although the stands are currently suitable habitat they are in decline due to bark beetle attacks. Historically lodgepole pine was not abundant in this area but has become established with fire exclusion. It is estimated the minimal habitat that currently exists in the project area provides for black-backed

woodpeckers below the 30% tolerance level with trees >10" diameter. Studies by Goggans et al. (1989) have documented black-backed woodpeckers also forage on down wood although at a much reduced rate as compared to snag habitat. This type of snag/down wood habitat would be generally clumped in pockets where insect activity has taken place.

Bird monitoring conducted by the East Cascades Bird Conservancy identified the black-backed woodpecker in the project area.

Pygmy Nuthatch

The pygmy nuthatch is a focal species identified in the Conservation Strategy for Land Birds of the East Slope of the Cascade Mountains. In Oregon, it occurs in mature and old growth ponderosa pine or mixed-species forests dominated by ponderosa pine. However, sometimes this bird forages in young ponderosa pines and in lodgepole pine stands (Stern et al. 1987). Pygmy nuthatches nest in cavities in snags or dead portions of live trees (Norris 1958). Foraging is on the outer branches in the upper canopy on needle clusters, cones, and emerging shoots. Their diet varies by season and locale, but consists mainly of insects (Norris 1958). Population declines have been based on habitat deterioration caused by loss of large diameter snags and replacement of large ponderosa pines with smaller trees and other conifer species through fire control and logging (Agee 1993).

Currently, there are approximately 458 acres of suitable habitat for this species. Current snag levels are available at the 30% tolerance level.

Environmental Consequences

Analysis Issue: What are the effects of the project to Management Indicator Woodpecker Species, including the pygmy nuthatch?

Measure: Impacts to snags and coarse woody material habitat

Alternative 1 - No Action - Ecological Trends

With no action, snag habitats would continue to be provided in both the short and long-term and no habitat would be removed. Previously treated stands would continue to grow providing future late-structural habitat. Untreated dense stands would see increased snag recruitment through tree mortality from natural disturbances such as wildfire, wind events, insect and disease pathogens, and lightning. High tree density in some ponderosa pine stands would not only retard the development of large diameter (greater than 21") ponderosa pine trees and future snags but may also hasten the development of smaller diameter snags and coarse woody material as a result of mortality from bark beetles or fire.

This would benefit Management Indicator cavity-nesting species that utilize smaller snags for nesting and provide for increased foraging opportunities for many of the Management Indicator Species. Large snags and downed logs would continue to be limited and those species that select for these habitat components (e.g. Williamson's sapsucker, and to a certain extent, white-headed woodpeckers) would continue to have limited populations within the planning area. The increased

fire risk with no management actions would put these limited habitat features at risk. If a high intensity wildfire did burn through the planning area, habitat for many of the Management Indicator Species would be lost. However, most species of Management Indicator woodpecker species take advantage of snags and insect infestation following fire in varying degrees (Saab and Dudley 1998). This would provide a short-term increase in habitat, however in the long-term there would be a void in snags in the area and a lag effect due to the length of time to grow trees that would provide future snags.

Black-backed woodpeckers would benefit the most under a no action alternative. Without treatment, their habitat would continue to develop. Densely stocked stands or pockets of trees would continue to attract insects and disease. Over time untreated stands could increase habitat to provide for the 30-50 percent tolerance levels. Fire in this area would not be a detriment to the species as they flourish in burned habitat (Saab and Dudley 1998).

Williamson's sapsuckers would decrease over-time as stands begin to deteriorate. This species is a weak excavator and feeds on sap wells of smaller diameter trees but needs large snags for nesting. Dense stands of large and small diameter green trees would deteriorate in the short-term. Because of high stand densities, very few large trees would develop over the long-term and large snags for nesting would be limited in the project area.

Alternative 2 – Direct and Indirect Effects

The thinning and fuels treatments planned under the action alternatives are designed to reduce the risk of high intensity wildfires in wildland urban interface areas. The action alternatives do not propose commercial harvest or salvage of any snags or coarse woody material (see mitigation measures). With the exception of occasional felling of snags that pose a hazard to human safety during timber sale operations, commercial harvest treatments would have no direct effects to snags or coarse woody material habitats. Commercial harvest would directly effect green tree replacements by reducing the number of trees in treatment units. However the units would retain enough green tree replacements to exceed currently directed levels and meet the 30-80% tolerance level of wildlife habitat use in all types. Thinning would open up areas, reducing the quality of the habitat for species needing denser stands (i.e. Williamson's sapsucker and black-backed woodpecker) (see mitigation measures). Indirect effects of treatments include healthier stands that could reduce the foraging potential in the short term.

Proposed treatments would reduce the risk of high intensity wildfire by thinning the understory, reducing the ladder fuels that make the area susceptible to a stand replacing fire. Treatments would accelerate stand development providing long-term habitat for woodpecker species such as the white-headed woodpecker which is dependent on LOS ponderosa pine. Although the recruitment of dead wood habitats would be slow, silvicultural treatments would provide beneficial indirect effects by promoting faster growth of green tree replacements, ultimately providing larger diameter snags and down wood over the next 30+ years. As the stands age, additional snags and logs would develop, providing a higher diversity of habitat and structure. As a result, stands would contain more abundant nesting habitat for Williamson's sapsucker, white-headed woodpecker, and pygmy nuthatch. In the short-term thinning from below will reduce the dense understory in the ponderosa pine removing foraging habitat that is utilized primarily by Williamson's sapsucker, white headed

woodpecker, and occasionally pygmy nuthatch. Reducing understory densities will not preclude foraging, but will limit the abundance of foraging habitat, thus changing foraging behavior to focus on residual areas of denser trees. Through project design, untreated areas will be left throughout the project that will maintain high density stands up to $\frac{1}{2}$ acre in size.

The black-backed woodpecker may see a decrease in habitat because of its need for larger areas of beetle outbreaks or burned forest which would be less likely within the project area. The indirect effects of this alternative are healthier stands of larger trees. Because black-backed woodpeckers utilize trees with heartrot for nesting purposes and actively seek mountain pine beetle infested trees for foraging, the density reduction thinning would also reduce current and future nesting opportunities where thinning occurs.

On a stand exam plot-average basis, approximately 72% of the acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality (Forest Vegetation section). Approximately 77% of the old growth stands and approximately 67% of the second growth stands are above the upper management zone. This includes conifer encroachment within the Riparian Habitat Conservation Areas along Indian Ford Creek and in aspen stands. Under Alternative 2 the percentage that is above the upper management zone is reduced to 25% by thinning trees up to 21" diameter. This alternative will allow for thinning of larger trees allowing for a better stand density reduction. This will promote good crown growth and crown development and by moving trees into larger size classes sooner will in the long-term recruit larger snags and logs into the area.

Levels of coarse woody material within the project area are low. Piling or removal of slash, pile burning and prescribed natural fire could reduce the quantities of coarse woody material (see mitigation measures) and reduce some foraging habitat for woodpeckers.

Alternative 3 - Direct and Indirect Effects

Treatments to the 416 acres of second growth are the same under Alternative 2 and 3. Within the 458 acres of late old structure, thinning will be limited to trees 6" diameter. There would be less thinning done within the Riparian Habitat Conservation Area because it would be done by hand and handpiled. Therefore, some replacement trees will remain in competition for resources and this will prolong the time it takes them to reach desired size and height and replace the existing old growth in the stand. In turn this will result in recruitment of much smaller down wood, rather than recruitment of large down wood.

Habitat for the white-headed woodpecker and pygmy nuthatch are dependent on mature and old growth ponderosa pine for nesting and foraging, with some foraging habitat being provided by understory ponderosa pine. Treatments in the old grow and along Indian Ford Creek will not thoroughly reduce stand densities, reducing the longevity of the old growth in the area and slowing the development of old growth along Indian Ford Creek. Future nesting habitat in the area will exist but will be limited in the long-term, as well as primary foraging habitat for pygmy nuthatch.

Williamson's sapsucker foraging habitat will remain and be more contiguous over the project, with the area providing high densities of mid-seral 60-80 year old ponderosa pine. However without

thoroughly thinning the understory within the 458 acres of old growth, nesting habitat will become limited over time. The overstory will remain stressed from competition and the old growth will die and come down (which is currently occurring) and as a result of understory densities, trees will be slow to develop limiting future old growth. Some nesting will occur within small snags that are created due to over stocked stands.

For the black-backed woodpecker, this species may see a decrease in habitat as its need for larger areas of beetle outbreaks or burned forest would be less likely within the project area. The indirect effects of this alternative are healthier stands of larger trees. Because black-backed woodpeckers utilize trees with heartrot for nesting purposes and actively seek mountain pine beetle infested trees for foraging, the green tree density reduction planned would also reduce current and future nesting opportunities where thinning would occur. However, under this alternative there will be limited thinning in the 458 acres of old growth and along Indian Ford Creek, stand will remain more susceptible to mountain pine beetle infestation providing more foraging habitat.

On a project area basis the percentage of the project area that is above the upper management zone will be reduced to 38% in Alternative 3 as opposed to 25% in Alternative 2. Ladder fuels will not be fully removed from the under-story of the old growth, leaving the old-growth stand susceptible to crown fire, disease, and infestation. Averages to characterize stand densities can be misleading because averages mask the fact that in areas where there is a significant component of trees greater than the thinning diameter limit (e.g. 6" or 21") that are above the upper management zone before treatment will remain above the upper management zone after treatment, even though the stand average is below the upper management zone. A higher diameter limit will allow for more acres to be thinned to sustainable densities (i.e. below the upper management zone) than a smaller diameter limit. Consequently, Alternative 2, with a diameter limit of 21" diameter will allow for a better stand density reduction within late old structure stands than Alternative 3.

In the short-term, many small snags will be recruited due in higher density stands as beetles continue working in these areas. Due to the dense understory, old growth trees will remain stressed and may succumb to beetle infestation resulting in the recruitment of large snags in the short-term. In the long-term, due to higher densities, fewer large snags will be produced and stands will continue to recruit smaller snags and logs because of the lack of larger trees.

Alternative 2 and 3 - Cumulative Effects

Approximately 52,566 acres of both nesting and foraging habitat exists for white-headed woodpecker, pygmy nuthatch, and Williamson's sapsucker within low elevation ponderosa pine stands under the direction of the Eastside Screens. Since black-backed woodpeckers are generally tied to high elevation lodgepole pine stands, but occur in the ponderosa pine stands during beetle outbreak, black- backed wood pecker occurrences are generally incidental within this 52,666 acre area.

Several vegetation management projects have occurred or may occur within suitable habitat for these species including: Black Butte Ranch Fuels, Underline Thinning, Highway 20, Canal 16 Thinning and Canal 16 Underburn). These treatments were proposed to reduce the risk of loss of habitat to large-scale disturbances and thinned approximately 10,146 acres. Mowing and burning were widely

prescribed to promote grassy understories. This benefited white-headed woodpecker nesting habitat and reduced predation on their nests by rodents. Fuels treatments associated with these projects enhanced habitat for these species on approximately 4,680 acres of ponderosa pine habitat.

The SAFR and Flymon Project also propose fuel reduction within ponderosa pine stands, which will be beneficial to these species. The SAFR Project proposes approximately 17,000 acres of thinning and the Flymon project proposes approximately 250 acres of thinning. The objectives of these projects are also focused around ponderosa pine obligates such as the white headed woodpecker, therefore on a landscape basis there will be short-term impacts on approximately 17,250 acres of habitat but also long-term benefits to habitat for these species.

Private lands are not managed for above mentioned species. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long-term. There is approximately 51,530 acres of eastside ponderosa pine or variations of ponderosa pine habitat associated with private lands within the zone of influence.

Cumulatively, the actions associated with Alternatives 2 and 3 will both be beneficial in the long-term. Although both alternatives will reduce foraging habitat for all species, residual foraging habitat will remain under both alternatives and the effects of either action alternative will not preclude use by white-headed woodpeckers, black-backed woodpeckers, Williamson's sapsuckers, or pygmy nuthatches.

The project will minimally reduce foraging habitat on approximately 1% of the habitat identified within low elevation ponderosa pine stand within the Eastside Screens. Therefore the project activities will not lead to a trend toward Federal listing for white-headed woodpecker, black-backed woodpecker, Williamson's sapsucker, or pygmy nuthatches.

Landbird Conservation Strategy Consistency

Biological objectives are based on (where ecologically appropriate) meaningful actions that occur within the habitat addressed. The action alternatives are consistent for Management Indicator Woodpecker Species for the following reasons:

Species	Biological Objectives	Consistent Yes, No, or NA	Rationale
White-headed Woodpecker and Pygmy Nuthatch In Ponderosa Pine Stands: Other species to benefit from objectives: Flammulated Owl, Lewis' Woodpecker, White-breasted Nuthatch, Williamson's Sapsucker, Northern Goshawk, Hammond's Fly Catcher, Hairy Woodpecker, and Brown Creeper	Provide a mean of 10 trees/acre >21" dbh and at least 2 trees >31" dbh	Yes	There will be no removal of trees 21 inches dbh or greater.
	Provide a mean of 1.4 snags/acre >8" dbh with 50% >25" dbh in a moderate to advanced state of decay	Yes	No snags are targeted for removal.
	Provide a mean canopy closure of 10-40%	Yes	The project will be a thinning from below project that will leave 10 to 40% canopy closure.
	In predominantly old-growth, provide >350 acres of contiguous habitat	Yes	This project is designed to move the ponderosa pine stands towards old-growth conditions across the project area.
	In 26-75% old-growth, provide >700 acres of contiguous habitat	NA	This project is designed to move mid seral "black bark ponderosa pine stands towards old-growth conditions across the project area. It will also enhance 428 acres of residual old growth. Project area is too small to meet objective

Management Indicator Species Not Associated with Snags or Coarse Woody Material

Raptors

Habitat exists for the red-tailed hawk, northern goshawk, Cooper's hawk, sharp-shinned hawk, and great gray owl within the project area. Goshawk and great gray owl surveys were conducted during the 2005 and 2006 breeding season to determine occupancy within the project area. No active goshawk nest sites or great gray owl nest sites were found during these surveys. There is one historic goshawk nest site and one historic red-tailed hawk nest site within the project area.

Red-tailed hawk

This species has an extremely wide tolerance for a variety of habitats. Generally, the species prefers open woodland areas associated with forest edges for nesting (Johnsgard 1990). The project area contains two large meadows surrounded by mid and late seral ponderosa pine. These areas provide perching and foraging habitat within the project, and there is a historic nest adjacent to Glaze Meadow. Although the nest was found it has not been occupied in the last 2-3 years.

Environmental Consequences

Analysis Issue: What are the effects of the project to the red tailed hawk?

Measure: Impacts to nesting and foraging habitat

Alternative 1 - No Action - Ecological Trends

Under the no action alternative, suitable nest trees that occur within dense stands would decrease as more trees die from stress. Without treatments in the second growth stands, high stand densities will prolong future development of larger nesting trees. Approximately 72% of the acres in the project area are above the upper management zone and considered at risk of bark beetle mortality. Approximately 77% of the old growth stand and 67% of the second growth stands are above the upper management zone. These high density areas will remain susceptible to bark beetle activity and the susceptibility will increase over time. High stand densities will result in an overall decrease in tree vigor among all size classes of trees. The most significant effect of high stand densities will be the loss of existing large old trees at a rate that is likely to be much faster than if the stand densities had been reduced to lower levels.

Alternatives 2 – Direct and Indirect Effects

Alternative 2 would not impact or remove any nesting habitat (i.e. trees greater than 21" diameter). Thinning from below would increase foraging areas for red-tailed hawks by removing trees (under 21" diameter) and potentially increase the access to prey on the ground on approximately 874 acres. Alternative 2 will decrease the stress on the larger overstory trees the most, therefore helping retain potential nest sites in the long-term (greater than 20 years). Treatments to second growth stands would promote and accelerate the development of late old structure.

Under both alternatives, the reduction of shrubs from mowing and burning activities can impact prey species of ground dwelling small mammals (ground squirrels, cottontails, voles, and pocket gophers). These ground species depend on shrubs for cover for hiding from predators and the forbs for food. This activity would reduce the amount of available habitat for red-tailed hawk prey species, potentially reducing areas utilized by them for foraging as well as minimizing the availability of prey within nesting areas (see mitigation measures).

Alternative 3 – Direct and Indirect Effects

Treatments to the 416 acres of second growth are the same under Alternative 2 and 3. Within the 458 acres of late old structure, thinning will be limited to trees 6" diameter. There would be less thinning done within the Riparian Habitat Conservation Area because it would be done by hand and handpiled. Therefore, some replacement trees will remain in competition for resources and this will prolong the time it takes them to reach the desired size and height and replace the existing old growth in the stand. In turn this will result in recruitment of much smaller down wood, rather than recruitment of large down wood. The percentage of the project area that is above the upper management zone will be reduced to 38% in Alternative 3 as opposed to 25% in Alternative 2. Densities in some old growth areas may reduce the longevity of large old trees and limit the availability of nesting habitat in the long-term. Ladder fuels will not be fully removed from the under-story of the old growth, leaving the old-growth stand susceptible to crown fire, disease, and

infestation. A higher diameter limit will allow for more acres to be thinned to sustainable densities (i.e. below the upper management zone) than a smaller diameter limit. Both treatments will be beneficial in promoting the development of old growth in black bark stands. Alternative 3 will not fully reduce understory competition in old growth stands and will limit future nest trees.

Alternative 2 and 3 - Cumulative Effects

Past thinning projects in the low elevation ponderosa pine (Black Butte Ranch Fuels, Canal Thinning, Highway 20 Thinning, and Underline Thinning) and associated fuels treatments did not impact red-tailed hawk habitat. This is because thinning occurred in stands that are not yet habitat because of the small diameter of the trees. Fuels treatments may have helped to improve foraging habitat by reducing brush layers and opening up the understory.

Within the SAFR project, measures were incorporated to retain large tree and snag habitat as well as enhance habitat conditions on the 17,000 acres proposed for thinning. Large tree and snag habitats were also protected on the 250 acres associated with the Flymon project. Overall, the 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 large-scale disturbances.

Private lands are not managed for red-tailed hawk habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be available long term.

Cumulatively, red-tailed hawk populations are expected to remain stable within these low elevation dry ponderosa pine sites due to their generalist behavior. However, distribution of red-tailed hawks across the low elevation dry ponderosa pine habitat may become patchy as habitat develops in second growth stands. In the long-term there may be a decrease in their populations because of the long period of time before large old trees develop for nesting habitats.

Cumulatively this project will not remove or cause any incremental impact to the red-tail hawk or its habitat and will not cause a trend toward federal listing of this species.

Consistency with the Deschutes Land and Resource Management Plan

Wildlife standard and guidelines WL-2 and WL-3 were assessed. The project is consistent with the Deschutes Land and Resource Management Plan because:

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 active 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	The Glaze project will thin from below. The largest trees within the stands will be identified for retention. In addition no trees 21 inches diameter or larger will be removed from 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.

Mitigation measures are required in the event a nest site is found (see mitigation measures).

Northern 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 for 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).

The project area contains one historic nest territory that has been intermittently active since the early 1990's.

The last date the goshawk nest was active was in 2000. Surveys following the required protocol were done in 2005 and 2006 and no nesting goshawks were found. Because the nest core has been inactive for more than 5 years, a 30 acre nest core and 400 acre post fledging area will not be defined for this project (Eastside Screens 1995).

Approximately 36% of the project area (458 acres) has old growth forests that provide suitable nesting habitat for goshawks. Foraging habitat is not limited and occurs over 911 acres, or 76% of the project area.

Environmental Consequences

Analysis Issue: What are the effects of the project to the goshawk?

Measure: Impacts to nesting and foraging habitat.

Alternative 1 - No Action - Ecological Trends

Areas that currently provide suitable nesting habitat would most likely have increased mortality due to tree stress. Without treatments in the second growth stands, stand densities will prolong future development of larger nesting trees. Approximately 72% of the acres in the project area are above the upper management zone and considered at risk of bark beetle mortality. Approximately 77% of the old growth stand and 67% of the second growth stands are above the upper management zone.

These high density acres will remain susceptible to bark beetle activity and the susceptibility will increase over time. High stand densities will result in the overall decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing historic large-tree component/nesting habitat which is likely to be at a much higher rate than if stand densities were reduced to more sustainable levels.

Alternatives 2 – Direct and Indirect Effects

The identified 458 acres of old growth that provides potential nesting habitat and 874 acres of potential foraging habitat are identified for treatment. In areas identified for thinning, canopies will be opened up and stand densities reduced to lessen the risk of a large-scale event (insects, disease, or fire). Thinning will directly reduce canopy cover, but it will also reduce the fire risk to individual stands by breaking up the fuel continuity across the landscape reducing the risk of larger scale disturbance events. However, each unit identified for thinning will leave 10% in retention clumps. These areas will have a higher stocking rate and will provide some diversity of canopy cover across the landscape, these retention clumps could benefit some prey species. Retention clumps within the 458 acres identified as potential nesting could be up to 20% of the area.

Mowing and burning 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 trees, increasing the stands resiliency to wildfire. 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 and will support foraging opportunities.

On a stand-average basis, approximately 77% of the late old structure in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality. Under Alternative 2, the percentage of the late old structure that is above the upper management zone is reduced to less than 40%, as opposed to 67% under Alternative 3. Loss of the large tree component would continue to occur, but should be slowed on treated acres as trees respond to the increased growing space resulting from thinning from below.

Overall within the late old structure, overstory structural diversity will remain, but understory complexities will be reduced through thinning, mowing, and burning. Although prey habitat will be reduced in the short-term residual habitat will remain providing foraging opportunities for the goshawk. Long-term benefits of treatments will be an reduction of stress to overstory promote the longevity of the old growth, but also to promote the development of future old growth in the stand that will provide long-term nesting habitat.

Alternatives 3 – Direct and Indirect Effects

This alternative is similar to Alternative 2. However, Alternative 3 will only thin trees up to 6" diameter within the 458 acres of late old structure. This will leave many of the old growth competing with the dense understory for resources. Old growth trees are also at risk from crown fire due to ladder fuels. Goshawk habitat will be maintained, and may be more suitable for prey species due to the high stand densities in the short-term, however over the long-term old growth trees may diminish at a higher rate due to stress from the under-story. In the long-term nesting suitability may diminish in this area due to the lack of old-growth structure.

All acres that were late old structure before treatment would remain late old structure after treatment. By limiting thinning to trees less than 6" diameter under alternative 3, the thinning treatments would do very little to move multi-stratum late old structure toward single-stratum late old structure and

most acres will remain multi-storied as thinning from below somewhat reduces canopy layers and canopy cover. However, because of the 6" diameter limit on thinning under Alternative 3 more acres would remain multi-storied compared to Alternative 2.

The amount of foraging and nesting acres impacted is the same for this alternative as well, but the structure will differ with the diameter limit for the 458 acres of nesting habitat associated with the late old structure. Canopies will remain denser under this alternative, which may maintain some short-term nesting habitat in the late old structure. In the long-term the residual dense pocket will fade due to insects and disease potentially impacting residual old growth in the stand.

Overall, the treatments described above will aid in the development of a more resilient landscape to disturbance. Action alternatives differ by the longevity of the effectiveness of treatments to maintaining and developing old growth in designated old growth areas.

Alternative 2 and 3 - Cumulative Effects

The low elevation ponderosa pine stands under the direction of the Eastside Screens total approximately 109,571 acres. Nesting habitat for the goshawk within ponderosa pine habitat is associated with late old structure ponderosa pine stands in the low elevation pines stand within this area. Approximately 12,566 acres or 11% of the habitat that could potentially be used as nesting habitat exists within lower elevation ponderosa pine stands outside the area, under the direction of the Northwest Forest Plan. Understory thinning within the 458 acres will not remove or reduce late old structure habitat, and treatments will only be associated with roughly 3% of the total goshawk habitat associated with ponderosa pine stands in lands under the Eastside Screens.

Approximately 10,146 acres of thinning have or will occur under the Black Butte Ranch Fuels, Underline Thinning, Highway 20, Canal 16 Thinning projects, and 4,680 acres of prescribed natural fire. No reduction in late old structure ponderosa pine has occurred within these projects and the projects were designed to expedite the development of late old structure habitat by thinning early /mid seral habitat. Stands within these project areas are primarily utilized by goshawks for foraging not impact nesting habitat, but promoting short-term foraging habitat and promoting nesting habitat over the long-term (30+ years).

The SAFR and Flymon projects propose approximately 17,250 acres of thinning. The majority of these treatments will not occur within nesting habitat. These treatments will also enhance residual old growth ponderosa pine as well as promote the growth of early/mid seral ponderosa pine to provide future nesting and foraging habitat for the goshawk.

Private lands are not managed for the above mentioned species. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long-term. There are approximately 51,530 acres of eastside ponderosa pine or variation of ponderosa pine habitat associated with private lands within the zone of influence.

Cumulatively, Alternative 2 and 3 will not have incremental impacts to the reduction of nesting and foraging habitat, however they will change the structure and densities of these stands, which may influence how goshawks utilize the areas in the short-term. Treatments will promote more contiguous stands of late old structure throughout the project area in the future, providing both

nesting and foraging habitat in the same stands. This project will not lead to a trend toward Federal listing for the northern goshawk.

Consistency with the Eastside Screens

This project is consistent with the Eastside Screens category 6-5a, 6-5b, and 6-5c.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
6-5a - Protect every known active and historic (nesting activity occurring in the last five years) from disturbance.	NA	Although there is one historic nest core, the nest has not been active in the last 5 years. This has been confirmed by surveys.
6-5b – 30 acres of the most suitable nesting habitat surrounding all active and historic nest tree(s) will be deferred from harvest	NA	No active nests occur within the project area therefore no nest cores have been designated.
6-5c – A 400 acre “Post Fledging Area” (PFA) will be established around every known active nest site. While harvest activities can occur, retain the Late and Old Structural (LOS) stands and enhance younger stands towards late old structure conditions as possible	NA	There are no active nest cores therefore no nest cores have been identified and no post fledging areas are needed.

Consistency with the Deschutes Land and Resource Management Plan

Wildlife standards and guidelines WL-6, WL-10, and WL-11 were assessed. The project is consistent with the Deschutes Land and Resource Management Plan.

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	Habitat is available across the Forest.
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 $\frac{1}{4}$ mile from disturbing activities.	Meets	Mitigation measures are in place for seasonal restrictions in the event a new nest site is found.

Mitigation Measures are required (see Mitigation Measures).

Cooper's and Sharp-shinned Hawks

The Cooper's and sharp-shinned hawks are Management Indicator Species. They 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 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 (1982): 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. Sharp-shinned hawks have been observed soaring above Glaze Meadow within the project area and there are historic sightings of Cooper's hawks within the project area. (Marshall et al. 2003).

The project area provides approximately 416 acres of 60 to 80 year old ponderosa pine stands that provide potential Cooper's and sharp-shinned hawk habitat. An old Cooper's hawk nest was discovered in these stands, but had not been recently active. Approximately 50 acres of aspen intermingled with lodgepole pine provide habitat for the Cooper's and sharp-shinned hawks. Although canopy cover varies in the stands between 30-50 percent and the mean is below defined habitat requirements, the 416 acres provide groups of dense trees that provide potential nesting and foraging habitat.

The Deschutes Land and Resource Management Plan defines Cooper's hawk habitat as:

- Mean canopy cover of 60 percent or greater.
- Tree density of at least 365 trees per acre.
- Stand age 50 to 80 years old.

The Deschutes Land and Resource Management Plan defines Sharp-shinned hawk habitat as:

- Mean canopy cover of 65 percent or greater.
- Tree density of at least 475 trees per acre.
- Stand age 40 to 60 years old.

A total of 416 acres within the project area are Cooper's and sharp-shinned hawk habitat.

Environmental Consequences

Analysis Issue: What are the effects of the project to the Cooper's or sharp-shinned hawk?

Measure: Impacts to nesting habitat and foraging habitat by loss of black-bark pine

Alternative 1 - No Action - Ecological Trends

There are no known direct impacts to Cooper's or sharp-shinned hawks associated with this alternative. Habitat conditions would remain the same for the short-term. Stand densities would continue to increase due to fire suppression. This would increase the potential habitat over time. However, with increased stand densities comes increased risk of loss from disturbance events (insects, disease, or fire). These events would likely impact the densest stands the greatest which would result in reduced availability of suitable habitat in the project area.

Alternative 2 and 3- Direct and Indirect Effects

There are no active Cooper's or sharp-shinned nest sites in the project area. However, 458 acres of potential habitat exist and is proposed for thinning. Where these stands are associated with the Indian Ford Creek Riparian Habitat Conservation Area, stands are denser. Treatments in the Riparian Habitat Conservation Area are minimized because of the sensitivity to riparian vegetation,

erosion, and the importance of maintaining an overstory to provide shade to the stream. Stands will remain dense and still provide potential nesting habitat.

In areas identified to be thinned, canopies will be opened up and stand densities reduced to lessen the risk of a large-scale event (insects, disease, or fire). Thinning will directly reduce the amount of potential Cooper's and sharp-shinned habitat, but it will also reduce the fire risk to individual stands breaking up the fuel continuity across the landscape, reducing the risk of larger scale disturbance events. However, each unit identified for thinning will leave a minimum of 10% in retention clumps. These areas will have a higher stocking rate and may provide habitat for Cooper's and sharp-shinned hawks as well as prey species.

Mowing and burning treatments will reduce both fuels associated with thinning and overall fuel loadings to acceptable levels. Fuels treatments will reduce fire risk and will reduce competition to established trees, further increasing the stand's resiliency to wildfire. Fuels treatments will also reduce the understory complexity which may result in a change or reduction in potential prey species. Shrubs provide habitat for a variety of passernines that are utilized by the Coopers' and sharp-shinned hawk for prey. By reducing shrub densities, habitat for prey will diminish in the short-term reducing potential foraging areas. However, adjacent untreated areas may provide the structural complexity for prey providing the potential for foraging opportunities.

The approximately 79 acres associated with aspen and lodgepole are also scheduled for conifer removal. Treatments will have the same effect as the thinning described above. However, reduction of conifers should increase canopy cover of aspen and eventually create potential Cooper's and sharp-shinned aspen habitat within the next 20 years. In addition aspen treatments will increase the limited hardwood diversity within the project area, which may increase the diversity of prey species available.

Overall, all treatments described above will aid in the development of a more disturbance resilient landscape.

The Cooper's and sharp-shinned hawks are smaller accipiters and therefore can utilize younger stands that offer seclusion and structure for nest support than the much large goshawk which needs larger trees for nest support and over head canopy to make the much larger bird more discreet. Potential nesting habitat would most likely develop within proposed units within 20-40 years. In the short-term, the designated cover clumps would provide dispersal, foraging, and possible nesting habitat.

Foraging habitat would not necessarily decrease in acreage, but would decrease in quality from mechanical shrub treatment or prescribed fire. For Cooper's and sharp-shinned hawks, the reduction of shrubs from mowing activities can impact their prey species of ground dwelling small mammals and shrub/ground nesting passernines. These ground species depend on the shrubs for nesting, and cover for hiding from predators. This activity would reduce the amount of available habitat for some Cooper's and sharp-shinned hawk prey species, potentially reducing areas utilized by them for foraging as well as minimizing the availability of prey within suitable nesting areas.

Alternative 2 and 3 - Cumulative Effects

The Zone of Influence for the Cooper's and sharp-shinned hawk occur within low elevation ponderosa pine stands within lands managed under the Eastside Screens.

Several vegetation management projects have occurred or may occur within suitable habitat in the ponderosa pine habitat types (Black Butte Ranch Fuels, Canal Thinning, Highway 20 Thinning, and Underline Thinning). Stand densities have been reduced on approximately 10,146 acres within treatment units or proposed treatment units, creating conditions in some areas that may not be favorable for nesting, while maintaining areas of contiguous stands that do provide nesting and foraging opportunities. Overall, treatments will reduce the risk of loss of existing habitat from other large-scale disturbances.

The Flymon and SAFR projects propose to thin approximately 17,250 acres of ponderosa pine that could also reduce suitable nesting habitat, but will provide foraging habitat. In the future the majority of the past, present, and future proposed thinning projects will provide nesting habitat for Cooper's and sharp-shinned hawks by creating old-growth ponderosa pine stands that contain suitable nesting structure due to patches of regeneration in the understory.

An estimated 40,000 acres of potentially suitable habitat exists within Eastside Screens lands. Cumulatively, less than 2% of the overall suitable habitat that occurs will be treated with the implementation of this project under both Alternatives 2 and 3. Within ponderosa pine stands, Cooper's and sharp-shinned hawk populations are expected to remain relatively stable due to minimal treatment occurring with this habitat type.

Cumulatively, these alternatives will maintain Cooper's and sharp-shinned hawk habitat within the 416 acres of treatments. Structure within stands will change with density reductions and may change how these species utilize the stands. However, there no incremental impact to the species as a result of treatments, and over the next 20-30 years, better nesting and foraging habitat will develop. These alternatives will not lead to a trend toward federal listing for the Cooper's or sharp-shinned hawk.

Consistency with the Deschutes Land and Resource Management Plan

Wildlife standards and guidelines WL-13, WL-18, WL-19, WL-21, WL-27 and WL-28 were assessed. These standards address providing nesting habitat for Coopers and Sharp-shinned hawks, and protecting nests from new roads or disturbance. The project is consistent with these standards because:

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
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	Habitat is available 60 to 80 year old black bark ponderosa pine stand across the Forest.
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 $\frac{1}{4}$ mile from disturbing activities.	Meets	Mitigation measures are in place for seasonal restrictions in the event a new nest site is found.

Mitigation Measures are required (see Mitigation Measures).

Great Gray Owl

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 2004). Bull et al. (1990) found them utilizing forested stands between 11 and 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.

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 et al. (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.

The meadows and associated 458 acres of old growth within the project area provide nesting habitat within the project area. The project area contains approximately 236 acres of meadow habitat that

provides foraging opportunities adjacent to nesting habitat for the great gray owl. The great gray owl is considered a Management Indicator Species on the Deschutes National Forest and surveys were completed to protocol for two consecutive years in 2005 and 2006. No great gray owls were identified within the project area.

Environmental Consequences

Analysis Issue: What are the effects of the project to the great gray owl?

Measure: Impacts to nesting and foraging habitat associated with Late Old Structure habitat adjacent to meadows.

Alternative 1 - No Action - Ecological Trends

No great gray owls or habitat will be impacted with the implementation of this alternative. Nesting and foraging habitat are not static and in the short term (<30 years), may be reduced in quality or lost due to environmental factors such as insects, disease, and/or wildfires. Canopy closure may be sufficient for great gray owls, however large structure would be sparse over the project area and may reduce potential nesting habitat in the long-term due to the loss of this large structure from resource competition, insects, and disease associated with dense understory stands.

Alternative 2 - Direct and Indirect Effects

Treatments to the 458 acres of old growth will not reduce the overall amount of old growth within the project area, however it has the potential to reduce crown closures by thinning from below limiting nesting suitability in areas within these old growth stands. However, within the long-term trees will be less stressed and provide a variety of large trees that will provide viable nesting habitat. On a stand-average basis, approximately 77% of the old growth acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality. Under Alternative 2, the percentage of the late old structure that is above the upper management zone is reduced to less than 40%, as opposed to 67% under Alternative 3. Loss of the large tree component would continue to occur, but should be slowed on treated acres as trees respond to the increased growing space resulting from thinning from below. Old growth stand will still provide nesting habitat, but may be limited in areas due to the reduction in understory densities.

Alternative 2 will also remove conifer encroachment on the 236 acres of meadow within the project area reclaiming the historic boundary of the meadow. This will immediately enhance foraging habitat for the great gray owl by reclaiming the historic boundaries and maintaining meadow habitat in the future.

Alternative 3- Direct and Indirect Effects

Alternative 3 proposes treatment to the 458 acres of late old structure habitat, however under this alternative it will only thin trees up to 6" diameter leaving the understory with a higher stocking level. As addressed in Alternative 2 on a stand average basis 67% of late old structure is above the upper management zone under this alternative. Some portions of the old growth stand main remain

stressed and reductions in pockets of large trees may occur throughout these stands due to competition for resources, insects, and disease. In the long-term this could potentially leave gaps in the over story canopy minimizing the availability of nest-sites. Additionally, the use of averages to characterize stand densities can be a little misleading because the use of averages masks the fact that areas of stands where there is a significant component of trees greater than the thinning diameter limit (e.g., 6" or 21") that are above the upper management zone before treatment will remain above the upper management zone after treatment, even though the stand average is below the upper management zone. A higher diameter limit will allow for more acres to be thinned to sustainable densities (i.e., below the upper management zone) than a smaller diameter limit. Consequently, Alternative 2, with a diameter limit of 21" diameter will allow for better stand density reduction within late old structure stands than Alternative 3 by reducing the stress to residual old growth which provide nesting and roosting habitat for the great gray owl. Meadows treatments will occur under this alternative reclaiming the historic perimeter of the meadow. However, if there are trees larger than 6" diameter occur along the meadows edge and are not removed, the reclamation of the meadow may not be as thorough.

Alternative 2 and 3- Cumulative Effects

The lower elevation ponderosa pine stands managed under the Eastside Screens total approximately 109,571 acres. Within this area there is no great gray owl habitat except the habitat associated with Glaze project. Old plantation/regeneration harvests that exist were established in the early to mid 1980's and are densely stocked with trees and shrubs and do not provide foraging habitat totaling approximately 10,759 acres.

Approximately, 10,146 acres of thinning have or will occur under the Black Butte Ranch Fuels, Underline Thinning, Highway 20, Canal 16 Thinning projects, and 4,680 acres of prescribed natural fire. No reduction in late old structure ponderosa pine has occurred within these projects and the projects were designed to expedite the development of late old structure habitat by thinning early /mid seral habitat. No great gray owl habitat occurs within these project areas.

The SAFR and Flymon project also propose approximately 17,250 acres of thinning. These treatments will also enhance residual old growth ponderosa pine as well as promote the growth of early/mid seral ponderosa pine to provide future late old structure stands. No great gray owl habitat occurs within these project areas.

Private lands are not managed for above mentioned species. Therefore, it is assumed any habitat provided by these parcels is incidental and may not be long-term. There is approximately 51,530 acres of eastside ponderosa pine or variation of ponderosa pine habitat associated with private lands within the zone of influence.

Cumulatively, great gray owl populations will likely remain stable. Due to the lack of great gray owl habitat on the District on lands managed under the Eastside Screens, this project will promote the longevity of that habitat that occurs in the Glaze project area. More resilient, stable habitat will develop in the long-term as a result of the action alternatives.

Cumulatively, the reduction in canopy closure associated with the 458 acres of old growth adjacent to meadow habitat will not cause incremental impact to great gray owl habitat. No nest sites occur with this area and the amount of reduction under both Alternative 2 and 3 will be so minor that it is immeasurable on the landscape. The actions associated with Alternatives 2 and 3 will not lead to a trend toward federal listing for the great gray owl.

Consistency with the Deschutes Land and Resource Management Plan

Wildlife standards and guidelines WL-30 through WL-33 were assessed. These standards address providing habitat for great gray owls, protecting nest sites, and altering harvest patterns near nests and meadows. The project is consistent with these standards because:

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	No suitable habitat exists outside the project area within low elevation pine stands associated with Eastside Screens lands.
WL-31 – Active nest sites will be protected by maintaining at least 30 acres surrounding nest.	Meets	A $\frac{1}{4}$ 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.	Meets	Treatments will selectively thin the understory adjacent to Glaze Meadow and Black Butte Swamp.
WL-33 – Nests will be protected within $\frac{1}{4}$ mile from disturbing activities.	Meets	Mitigation measures require seasonal restrictions for known nest sites.

Mitigation measures are required (see Mitigation Measures)

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).

Indian Ford Creek is in the project area. There has been recent beaver activity along portions of the creek and waterfowl have been identified utilizing the area of the creek that the beavers have dammed up. The north portion of Glaze Meadow has standing water associated with a spring and the south end contains ponds that seasonally hold water depending on water use by Black Butte Ranch, which waterfowl have been identified using. No treatments will occur in these areas as a result of the action alternatives. No formal surveys have occurred for most waterfowl species to date.

Environmental Consequences

Analysis Issue: *What are the effects of the project to waterfowl?*

Measure: *Impacts to pond and stream habitat.*

Alternative 1 - No Action - Ecological Trends

There are no impacts to waterfowl associated if no action occurs.

Alternative 2 and 3- Direct and Indirect Effects

There are no known direct impacts to waterfowl associated with action alternatives. There is very limited potential waterfowl habitat occurring within the project area, however Indian Ford Creek and Glaze Meadow have limited habitat. There will be no treatments that will impact waterfowl habitat associated with Indian Ford Creek or Glaze Meadow. Therefore impacts to waterfowl associated with this project will be minor. Treatments to the Riparian Habitat Conservation Areas, but they will not impact waterfowl or there habitat. Treatments to encroaching conifers will reclaim the historic perimeter of the meadow and will be beneficial to waterfowl such as geese that forage in grassy openings.

Alternative 2 and 3- Cumulative Effects

There are no incremental impacts to waterfowl from the two action alternatives, therefore the project will not lead to a trend toward federal listing of any waterfowl species.

Consistency with the Deschutes Land and Resource Management Plan

Wildlife standard and guideline WL-39 was assessed. This standard addresses habitat enhancement for waterfowl to increase production of waterfowl. This project is consistent with the Deschutes Land and Resource Management Plan.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-39 – Waterfowl production will be increased where possible with appropriate habitat enhancement.	N/A	This project does not specifically implement habitat enhancement projects for waterfowl. However, the Glaze project will not alter waterfowl production.

No Mitigation Measures are required.

Great Blue Heron

The great blue heron is one of the most wide-ranging waterbirds in Oregon (Marshall et al. 2003). 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). 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 54 inches and the average height is 79 feet, they use a wide range of sizes from 18 to 72 inches in diameter and 43 to 120 feet tall (Marshall et al. 2003). They hunt shallow waters of lakes and streams, wet or dry meadows feeding on fish, amphibians, aquatic invertebrates, reptiles, mammals and birds. They are very sensitive to disturbance, especially during the nesting season. (Jackman and Scott 1975).

Nesting and foraging habitat in the project is primarily located along Indian Ford Creek and Glaze Meadow and Black Butte Swamp provide foraging habitat.

There are no known colonies/rookeries in the Glaze project area.

Environmental Consequences

Analysis Issue: What are the effects of the project to the great blue heron?

Measure: Impacts to ponds, streams, or wet meadow habitats

Alternative 1 - No Action - Ecological Trends

There are no known nests, colonies, or rookeries within the project area. In the absence of disturbance events, habitat trends would continue with increased stand densities, canopy cover, down woody debris and snags. However, with increased stand densities comes increased risk of loss from disturbance events. In addition, the meadow habitat also exhibits conifer encroachment, which would increase over the short-term limiting available foraging habitat. Trees growing in heavily stocked stands may also lead to smaller limb structure, which would limit available nesting habitat.

Alternative 2 and 3- Direct and Indirect Effects

Areas not treated will exhibit the same impacts as described in the no action alternative. Breaking up the fuel continuity across the project area will reduce the risk of a larger scale disturbance event.

Under Alternative 2, approximately 51 acres of hand thinning in the Indian Ford Riparian Conservation Area to restore riparian habitat condition. In these areas ladder fuels will be reduced, which should reduce the risk of stand replacing wildfire, insects and disease. It will also allow these areas to be reclaimed with hardwood riparian vegetation such as alder and aspen. Residual pine will be released accelerating trees that will develop larger limb structure in 30+ years, that could be utilized as potential nesting habitat.

Under Alternatives 2 and 3 approximately 236 acres of meadows will be restored by cutting and removing or girdling trees to reduce conifer encroachment to reestablish the meadow perimeter and enhance foraging habitat. Prescribed fire would also be used to reestablish the historic meadow perimeter and enhancing foraging habitat.

Alternative 2 and 3- Cumulative Effects

There are no incremental impacts to great blue heron as a result of the action alternatives; therefore the project will not cause a trend toward federal listing.

Consistency with the Deschutes Land and Resource Management Plan

Wildlife standards and guidelines WL-35 and WL-36 were assessed. The project is consistent with the Deschutes Land and Resource Management Plan.

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	Silvicultural treatments emphasize retaining large trees and growing more large trees (and eventually snags) in the Indian Ford Creek Riparian Habitat Conservation Area.

No Mitigation Measures are required.

Mule Deer and Elk

The project area occurs within deer summer range and transition range as designated within the Deschutes National Forest Land and Resource Management Plan. The goal of transition range is to provide optimum habitat conditions. Habitat management in transition range is to be designed to provide a mosaic of forested conditions that incorporates the concepts of escape and hiding cover, thermal cover, travel corridors, visual screens, and harassment potential (M7-10).

Hiding areas in summer range must be present over at least 30% of National Forest land in each implementation unit (WL-54). Hiding cover is defined as vegetation capable of hiding 90% of a standing adult deer from view of a human at a distance equal to or less than 200 feet (Thomas 1979). Hiding cover provides security to big game and protection from predators. Hiding cover is especially important for reducing vulnerability to hunting and poaching pressure by providing concealment in areas that have high open road densities and easy access by hunters. The Forest Plan requires evaluation of hiding cover in deer summer range (deer summer range includes the entire Forest outside of the Deer Habitat Management Allocation). Within these areas, travel corridors would be provided where needed by linking the stands providing cover (WL-56).

Ideally, hiding cover stands would be in close proximity to foraging areas and would make up approximately 30-40% of the land area (Thomas 1979). The optimum distance between cover stands for maximum use by big game is thought to be approximately 1,200 feet with stand sizes ranging from 6-26 acres (Thomas 1979).

Because of the importance of mule deer cover on the landscape, a broad scale analysis was completed. Although there is no implementation unit defined within the context of the Deschutes Land and Resource Management Plan, for the purpose of this analysis, mule deer hiding cover within the Glaze Forest Restoration project was analyzed in the context of summer range associated

with the Glaze and SAFR analysis areas. This area is approximately 11,941 acres and defines the summer range area with and adjacent to the project more thoroughly portraying cover connectivity in the immediate area. An analysis was completed for the adjacent SAFR project area to quantify hiding cover for mule deer outside of winter range (transition and summer range). After implementing the SAFR proposed treatments, 32% of the SAFR planning area will remain in hiding cover. Adding the adjacent Glaze project acres that contain areas of forested stands (excluding all meadows and black bark stands) it would add approximately 533 acres of cover to the overall hiding cover between the Glaze Project and adjacent SAFR project areas (approximately 4,175 acres). Therefore, within the Glaze and SAFR projects areas, there is approximately 35% hiding cover at the landscape level. Therefore this meets the standard and guideline of 30% within the Deschutes Land and Resource Management Plan. The project area is also considered transition range. It is important to retain enough forage in the area for body conditioning prior to going on to winter range.

The project area also provides habitat for a transient population of elk. Since this project is not within a key elk area, there is no direction for management of hiding or thermal cover. However, hiding cover to protect elk from disturbance is provided by deer hiding cover within the project area. Elk will also benefit from restoration of aspen and riparian areas for forage and calving.

Environmental Consequences

Analysis Issue: What are the impacts of the project to mule deer and elk?

Measure: Impacts to hiding cover

Alternative 1 - No Action - Ecological Trends

Without treatment, it is expected hiding cover would increase in the short-term. In the long-term, as the stands mature, hiding cover would be lost and thermal cover would increase.

Alternative 2 and 3- Direct and Indirect Effects

Cover connectivity for mule deer and elk would be provided in the project area by maintaining 10% cover within treatment units in addition to the cover maintained within the adjacent SAFR project. Connectivity corridors discussed earlier in this report, which link late old structure stands, will provide additional security. A detailed discussion follows.

Within the 533 acres of forested vegetation identified as providing hiding cover in the project area, cover will be reduced as a result of Alternatives 2 and 3. Approximately 11,941 acres of summer/transition range occurs in the Glaze and SAFR project areas. Of that, 533 acres is proposed for thinning treatments which will reduce hiding cover in the project area and on the landscape. Approximately 3,642 acres of hiding cover would remain in the Glaze and SAFR project areas. Approximately 31% hiding cover would exist within summer/transition range on the landscape which meets the Deschutes Forest Plan standard and guidelines for mule deer outside winter range. This cover occurs within stands of old growth and black bark ponderosa pine.

Approximately 416 acres of black bark ponderosa pine occurs in the Glaze project area, not all of which provides hiding cover but portions are identified within the 533 acres of total cover within the Glaze project area. Mid-seral black bark ponderosa pine stands do not provide optimum hiding cover due to the openness of the stands. To meet standards and guidelines for this habitat type a

minimum of 10% of the 416 acres of black bark stands will be left in clumps to provide visual screening (WL-59).

All thinning implementation units will retain at least 10% of units associated in clumps to provide visual screening. Approximately 458 acres of old growth understory thinning will occur; portions of these stands provide cover to the overall 533 total acres identified as cover in the project area. Alternative 2 will thin trees up to 21" diameter and Alternative 3 will only thin up to 6" diameter within the 458 acres of old growth. Under both alternatives the majority of cover in old growth is provided by trees approximately 6" diameter and smaller. However retention clumps will be designated and will still be left to break up sight continuity.

The riparian stringers along Indian Ford Creek provide security cover for elk and deer during calving/fawning season. Under Alternative 2, treatments to thin trees will occur in a zone starting at 12 feet from the streams edge. Only trees which can be removed without affecting shade will be thinned. In the short-term, this may remove some cover adjacent to the stream, however in the long-term treatments will promote the growth of riparian vegetation for species such as willow, aspen, ocean spray, etc. providing better cover for fawns and calves as well as, forage base adjacent to the creek. Alternative 3 will accomplish less intensive thinning by hand, so riparian growth may not be as robust, but conditions for aspen and other species as well as conifers will improve to a lesser degree.

The entire 1,192 acre Glaze project area is in a designated motorized vehicle closure. Therefore, there are no open roads within the project area. This provides optimum habitat effectiveness and minimizes disturbance from motorized vehicles.

As a result of both Alternatives 2 and 3, even with the design criteria of leaving unthinned cover clumps, this project is expected to change how mule deer and elk utilize the area. The area is very popular and frequently visited by local birders as well as Black Butte Ranch home owners who live adjacent to the project area. There is also a horse back riding operation that operates from Black Butte Ranch stables within the project area. With this continued level of use and with the overall reduction in cover, deer and elk use will concentrate in areas where there is less human use. However, this is a small portion of mule deer summer/transition range, and on the landscape cover calculation, based on both the SAFR and Glaze projects meet forest standards and guides of 30% (31% over Glaze and SAFR in summer/transition range).

Alternative 2 and 3- Cumulative Effects

Several large vegetation management projects have occurred in the low elevation ponderosa pine that is used as both transition and winter range over the past several years. These projects include Highway 20, Canal Thinning, Black Butte Ranch Fuels, and Underline. Within these project areas, there has been an overall decrease in hiding cover. An increase in forage has also occurred. This forage increase may have helped to increase the health and vigor of resident herds, leading to increased survival rates. Overall approximately 10,146 acres were thinned in the areas associated with winter and transition range.

Private lands are not managed for big game habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term.

Use and movement through the ponderosa pine stands across the district is expected to change over time as additional cover develops providing more security in areas with high open road densities and allowing the deer to utilize these areas more thoroughly due to the added security provided. (17,250 acres of thinning associated with Flymon and SAFR Project).

Cover was analyzed on a landscape basis with the SAFR project due to the small size of the Glaze project area. Overall, Alternatives 2 and 3 will reduce cover within the project area but will not reduce cover below Forest Plan standards and guides for the area. Treatments are minimal and cover will be retained in the project, although there are minor incremental impact from the loss of cover, the project will not cause an overall reduction in the population for the area. Cumulatively, this project will not cause a trend toward federal listing of mule deer or elk as a result of this project.

Consistency with the Deschutes Land and Resource Management Plan

Wildlife standard and guidelines WL-52 through WL-59 were assessed for deer. The project is consistent with the Deschutes Land and Resource Management Plan. There are no Key Elk Habitat Areas within the project therefore elk standards and guidelines do not apply and were not analyzed. However, hiding cover to protect elk from disturbance can be met from deer hiding cover within the project area.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
Outside Allocated Deer Habitat		
WL-53 – Target open road densities are 2.5 miles per square mile to achieve deer summer range habitat effectiveness targets.	Not Applicable	The Glaze project proposes no new roads or any road closures.
WL-54 – Hiding areas must be present over at least 30% of National Forest land in each implementation unit excluding stands identified as black bark.	Meets	Within the SAFR and Glaze project areas 31% of the forest outside of black bark stands that has been identified as hiding cover will be retained.
WL-55 – Hiding areas will be dispersed throughout the implementation unit.	Meets	Acres to be left as hiding cover are scattered throughout the project area. In addition 10% of each individual unit will be left in retention clumps.
WL-56 - Travel corridors will be provided by linking stands (to assist in meeting hiding cover needs).	Meets	Connectivity Corridors have been identified to connect the SAFR project to the Glaze project area.
WL-57 – Hiding areas are assumed to provide suitable thermal cover conditions on summer range.	Meets	Hiding cover definition was used on the summer range.
WL-58 – If possible, a narrow strip of trees should be left along roads to reduce view distances.	Not Applicable	The Glaze project area is within a designated area closure for motorized vehicles.
WL-59 – Approximately 10% of treated black bark pine stands will be in clumps that will provide visual screening throughout the area.	Meets	There will be 10% retention clumps left in all units, including units identified as black bark.

No Mitigation Measures are required.

LANDBIRDS

FOCAL BIRDS SPECIES/BIRDS OF CONSERVATION CONCERN

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.

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 of 1973. Bird species considered for inclusion on lists in this report include non-game birds, game birds 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 Endangered Species Act listing. The goal is to prevent or remove the need for additional Endangered Species Act 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 Glaze Forest Restoration Project Area – BCR 9, Great Basin. Table W-10 lists 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 Glaze Forest Restoration project area.

Table W-10. Bird Conservation Region 9 (Great Basin) BCC 2002 list.

Bird Species	Preferred Habitat	Habitat within the Glaze Forest Restoration 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	No
**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	No
Sage Sparrow	Sagebrush	No
Tricolored Blackbird	Cattails or Tules	No

*Woodpeckers are addressed in the Snag and Log Section

** The project area contains seasonally wet meadow habitat. These meadows are generally dry by June. The meadows do not contain marsh type habitats which the above species utilize. Therefore, the project area does not contain habitat for these species. The East Cascades Bird Conservancy is currently monitoring the project area and has historic birding lists of the area. None of the above species have ever been identified within the project area.

Landbird Strategic Plan

The Forest Service 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. Table W-11 lists specific habitat types highlighted in that document, the habitat features needing conservation focus, and the focal bird species for each.

Table W-11. 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

Eleven species are identified from these lists with the potential to be found within the Glaze 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, Williamson's sapsucker, and black-backed woodpecker. The remaining species will be addressed as they relate to specific habitat associations.

The East Cascades Bird Conservancy has established monitoring plots within the project area to assist the Forest Service in determining which species are found in the project area. This determination is based solely on visual or auditory observances.

Ponderosa Pine– Lewis’ Woodpecker

Habitat for the Lewis’ woodpecker, a migrant in this part of its range, includes old-forest, single-storied ponderosa pine. 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). 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).

Although there are approximately 874 acres of ponderosa pine dominated plant associations, there is limited quality habitat for Lewis’ woodpecker in the project area. The project area consists of green stands and the Landbird Conservation Strategy identifies focal habitat to be patches of old burned forest, therefore this analysis includes this species because of its association with ponderosa pine habitat, and its status as a focal species in the Land Bird Conservation Strategy.

The Whychus Watershed Analysis shows acres dominated by big trees (over 21 inches DBH) have decreased by 88% since 1953 (USDA 1998). In addition, a large portion of the ponderosa pine within the Whychus Watershed are dominated by small trees(9-21 inches DBH) and bitterbrush, snowbrush, and manzanita now dominate some sites (USDA 1998).

The Lewis’ Woodpecker is not known to use the project area and habitat is limited.

Environmental Consequences

Analysis Issue: What are the effects of the project to the Lewis’ Woodpecker?

Measure : Acres of fuels treatments within ponderosa pine habitat.

Alternative 1 - No Action - Ecological Trends

Increasing stand densities perpetuate the problem of losing large structure over time which these species require for suitable nesting and foraging habitat. In dense stands, smaller trees will require a longer period of time to develop into suitable habitat due to competition for nutrients. It also minimizes nest site availability, which could increase competition for existing sites between species and may lead to greater risk of predation. Increasing stand densities may increase the risk of loss from wildfire. These species require snags for nesting and utilize softer snags (moderate decay). These structures would be consumed more rapidly with increased fire intensities and may lead to large areas of the landscape being unsuitable if such an event were to occur.

Alternative 2 and 3- Direct and Indirect Effects Common to both Alternatives

There will be no known direct impacts to Lewis’ woodpeckers. However, disturbance may occur during treatments which may result in altering their foraging locations or behavior. Approximately 873 acres of ponderosa pine habitat are proposed for treatment. However, green trees 21 inches and

greater will not be removed. In addition, large snags are not targeted for removal, but there is a possibility for incidental loss of snags during treatments.

Thinned areas will be more open which should benefit Lewis' woodpecker. Thinning will open up sight distances around nests, which should help this species with avoiding predators around nest sites. In addition, the thinning will reduce ladder fuels associated with large trees. Ladder fuel reduction will decrease the risk of losing the remaining large trees. Removal of the understory in overstocked stands will decrease the competition for nutrients and water, which should also lower the susceptibility to insects and disease. An important benefit to thinning is the reduction in beetle caused mortality (Cochran and Barret 1999).

Currently, there are a limited number of large snags and trees available as well as replacement large trees. Many of the future large trees are within overstocked stands, which will increase the amount of time the trees will take to get to the desired size and height. Thinning overstocked stands will reduce competition which should increase growth rates to the remaining trees. Cochran and Barret (1999) were able to show that years after thinning there were large differences in average tree sizes among different group stocking levels. They also showed that growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees. Increasing growth rates will benefit Lewis' woodpecker by creating more available suitable habitat.

Mowing and burning will reduce both activity fuels and overall fuel loadings to acceptable levels. Reduction of fuels will reduce fire risk and will reduce competition to established trees, further increasing the stands resiliency to wildfire. Prescribed natural fire will also create small isolated areas of foraging habitat from incidental fire killed trees.

Alternative 3- Direct and Indirect Effects

Alternative 3 would only remove trees 6" and less within 428 acres of old-growth. Understory densities would remain higher. Alternative 3 will leave a greater amount of ladder fuels in the canopy of the old-growth leaving them susceptible to crown fire and continued competition with the understory for resources adding stress to the large trees. This may reduce the amount of snags available in the long-term for nesting, due to the loss of trees at a higher rate from understory competition.

On a stand exam plot-average basis, approximately 72% of the acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality. Under Alternative 3, the percentage of the project area that is above the upper management zone can only be reduced to 38% as opposed to 25% under Alternative 2.

Additionally, the use of averages to characterize stand densities can be a little misleading because the use of averages masks the fact that areas of stands where there is a significant component of trees greater than the thinning diameter limit (e.g., 6" or 21") that are above the upper management zone before treatment will remain above the upper management zone after treatment, even though the stand average is below the upper management zone. A higher diameter limit will allow for more acres to be thinned to sustainable densities (i.e., below the upper management zone) than a smaller

diameter limit. Consequently, Alternative 2, with a diameter limit of 21" diameter will allow for more stand density reduction within late old structure stands than Alternative 3.

Mitigation Measures are required (See Mitigation Measures for Snags)

Landbird Conservation Strategy Consistency

Biological objectives are all based on “where ecologically appropriate” meaning actions must occur within the proper habitat addressed in order to be consistent or not.

Species	Biological Objectives	Consistent Yes, No, or NA	Rationale
Lewis' Woodpecker In Ponderosa Pine Stands:	Through natural events or management, maintain >1% of landscape as post-fire old ponderosa pine forest habitat	NA	Prescribed fire will be used within the Glaze project, which should mimic historic fire events.
	Through natural events or management, maintain >50% of the post-fire landscape as unsalvaged	NA	This is not a fire salvage project.
	Where salvage is occurring in post-fire old ponderosa pine forest, (in burns >100 acres) salvage <50% of the standing and down dead	NA	This is not a fire salvage project. No snags will be salvaged.
	Where salvage is occurring in post-fire old ponderosa pine forest, (in all burns) retain all trees/snags >20" diameter and >50% of those 12-20" diameter	NA	This is not a fire salvage project. No snags will be salvaged.
	In all burns, snags should be clumped and hard and soft decay classes left to lengthen period of suitable habitat	NA	This is not a fire salvage project. No snags will be salvaged.
	In old forest habitat, provide 24 snags/acre >9" diameter and of these 6 snags/acre should be >20" diameter	NA	No snags will be salvaged in connection to this project.
	In old forest habitat, provide recruitment snags especially in areas of high risk stand replacement fire	Yes	Green Tree Replacements will be left for future snag recruitment.
	In old forest habitat, provide shrub understory of >13% cover	Yes	Within 10-20% of all thinning areas that will be left untreated shrubs levels will be left at higher levels.

Mixed Conifer/Ponderosa Pine, Edges and Openings Created by Wildfire – Olive-sided Flycatcher

Breeding habitat for the olive-side flycatcher primarily occurs in conifer forests and is associated within forest burns where snags and scattered tall live trees remain; near water along the wooded shores of streams, lakes, rivers, beaver ponds, marshes, and bogs, often where standing dead trees are present; at the juxtaposition of late- and early-successional forest such as meadows, harvest units, or canyon edges; and in open or semi-open forest stands with a low percentage of canopy cover (Altman and Sallabanks 2000). It forages mostly from high, prominent perches at the top of snags or the dead tip or uppermost branch of a live tree.

This bird species has been steadily declining since 1966. Factors potentially related to the decline of the species on it's breeding grounds include: habitat loss through logging, alteration of habitat from forest management practices including clearcutting and fire suppression, lack of food resources, and reproductive impacts from nest predation or parasitism. It may seem that by mimicking natural disturbance regimes by selective cutting or clearcutting we are providing habitat for this species, but, it appears to be more dependent on early post-fire habitat. The latter may provide what appears to be post-fire habitat, but it could be lacking in some attributes or resources required by the olive-sided flycatcher (Hutto 1995).

As a result of bird monitoring conducted by the East Cascades Bird Conservancy the Olive-sided Flycatcher is a species that has been identified using the project area. It has been identified using old growth ponderosa pine stands adjacent to Glaze Meadow.

Environmental Consequences

Analysis Issue: What are the effects of the project to the olive-sided flycatcher?

Measure: Acres of prescribed burning in ponderosa pine stands

Alternative 1 - No Action - Ecological Trends

The olive-sided flycatcher has been identified utilizing the old growth ponderosa pine which occurs on approximately 458 acres, although the majority of the project area provides habitat. With no action currently suitable habitat would become denser, and eventually lose habitat components needed by the olive-sided flycatcher. Existing dense stands would continue to fall apart due to tree mortality, and eventually they will open up as trees fall and provide habitat. This alternative would leave the stands in a dense condition, making them susceptible to fire, which could benefit this species by providing early post-fire habitat it needs. However, there is a risk that no green trees would be left due to the intensity of the fire and burned areaswould only provide habitat for this species in the short-term until trees fell.

Alternative 2 and 3- Direct and Indirect Effects

The majority of the project area provides habitat due to the diversity of the habitats found. The project area provides wooded streamside vegetation with beaver dams as well as tall old-growth adjacent to a natural edge provided by Glaze Meadow. Treatments under both alternatives will alter the vegetation within all the described forested habitats. However, under both alternatives treatments would improve habitat for this species.

Both alternatives propose to thin from below maintaining the tallest and healthiest trees in all stands. The difference between the two alternatives is the extent of the thinning. Alternative 3 proposes to thin trees up to 6" diameter within 458 acres of old growth, and thins less within the Riparian Habitat Conservation Areas because only hand thinning of trees will occur. Under Alternative 2, understory thinning in the 458 acres of old growth will occur on trees <21" diameter, and the use of equipment over frozen ground allows more thinning within the Riparian Habitat Conservation Area.

Although the species has not been identified using the Riparian Habitat Conservation Area's in the project area, literature review identifies the species preference of riparian habitat and both alternatives will be beneficial. Both alternatives will promote maintenance of the tall overstory trees as well as promote growth of future overstory trees. Although Alternative 2 is a more broad scale and a more intensive treatment, both alternatives will promote long-term habitat. Alternative 3 is a more conservative approach and density reduction will not be as thorough. On a stand exam plot-average basis, approximately 72% of the acres in the project area are above the upper management zone and considered at risk for bark beetle (mountain and western pine beetle) mortality. Under Alternative 3, the percentage of the project area above the upper management zone can only be reduced to 38% as opposed to 25% under Alternative 2.

Additionally, the use of averages to characterize stand densities can be misleading because the use of averages masks the fact that areas of stands where there is a significant component of trees greater than the thinning diameter limit (e.g., 6" or 21") that are above the upper management zone before treatment will remain above the upper management zone after treatment, even though the stand average is below the upper management zone. A higher diameter limit will allow for more acres to be thinned to sustainable densities (i.e., below the upper management zone) than a smaller diameter limit. Consequently, Alternative 2, with a diameter limit of 21" diameter will allow for more stand density reduction within late old structure stands than Alternative 3, reducing understory competition maintaining overstory old growth and providing nesting/perching and foraging habitat for the olive-sided flycatcher in the long-term. Treatments may change use patterns within the project area by opening up stands, however 10-20% of each treatment unit will be left untreated maintaining density and structural diversity in the stands that will still provide habitat.

The olive-sided fly catcher has also been identified as being dependent on post-fire habitat. Prescribed natural fire on approximately 874 acres will incidentally kill individual understory and an occasional overstory tree. These habitats will be beneficial for short-term foraging from attracted insects to the area.

Long-term benefits to olive-sided flycatchers are expected from both alternatives.

Alternative 2 and 3- Cumulative Effects

Cumulative effects to all landbirds are discussed at the end of this section.

Landbird Strategy

Biological objectives for olive-sided flycatcher habitat in mixed conifer/ponderosa pine stands with edges and openings created by wildfire were assessed. Although there are no stands identified as mixed conifer within the project area, this species is known to occur and utilizes the extent of the project area, therefore conservation criteria are utilized for this project.

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	Not applicable	This is not a post fire salvage project.
Where ecologically appropriate in mixed conifer through natural events or management maintain: >40% of the post fire landscape as unsalvaged.	Not applicable	The project is not a fire salvage project.
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	Not applicable	The project is not a fire salvage project.
Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: retain all trees/snags >20" diameter and >50% of those 12-20" diameter	Not applicable	The project is not a fire salvage project.
Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: retain all trees/snags >20" diameter and >50% of those 12-20" diameter	Not applicable	The project is not a fire salvage project.
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	Not applicable	The project is not a fire salvage project.

No Mitigation Measures are required.

Open Habitats/Open Understories with Regenerating Pines – Chipping Sparrow

The chipping sparrow is a low-tree/ground-nester that uses open overstory ponderosa pine and lodgepole pine (Marshall et al. 2003). This species prefers open coniferous forests or stands of trees interspersed with grassy species or other areas of low foliage suitable for ground foraging (Farner 1952). In Central Oregon, they are found in good numbers in juniper, ponderosa pine, and lodgepole pine forests. This bird species feeds primarily on seeds of grasses and herbaceous annuals, adding insects and other invertebrates when breeding (Middleton 1998). Habitat changes have brought on increased risk of cowbird brood parasitism and competition with house sparrows and house finches

(Middleton 1998). Both the old growth and second growth stands provide habitat within the project area on approximately 874 acres.

As a result of bird monitoring conducted by the East Cascades Bird Conservancy the chipping Sparrow is a species that has been identified using the project area.

Environmental Consequences

Analysis Issue: What are the impacts of the project to the chipping sparrow?

Measure: Acres of fuels reduction within ponderosa pine stands

Alternative 1 - No Action - Ecological Trends

Risks to chipping sparrow habitat will continue due to increased fuel loading from fire suppression, which causes increased stand densities. The densely stocked stands that currently exist impact this species by reducing the open areas. Potential habitats that occur adjacent to densely stocked stands are more susceptible to wildfire, due to increased fuel loadings and ladder fuels from the last 100 years of fire suppression. Under the no action alternative habitat will continue to be at an increased risk to insect, disease, and wildfire.

Alternative 2 - Direct and Indirect Effects

Treatments under this alternative will thin 458 acres of late old structure ponderosa pine allowing for better development of herbaceous ground vegetation. The proposed treatments would increase the growth of remaining trees, and fewer small pines would remain. Blackbark pine will be thinned over approximately 416 acres and open stands. The treatments will move the ponderosa pine towards conditions that better meet the habitat requirements of chipping sparrows. Thinning from below will create a more open understory. Each thinning unit will retain 10-20% of untreated habitat leaving pockets of shrubs and regenerating pine. Understory thinning would occur on trees 21" diameter and less throughout the project area. Thinning would replicate naturally occurring densities across the project area. Nesting habitat for chipping sparrows would occur within untreated wildlife areas. Mowing and prescribe natural fire will also occur reducing shrub densities in the stands, and increasing an open grassy understory. With a variety of treatments occurring across the project in ponderosa pine more habitat should be available for chipping sparrows post treatment. These treatments will move ponderosa pine closer to historical conditions.

Alternative 3- Direct and Indirect Effects

Under this alternative 458 acres of late old structure trees will be thinned with a 6" diameter limit. Densities would remain greater in these areas. Some potential nesting habitat may be removed by thinning. However, similar to Alternative 2, 10 % of all units will be left untreated providing adequate nesting habitat. With a variety of treatments occurring across the project in ponderosa pine, more habitat should be available for chipping sparrows post treatment. However, due to the diameter limits, treatments to late old structure will not provide as much future habitat as that in Alternative 2. Overall, these treatments will move ponderosa pine closer to historical conditions.

Alternative 2 and 3- Cumulative Effects

Cumulative effects to all landbirds are discussed at the end of this section.

Landbird Strategy

Biological objectives for chipping sparrow habitat in open understory ponderosa pine with regenerating pines are assessed. The project meets objectives outlined in 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	In areas identified for thinning, mowing, and burning 10% of each unit will be left untreated to provide herbaceous ground cover with shrubs and regeneration pines.
Where ecologically appropriate... maintain or provide: 20-60% cover in the shrub layer	Meets	In areas that are identified for thinning only, the current shrub layers will remain. In areas identified for mastication and burning, shrubs will be removed. However, small isolated pockets should remain post treatment.
Where ecologically appropriate... maintain or provide: >20% of shrub layer in regenerating sapling conifers especially pines	Meets	In areas that are identified for thinning only, the current shrub layers will remain. In areas identified for mowing and burning, shrubs will be removed. However, small isolated pockets should remain post treatment.
Where ecologically appropriate... maintain or provide: 10-30% mean canopy cover	Meets	Thinning from below will occur and canopy cover will be opened in some areas, but denser canopy covers will be left in untreated areas and within retention clumps.
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	With a variety of different treatments identified in ponderosa pine a mosaic of tree and shrub densities will remain.

No Mitigation Measures are required.

Mixed Conifer/Ponderosa Pine, with interspersed grassy openings and dense thickets – Flammulated Owl and Brown Creeper

The flammulated owl is a focal species for fire climax ponderosa pine and mixed conifer dry habitats. Preferred habitat is typically a mosaic of open forests containing mature and old growth ponderosa pine and Douglas-fir trees, interspersed with dense patches of second growth providing roosting areas. All stands with a significant component of mature and old growth trees are considered potential habitats. This owl will nest in medium to large snags 6.2" to 51.6" diameter

with a mean of 24.5" diameter (Mellen et al. 2006). It forages primarily on arthropods and insects (USDA 1994).

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" diameter to 42" diameter. In northeastern Oregon, creeper abundance was positively associated with the height of the canopy and density of trees. (Marshall et al. 2003). 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.

There are currently 458 acres of late old structure that provides potential habitat within the Glaze project area.

No formal surveys have been completed for flammulated owls and it is unknown if they occur within the project area. As a result of bird monitoring conducted by the East Cascades Bird Conservancy the Brown Creeper is a species that has been identified using the project area.

Environmental Consequences

Analysis Issue: What are the impacts of the project to the flammulated owl and brown creeper?

Measure: Number of acres of fuels reduction within brown creeper habitat. The amount of mature forest that will receive fuels treatments that open up the understory.

Alternative 1 - No Action - Ecological Trends

Existing shrub layers in suitable habitat limit the available forage base for the owl by decreasing plant diversity due to competition. This may discourage some arthropods and insects from occupying these sites. It also hinders foraging attempts due to the somewhat limited maneuverability of flammulated owls with dense shrub structure (USDA 1994).

As stand densities continue to increase it perpetuates the problem of losing large trees over time from competition and disturbance events. These species needs these trees for suitable nesting and foraging habitat. Loss of large trees also limits the number of available nest sites, resulting in more competition for existing sites between species. Increased stand densities may increase the risk of wildfire. This species requires snags for nesting and utilizes softer snags (moderate decay). In the event of fire softer snags are lost and replaced with hard snags, limiting nesting habitat until developed by primary cavity excavators.

Currently there are a limited number of large trees available for potential use for the brown creeper. Replacement large trees are a concern. Many of the future habitat trees are within overstocked stands, which will increase the amount of time the trees will take to get to the desired size.

In the long-term, habitat for the brown creeper may still be limited. Habitat is not static and in the short term (<50 years), may be reduced in quality or lost due to environmental factors such as insects, disease, and/or wildfires.

Alternative 2 and 3- Direct and Indirect Effects

There will be no known direct effects to flammulated owls or the brown creeper. Approximately 458 acres of mature forest will receive thinning and fuels treatments. However, green trees 21 inches and greater will not be removed. There is a possibility for incidental loss of snags during treatments. Generally, snags would be avoided, however as a result of State health and safety regulations some may need to be cut. This would be minimized by placing landing away from snags if possible to avoid the issue and reduce impacts to snags.

Thinned areas within flammulated owl/brown creeper habitat will have less ladder fuels around large trees. Ladder fuel reduction will decrease the risk of losing the remaining large trees. In addition, removal of the understory in overstocked stands will decrease the competition for nutrients and water, which should also lower the susceptibility to insects and disease. An important benefit to thinning is the reduction in beetle caused mortality (Cochran and Barret 1999). The 10% retention clumps that will occur within treatments units will create dense thickets next to openings, which should benefit flammulated owl habitat.

Currently, there are a limited number of large snags and trees available as well as replacement large trees. Many of the future large trees and snags occur within overstocked stands, prolonging development of trees of the desired size and height. Thinning 416 acres of overstocked second growth stands will reduce competition which should increase growth rates to the remaining trees. Cochran and Barret (1999) were able to show 30 years after thinning there were large differences in average tree sizes among different group stocking levels. They also show growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees.

Prescribed natural fire will occur on approximately 874 acres within the project area. Treatments will benefit the flammulated owl creating an open grassy understory, providing foraging habitat within both mid seral and old growth ponderosa pine stands. These same treatments will also provide short-term foraging habitat for the brown creeper from incidental fire killed trees, when the bark begins to slough.

Overall the proposed treatment will maintain old growth ponderosa pine stands and accelerate the development second growth ponderosa pine stands providing both nesting and foraging habitat for flammulated owl and the brown creeper on 874 acres.

Alternative 2 and 3- Cumulative Effects

Cumulative effects to all landbirds are discussed at the end of this section.

Landbird Conservation Strategy Consistency

Biological objectives are all based on “where ecologically appropriate” meaning actions must occur within the proper habitat addressed in order to be consistent or not.

Species	Biological Objectives	Consistent Yes, No, or NA	Rationale
Flammulated Owl In Mixed Conifer/Ponderosa Pine Late- Successional Stands	Provide >10 snags/100 acres >12" diameter and >6 ft tall	Yes	No snags are targeted for removal.
	Provide >8 trees/acre >21" diameter for recruitment	Yes	There will be no trees 21 inches diameter or greater targeted for removal. In addition the thinning should accelerate the development of future 21 inch diameter trees.
	Provide at least 1 large or 2 smaller dense, brushy thickets of sapling/pole trees for roosting	Yes	10% of each treatment unit will be left in retention clumps, which should supply the desired thickets.
	Provide at least 1 large or 2 smaller grassy openings	Yes	In the areas that mowing and burning are occurring, grassy openings are expected post treatment.
Brown Creeper – Large trees	Where ecologically appropriate initiate actions in mixed conifer forests to maintain or provide: blocks of late-successional habitat >75 acres	Yes	The project will be a thin from below. Therefore, the larger trees will remain on the landscape post activity.
	Where ecologically appropriate initiate actions in mixed conifer forests to maintain or provide: >4 trees/acre >18" diameter with at least 2 trees >24" diameter	Yes	The project will be a thin from below. Therefore, the larger trees will remain on the landscape post activity.

Mitigation Measures are required (see Mitigation Measures for snags).

Aspen – Red-naped Sapsucker

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 provide food for other birds, insects, and mammals. Their diet includes sap, cambium, soft parts beneath bark, insects found under bark, and berries. (Marshall et al. 2003).

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 aspen stands on the Sisters Ranger District have experienced conifer encroachment and are in need of conifer removal or fire.

There are three major aspen stands in the project area totaling approximately 79 acres. In addition there are 73 acres of hardwood plant association groups identified within the within the project boundary. Within the riparian zone of Indian Ford Creek there are also various occurrences of aspen trees.

As a result of bird monitoring conducted by the East Cascades Bird Conservancy the red-naped sapsucker is a species that has been identified using the project area.

Environmental Consequences

Analysis Issue: What are the effects of the project to the Red-naped Sapsucker?

Measure: Acres of conifer reduction within aspen and other hardwood stands.

Alternative 1 - No Action - Ecological Trends

The no action alternative will continue to allow the advancement of conifer species into aspen stands and eventually replace the aspen with conifer communities without some type of disturbance.

Alternative 2 and 3- Direct and Indirect Effects

There will be no known direct effects to red-naped sapsuckers. Approximately 79 acres of aspen will be thinned and burned. In addition, under Alternative 2, approximately 51 acres of the Indian Ford creek riparian area is proposed for thinning and prescribed fire. There may be incidental loss of snags during treatments. Generally, snags would be avoided, however as a result of State health and safety regulations some may need to be cut. This would be minimized by placing landing away from snags if possible to avoid the issue and reduce impacts to snags.

Aspen restoration is a small-scale treatment within the project area but will result in increased habitat diversity. Small openings will stimulate growth of herbaceous plants and induce suckering of aspen. Treatments will benefit aspen stands in the long-term and create suitable habitat for the red-naped sapsucker. Incidental numbers of aspen may be cut under these alternatives to facilitate the thinning operation and openings will be created from conifer removal.

Alternative 2 and 3- Cumulative Effects

Cumulative effects to all landbirds are discussed at the end of this section.

Landbird Conservation Strategy Consistency

Biological objectives are based on “where ecologically appropriate”, meaning actions must occur within the proper habitat addressed in order to be judged consistent or not.

Species	Biological Objectives	Consistent Yes, No, or NA	Rationale
Red-naped Sapsucker In Aspen Stands	Provide >10% cover of saplings	Yes	Treatments in aspen stands are designed to increase the aspen sapling cover percentage.
	Provide >1.5 trees and >1.5 snags per acres at least 39 feet tall and 10 inches in diameter	Yes	Treatments will be removing live conifers, so aspen and conifer snags will remain. In addition, large aspen will not be removed.
	Initiate actions in aspen habitat to maintain or provide some areas with natural or mechanical disturbances.	Yes	Treatments will be a mechanical disturbance to reduce the competition from conifers.

Mitigation Measures- See mitigation measures for snags.

Cumulative Impacts to all Landbirds

Within low elevation ponderosa pine stands on lands managed under the direction of the Eastside Screens, 12,579 acres provide nesting and foraging habitat for the flammulated owl and brown creeper. The Highway 20 and Black Butte Ranch Fuels vegetation management projects have occurred or will occur on approximately 8,223 acres. Overall, treatments proposed will reduce the risk of loss of existing habitat from large-scale disturbances. Stand densities (regenerating trees) and shrubs were reduced within treatment units, impacting habitat in the short term until shrubs regenerate. Mowing and burning were widely prescribed and will maintain grassy understories, which should benefit flammulated owls and chipping sparrows. In addition, the SAFR project proposes thinning from below similar to the above mentioned projects on approximately 3,022 acres, creating more suitable habitat for flammulated owls and chipping sparrows.

Approximately 52,577 acres of olive-sided flycatcher habitat exists within low elevation pine stands on lands managed under the direction of the Eastside Screens. These stands provide nesting, foraging, or a variety of both due to the stands proximity to past regeneration harvest or their location near streamside habitat. Several vegetation management projects have occurred or will occur within suitable habitat (Black Butte Ranch Fuels, Highway 20, Canal 16 Thinning, Canal 16 Underburn and Underline Thinning) totaling approximately 10,146 acres. Overall, treatments proposed will reduce the risk of loss of existing habitat from other large-scale disturbances. Tree densities and shrubs were reduced within treatment units impacting habitat for the short term until shrubs regenerate. Mowing and burning were widely prescribed and will maintain grassy understories with regeneration shrubs. Measures were incorporated to retain large trees as well as

enhance habitat conditions. Treatments proposed 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.

Red-naped sapsucker habitat is tied to aspen habitat which is limited on the Sisters Ranger District and within low elevation pine stands in lands managed under the direction of the Eastside Screens. Only 36 acres of aspen is associated with these areas outside of the Glaze project. The Whychus Aspen project is a foreseeable future project that proposes to implement conifer removal on 30 acres of aspen stands. Treatments will reduce competition between conifers and aspen and stimulate regeneration, but will not remove any aspen. This project will enhance future nesting and foraging habitat for the red-naped sapsucker.

Private lands are not managed for flammulated owls, chipping sparrow, olive-sided flycatcher, or brown creeper habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term.

Overall, treatments will be beneficial to all above listed species and will create more contiguous stands of old growth as well as contiguous stands of suitable habitat. Incremental impacts to these species are minimal and habitat will not be reduced. In the short-term, use of the area by species may change due to the change in composition and structure of these stands.

Cumulatively, the alternatives will not lead to a trend toward federal listing for the chipping sparrow, olive-sided flycatcher, flammulated owl, brown creeper, or red-naped sapsucker.

The Birds of Conservation Concern addressed above were analyzed to show effects of the Glaze Project. To better understand how these bird species are doing over a larger scale, the Breeding Bird Surveys (BBS) were used to look at population trends within Oregon (Sauer et al. 2005). Table WL-12 shows the predicted trends in habitat over time for the Sisters Ranger District on the Deschutes National Forest.

Table WL-12. Trend data from BBS for Birds of Conservation Concern

Bird Species	Trend in Population*
White-headed woodpecker	Slight Increase
Pygmy nuthatch	Slight Increase
Lewis' woodpecker	Slight Decline
Pileated woodpecker	Slight Increase
Williamson's sapsucker	Slight Decline
##Flammulated owl	Decline
** Red-naped sapsucker	Slight Increase
Brewer's Sparrow	Slight Decline
Chipping Sparrow	Decline
Olive-sided Flycatcher	Sharp Decline
Brown Creeper	Slight Increase
##There is no data in the BBS for flammulated owls. However source habitat has decreased according to (Wisdom et al. 2000).	
*Information from BBS 1966-2004 (Sauer et al. 2005).	
** In the BBS three species of sapsuckers are combined for Oregon.	

Table WL-13 shows predicted changes in habitat over time for the Sisters Ranger District of the Deschutes National Forest.

Table WL-13. Predicted changes in habitat over time for cavity nesters for the Sisters Ranger District.

Bird Species	Trend in Population	Reason for Change
White-headed woodpecker	Increase	Increase in thinning and prescribed fire acres, which will increase late and old structural ponderosa pine forests also reducing mid-story and lessens fire risk.
Pygmy nuthatch	Increase	Increase in thinning and prescribed fire acres, which will increase late and old structural ponderosa pine forests.
*Lewis' woodpecker	Increase	Increase in uncharacteristic fire within ponderosa pine creating habitat.
Pileated woodpecker	Decrease	Increase in uncharacteristic large wildfire events resulting in a reduction of late successional mixed conifer stands.
Williamson's sapsucker	Decrease	Increase in uncharacteristic large wildfire events resulting in a reduction of late successional mixed conifer stands.
Flammulated owl	Decrease	Increase in uncharacteristic large wildfire events resulting in a reduction of late successional mixed conifer stands.
Red-naped sapsucker	Increase	Wildfire and mechanical treatments of aspen stands.
Chipping Sparrow	Increase	Increase in prescribed fire acres, which will increase grassy openings within ponderosa pine forests.
Olive-sided Flycatcher	Decline	Increase in uncharacteristic large wildfire events resulting in large tracts of stand replacement fires, which reduces available edge habitat.
Brown Creeper	Decline	Increase in uncharacteristic large wildfire events resulting in a reduction of late successional mixed conifer stands.

*Increase for Lewis is not as a result of risk reduction project such as Glaze, but because of the amount of uncharacteristically large wildfires that have occurred on the District from 2002 to 2007.

Fisheries

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Soil Resources Report for this project (Riehle, M. 2008). Additional information is contained in the full specialist report.

Desired Future Condition

The desired future condition for Indian Ford Creek and the channel within the Glaze Meadow would include meeting the INFISH Riparian Management Objectives (USDA Forest Service 1995). These include meeting shade guidelines to maintain water temperatures in the range for redband trout, sustain flow in late summer to hold fish and reduce fine sediment. Wood recruitment is maintained to provide adequate cover and stream channel stability. Connectivity with the upstream spring fed reaches and the lower meadow reaches to Whychus Creek are maintained by open fish passage at road crossings, adequate water quality and adequate connecting flow to the mouth.

Existing Condition

Redband Trout and Steelhead Trout

Genetic integrity of native redband trout in Indian Ford Creek has not been tested but there are questions of the potential impact of introduced rainbow strains in the pond upstream on Black Butte Ranch. Whychus Creek redband were found to have less than 2.3% hatchery fish genetic contribution (Phelps et al. 1996). The potential for fish to migrate to Indian Ford Creek is rare, and the genetic make up of trout in Indian Ford Creek in relation to Whychus Creek is unknown.

Density of redband trout in Indian Ford Creek has not been measured. Electrofishing samples conducted in the early 1991 showed redband trout ranging from 35 mm to 145mm. Longnose dace and sucker were also sampled (Riehle 1992). Crayfish are present in Indian Ford Creek (McGuire et al. 1996).

In a review of historic distribution of anadromous fish in the upper Deschutes River Basin, no steelhead trout were reported in Indian Ford Creek prior to the dams blocking fish runs (Nehlsen 1995). It is possible that rearing steelhead could swim upstream of Whychus Creek and enter Indian Ford Creek but the probability is low because of the intermittent connection to Whychus Creek and the lack of spawning habitat in Indian Ford Creek at the time of steelhead spawning. At this time steelhead trout are not released upstream of Indian Ford Creek and therefore Indian Ford Creek is not considered habitat for steelhead trout.

Fish Passage/Connectivity was surveyed at selected culverts. The culvert just downstream of the project area on the abandoned railroad grade is noted as having a jump and narrow bankfull width, making it a fish passage barrier. No culverts on Indian Ford Creek occur in the project area.

Bull Trout and Chinook Salmon

Bull trout have been found to rear in Whychus Creek near Alder Springs, 12 miles approximately downstream from the mouth of Indian Ford Creek. No recent reports or historic reports of bull trout have been confirmed in the area of Indian Ford Creek and therefore Indian Ford Creek is not considered habitat for bull trout.

Chinook salmon have been reported to have used Whychus Creek to spawn and rear near Alder Springs. Reintroduction of Chinook salmon fry to Whychus Creek is planned for 2009 but will not be planned for Indian Ford Creek. No historic reports of Chinook using Indian Ford Creek have been found and the habitat in the fall is not connect and not suitable for Chinook spawning. Indian Ford Creek is not considered habitat for Chinook salmon. Chinook salmon habitat in Whychus Creek is listed as Essential Fish Habitat under the Magnuson-Stevens Act, which protects habitat for commercially significant ocean fisheries.

Indian Ford Creek Habitat

Habitat surveys were conducted using level II protocol in the project area in 1991, during the period of cattle grazing. Subsequent data on selected attributes have been repeated in the following years. A total of 1.1 miles of fish bearing stream are within the project area, all of which is Indian Ford Creek. There are three intermittent channels that feed into Glaze Meadow wetland and one that exits the meadow and flows into Indian Ford Creek. There is little evidence of fish in Glaze Meadow when water occurs there but there has been a report from the public of fish in the meadow during wet periods. Another seasonal wet channel parallels Indian Ford Creek along the north boundary of the project area but that valley has little evidence of surface water.

Pools were estimated to be 5% of the channel but beaver ponds added a substantial amount of pool habitat above the scour or wood formed pools (Riehle 1992). One beaver pond at the time increased pool habitat to 53% of the channel area in 1991. That beaver pond no longer exists but a new series of ponds has been created by beaver downstream of Black Butte Swamp. Little of the channel in 1991 was considered riffle (25%) and most was typed as glide (65%), now considered mostly pool habitat under the current protocol (Riehle 1992).

In the 1991 stream survey in the project area, in-stream wood densities ranged from 37-44 logs >12 inches diameter, 35 ft long per mile. This density of logs is above the Riparian Management Objective minimums from INFISH.

Fine sediment/gravel was the dominant substrate type which offers little habitat for spawning fish, fry cover or invertebrates. Fine sediment may be a limiting factor for invertebrates based on sampling done from Indian Ford Creek. Embeddedness was estimated to exceed 35% during the 1991 survey (Riehle 1992).

Stream bank condition was low during the grazing period in 1991, particularly in the forested reach on the east end of the project area. Stream bank vegetation was between 26 to 50%. Without grazing, the existing condition of this same reach meets the Riparian Management Objectives at 91% streambank stability (McGuire et al. 1996).

Water temperature does not meet the desired condition for redband trout habitat. Maximum temperatures in the years 1984, 1994 and 1995 approached or exceeded 19°C in August (Riehle 1992, McGuire et al. 1996). The 2000 Forward Looking Infrared (FLIR) survey shows a dramatic increase in temperature as Indian Ford Creek leaves Black Butte Ranch land. Stream temperatures at the springs in Big Meadow were measured at 6.5°C on July 28, 2000, and measured at 19.1°C just 1.3 miles downstream (Watershed Sciences 2000, Table FH-1). The INFISH objectives for summer water temperature to be less than 15°C (USDA 1995)(Table FH-1).

Table FH-1. Water temperature monitoring in the Glaze Forest Restoration Analysis Area (from Hydrology report).

Stream	Period of record	Max 7-day ave. max. temperature	Max. 7-day ave. max. 2003 ODEQ water temperature criteria
Indian Ford at headwater springs	July 28, 2000	6.5°C**	18°C
Indian Ford Ck at Black Butte Ranch*	1996-1997	19.3°C	18°C
Indian Ford Ck below Glaze Allotment*	1993, 1994, 1996-2001, 2003	20.9°C	18°C
Indian Ford Ck at 2058 rd	1998 - 2002	19.4°C	18°C
Indian Ford at 025rd at lower end of USFS bdy	2000, 2003	18.4	18°C

* within Glaze Forest Restoration Project area

** one time recording

Flow in Indian Ford Creek is not consistent in the project area in years of drought. Irrigation and domestic use of water on Black Butte Ranch reduces summer flows to the point that the channel has been dewatered immediately downstream of the project area (personal observation in 2005, M. Riehle). Abrupt changes in flow on a daily basis can strand fish, and cause harmful changes in temperature and dissolved oxygen. These combined effects can kill redband trout and the invertebrates they depend on for food.

The stream has signs of recent beaver dam activity (Unit 11, see Figure H-1, Hydrology Section). One dam located just downstream of Black Butte Swamp, is ponding water into the ponderosa pine forest to the southwest and flooding a permitted horse trail (Figure FH-1). Another set of dams is located downstream for approximately 300 yds. This ponding of stream flow has caused inundation of trails, a trail bridge, a road crossing on the 1012345 rd, and a seasonal seep on the 2000300 rd. This beaver activity is increasing the flooded area of the creek between Black Butte Swamp and the eastern boundary of the project. Some mature aspen are being felled into the stream by the beavers and in small patches the canopy is being opened, allowing the small aspen and shrubs to be released and to grow more vigorously.

While the project area was grazed with cattle prior to 1995, shade was a concern, even in the big leaf sedge areas of Black Butte Swamp. With the grazing, the shade in the meadow reaches was as low as 36% in 1991 (McGuire et al. 1996). In its current condition, without cattle grazing, the big leaf

sedge can grow tall enough to provide adequate shade in the meadow reach. This reach also has birch and willow that provides some shade.

Riparian vegetation is important in the project area for fish habitat because the most dominant cover for fish was found to be overhanging or aquatic vegetation. This is particularly important in the meadow reaches. The diverse shrub, tree and emergent sedge community along Indian Ford Creek is important for shade, fish cover and organic matter inputs for stream invertebrates. Deciduous trees and shrubs loose their leaves in the fall and the litter fall is an important food source for various invertebrates that are important trout prey.

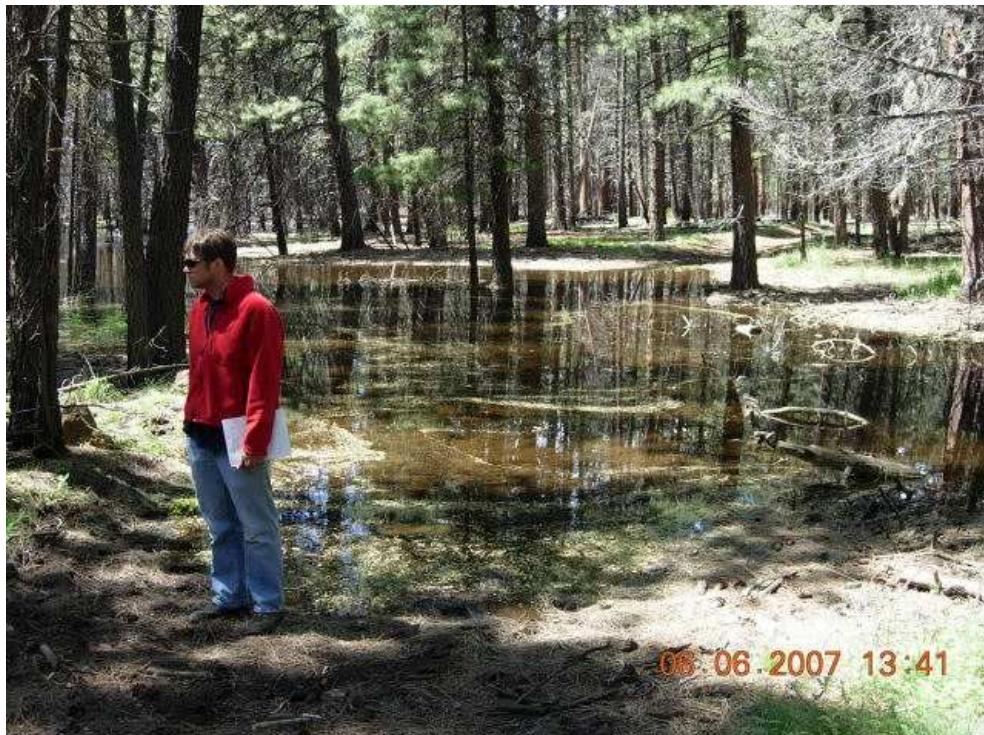


Figure FH-1. Beaver pond flooding ponderosa pine forest adjacent to Indian Ford Creek at the 1012345 rd crossing.

Glaze Meadow and Associated Wetlands

The ephemeral channel that flows from the south end, northward along the east side of Glaze Meadow was once an intermittent, if not a perennial stream. With the increase use of water use on private land upstream, the Glaze Meadow channel is now dry, except in winter of wet years. The channel has been manipulated for water management and pond creation and is now considered a ditch. It has been reported by the public that fish use the stream when water is in the meadow, perhaps moving upstream from Indian Ford Creek or downstream from upstream ponds on private land. The channel has been sampled for amphibians, but no fish have been found to date. It is possible that with more frequent flow the stream was once habitat for redband trout. The connection of this ditch to Indian Ford Creek is intermittent and flows out of Glaze Meadow to the northeast into Indian Ford Creek through a narrow forested area that separates the meadow and the creek.

Other channels that feed surface water into Glaze Meadow flow seasonally from the northwest side of the project area into the meadow. Surface flow from this wetland arm into the meadow in the spring contributes to a pond on the north end of Glaze Meadow and is used by water fowl. There has been no sampling in the pond for fish presence.

There is a meadow arm to the west of Glaze Meadow proper with seasonal open water and an aspen/lodgepole stand. This aspen/lodgepole stand complex divides the project area in half, running from west to east. There is some surface flow running through the aspen area (Figure FH-2). In many areas of this low land, tree root balls pulled up after blow down have left small ponds in the depression.



Figure FH- 2. Meadow northwest of Glaze Meadow, spring 2006.

Environmental Consequences

A Fish Biological Evaluation (BE) was prepared to document and review the findings of the Glaze Forest Restoration Project for potential effects on species that are listed or proposed for listing by the US Fish and Wildlife Service as Threatened or Endangered; or designated by the Pacific Northwest Regional Forester as Sensitive; or required consultation with the National Marine Fisheries Service under the Endangered Species Act or 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 effects of the project were assessed using redband trout habitat requirements. Other fish species that are sympatric with these species have similar habitat requirements as those associated with the listed species. Listed species are surrogates for the other species and their habitat needs. Effects to fish and fish habitat were considered for the proposed activities, together with past projects, present and the reasonably foreseeable projects listed below. When appropriate, particular projects that are

specifically related to the effects analysis are discussed in more detail. The timing of the effects of the project effects are in the range of decades after the project is implemented. In the example of sedimentation, the effects of past projects and future projects may last until adequate flows occur to move the substrate.

NOTE: Effects of the project to Riparian Habitat Conservation Areas are discussed in the Hydrology Section.

Past, Present and Reasonable Foreseeable Actions Considered in the Analysis of Fish Habitat

The projects listed below are activities that were considered to have some influence on the Indian Ford Creek and fish habitat that require further analysis for determining cumulative effects of the Glaze Forest Restoration Project. Due to the spring fed nature of Indian Ford Creek and much of the source of water rises on Black Butte Ranch, the wildfires such as Cache Mt. Fire, Black Crater Fire and GW Fire were considered not to contribute to changes to fish habitat to any meaningful extent. This projects listed below all occur or have occurred in the project area and overlap the project area or may occur in the project area in the future.

- 1) Fire suppression since early 1900's
- 2) Grazing since 1880's and ditching
- 3) 1930's logging that removed old growth (see 1943 historic photo)
- 4) Highway 20 Fuels reduction (1990's and ongoing)
- 5) Black Butte Ranch ponds and creek channel manipulations
- 6) Glaze grazing allotment (closed in mid 1990's)
- 7) Grazing on private lands- Black Butte Ranch & downstream
- 8) Black Butte Ranch sewage effluent (point source pollution in winter)
- 9) Black Butte Ranch wells & irrigation
- 10) Irrigation withdrawals downstream
- 11) Black Butte Stables Horse operation and trails
- 12) Road maintenance
- 13) SAFR Project

Alternative 1 -No Action- Ecological Trends

Water Temperature (stream shade)

For Essential Fish Habitat for Chinook salmon, and Mid Columbia steelhead trout, water temperature criteria is between 10 and 13.8°C for an appropriately functioning system (NOAA criteria, programmatic Biological Assessment, USDA and USDI 2003). Although some reduction in stream temperature (2°C) occurs as water flows through Black Butte Swamp (Watershed Sciences 2000), the stream will continue to exceed the water temperature criteria under no action.

Under the No Action Alternative no shade will be removed and no change in flood plains will occur, other than natural processes occurring from beaver activity along the stream. Riparian trees will

continue to grow in places that are cut by beaver. The in long –term, no change to water temperature will occur on Indian Ford Creek because there will be no long-term change to the canopy of riparian zone vegetation.

No long term changes are expected because no action will occur in the riparian zone other than natural processes. No shade will be removed, and no measurable change in stream temperature is expected to occur (see Hydrology section for Oregon Department of Environmental Quality – ODEQ temperature analysis).

Streambed Embeddedness (percent gravel/cobble embeddedness)

There will be no change to streambed embeddedness under the No Action Alternative. Fine sediment is high and embeddedness is expected to remain high because of the low frequency of high lows to flush the fine sediments. No change to sediment will occur from no action on Indian Ford Creek because no change will occur to the riparian zone vegetation or channel processes.

Large Wood (number of large wood pieces per mile)

No change to fish habitat would occur as a result of the No Action Alternative allowing natural processes to continue. In the 1991 stream survey in the project area, in-stream wood densities ranged from 37-44 logs >12 inches diameter, 35 ft long per miles. This density of logs is above the Riparian Management Objective minimums from INFISH (Table 2). No change to wood recruitment would occur that would affect fish habitat in water bodies within or downstream of the project area because no trees will be removed. Wood would be allowed to fall into the stream as it does now (though dominated by small sizes) and no change in the number of large wood pieces per mile would occur. There would be no change to fish habitat at the watershed scale.

Pool Frequency/ Pool Quality (pools per mile, pool depth, pools with large wood)

There will be no change to pool frequency and quality. No wood will be removed from channel of flood channels. Pools will not change because no actions will be taken to change wood recruitment or in stream wood. Alternative one would not change fine sediment delivery from current levels because roads would not be closed or decommissioned under this alternative. Current levels of fine sediment are not filling pools, nor would it affect pool temperature. No changes from no action are expected. No effect to pools will occur from no action on Indian Ford Creek because no change will occur to the riparian zone vegetation or channel processes.

Off-Channel Habitat (percent side channels and off-channel pools)

Under the No Action Alternative floodplains and streamside areas will not be treated. There is no effect to off channel habitats from no action on Indian Ford Creek because no change will occur to the riparian zone vegetation or channel processes.

Spawning Gravel Quality (percent fine sediment in spawning gravel)

Fine sediment will not be affected in the No Action Alternative because current sedimentation rates will not be changed. No effect to spawning gravel will occur from no action on Indian Ford Creek because no spawning habitat will be changed.

Fish Passage (number of stream miles with fish passage)

Fish barriers in the form of irrigation dams will not be altered in this alternative and therefore no effect to fish passage will occur, either directly, indirectly or cumulatively. No effect to fish passage will occur on Indian Ford Creek because no change will occur to culverts.

Refugia (fish passage, water temperature, spawning and rearing habitat quality)

There will be no effects to fish habitat refugia because stream temperature will not be impacted, spring fed reaches will not be changed, and off channel habitats and pools will not be changed. No changes to refugia will occur on Indian Ford Creek because habitats will not be altered.

Streambank Condition (percent stream bank instability, channel width to depth ratio)

There will be no change to stream banks because road use or prescribed fire will not occur along stream banks of Indian Ford Creek under no action. Stream stability will not be affected because flow regime of Indian Ford Creek will not be impacted and floodplains complexity will be retained in no action. No change to width to depth ratios will occur for similar reasons. Therefore, no change will occur to stream bank condition. No changes to streambank condition will occur on Indian Ford Creek because the riparian zone vegetation or channel processes will not be changed.

Floodplain Connectivity (distance of road fill restricting floodplain)

There will be changes to floodplains during floods other than natural scour and fill because no actions will occur in floodplains. In those reaches that have restricted floodplains, no change will occur from existing condition. No changes to floodplain connectivity will occur from no action on Indian Ford Creek because riparian zone vegetation or channel processes will not be altered.

Alternatives 2 and 3 – Direct, Indirect and Cumulative Effects

The effects on fish and fish habitat are presented in this section are combined for Alternatives 2 and 3. In most cases, the effects are the same and are presented together. Where there are differences, they are noted separately.

Zone of Influence

The analysis includes site specific effects to fish habitat in Indian Ford Creek and the Riparian Habitat Conservation Area. The zone of influence of the cumulative analysis also includes the project area and the influence on Indian Ford Creek that could occur at the sixth field (Indian Ford Creek Subwatershed) and fifth field (Whychus Creek) watershed level.

Fish Populations

Measure: Disturbance to Individuals

Direct and Indirect Effects

The temporary bridge installation and removal will require machinery to cross Indian Ford Creek approximately 14 times. In addition, clean gravel (<50 cubic yds) will be left at the crossing to narrow the stream and reduce the washing of fine sediment into the stream during future use of the ford. The activities will result in a minor turbidity in the stream for a short term timeframe, 20

minutes or less. No additional fine sediment will be added to the stream. The crossing will mobilize silt that already is in the streambed. This moving of fine silt downstream may disturb individual redband trout on a short term basis but will not adversely affect redband trout because the amount of sediment is minor, it is not an addition of sediment and it will be done at a time of year that will avoid effects to spawning fish or incubating embryos and fry. Survival of fish will not be reduced and the number of fish that could be disturbed temporarily is estimated to be about 15 fish or less. Due to the short duration, low magnitude and limited frequency of this disturbance, this effect on redband trout is minor and will not impact the population or its viability.

Cumulative Effects

Within the subwatershed and project area, there are infrequent crossings of the stream by the recreational outfitter and the clients on the trails in the project area. These crossings generally occur in the summer, when the bridge may be installed and removed and may add to the disturbance of fish on a short term basis but is still in a minor scale and short duration to not lead to mortality of fish or harm to the population. The additional disturbance of the bridge work is minor compared to the number of crossings from horses during a summer period. The combined effects of disturbing the fish are local, and affect only a few individuals (estimated to be less than 15 fish) and would not reach fish outside of the project area. The disturbance of fish from the bridge installation and removal and the horse trail crossings is minor, short term and limited to a small number of fish. Other projects listed a past, present or future foreseeable will not contribute to disturbance of fish because they are not in-stream or disturbing fish.

The cumulative effect on disturbance of fish is not adverse because of the small scale of the effects and will not impact the viability of the population of fish in the creek.

Measure: Water Temperature (stream shade as measured by shade modeling)

Direct and Indirect Effects

The project proposes to thin along the Riparian Habitat Conservation Area of Indian Ford Creek and install a temporary Acrow bridge at the road crossing on Indian Ford Creek. Mowing brush and prescribed burning is also proposed in the Riparian Habitat Conservation Area.

Water temperature will not change under Alternative 2 or 3 because the riparian thinning is not expected to change shade in Indian Ford Creek due to no cut buffers and restrictions on size of trees intended to protect shade and large wood (see Hydrology report for analysis). No indirect effects to stream temperature will occur because shade producing trees will not be removed. No adverse effects to fish habitat will result.

The temporary bridge will push some shrubs over to the side approximately 4 ft during installation. The shrubs will not be uprooted. The shrubs will remain on site and will be allowed to grow over the stream once the bridge is removed. The bridge will shade the stream while it is in place. No measurable change in stream shade or stream temperature will occur and no adverse effects to fish habitat will result (see Hydrology report).

Prescribed burning will not affect the Indian Ford Creek water temperature because the treatments are outside of the shade zone of Indian Ford Creek (See Hydrology report). No adverse effects to fish habitat will result.

Cumulative Effects

There will be no cumulative effects on shade or stream temperature from this project because there are no project effects to shade expected. Indian Ford Creek will remain at the same temperature as pre-project. No change in water temperature is expected in the Glaze project area or downstream in Indian Ford Creek or Whychus Creek (see Hydrology report for analysis). No other past, present or future foreseeable projects will influence shade or stream temperature. No cumulative effects to water temperature are expected from this project.

Measure: Streambed Embeddedness (percent gravel/cobble embeddedness)

Streambed gravels provide habitat for invertebrates that are the main food for redband trout in the stream and gravel also provides spawning habitat for the trout. Gravels clean of fine sediment such as sand and silt provides spaces in the gravel that have increased water flow within the gravel bed. This is important to both invertebrate production and fish embryo survival. Clean gravel can also provide cover for small fish to hide. Embeddedness is a measure of how much the surface gravel particles are covered, or embedded, in fine sands and silts.

Direct and Indirect Effects

The temporary bridge installation and removal in both action alternatives will require machinery to cross Indian Ford Creek approximately 14 times. In addition, clean gravel (<50 cubic yds) will be left at the crossing to narrow the stream and reduce the washing of fine sediment during future use of the ford. The activities will result in minor turbidity in the stream for a short term timeframe, approximately 20 minutes each pass. No additional fine sediment will be added to the stream, only mobilizing silt that already is in the streambed. On a short term basis, washing some minor amounts of the fine silt (that already is in the channel) downstream will not have a direct or indirect effect on redband trout habitat. The turbidity will not adversely affect redband trout habitat because the amount of sediment is minor, it is not an addition of sediment and it will be done at a time of year that will avoid effects to spawning fish or incubating embryos and fry (see Fish Populations section).

Sedimentation in Indian Ford Creek from activities associated with the Action Alternatives would be negligible because minimal detrimental soil acres would occur in Riparian Habitat Conservation Areas and haul road effects would be mitigated (see Hydrology report for analysis of road use, thinning with low impact equipment, burning, mowing and hand thinning).

No direct or indirect effects to gravel quality or sediment in Indian Ford Creek are expected to result from the action alternatives. No change is expected in gravel embeddedness or the percentage of fines in substrate rearing habitat or invertebrate habitat in Indian Ford Creek.

Cumulative Effects

In the long term (in the next few decades), no cumulative effects to streambed embeddedness will occur from the Glaze Forest Restoration Project. No negative or adverse effects to redband trout habitat in Indian Ford Creek or Whychus Creek will result. The connection of Indian Ford Creek to Whychus Creek is intermittent and the proximity of the rearing and spawning habitat to Whychus

Creek make for an unlikely connection most years. For this reason, no effects are likely to steelhead trout introduced to Whychus Creek because no steelhead are present or expected to be present during the project.

The project area is in the middle of the Indian Ford Watershed Area with Black Butte Ranch in the headwaters and Indian Ford Allotment in the lower subwatershed, within the cumulative effects analysis area. The Glaze Forest Restoration Project will have no cumulative impact on the redband trout habitat in the watershed because the project will only have temporary disturbance of sediment in relation to the temporary bridge installation and removal. The sediment effect is the temporary mobilization of sediments, not the overall addition of sediments from roads or logging trails in the Riparian Habitat Conservation Area. The small amount of sediment mobilized during the bridge work is short term, 20 minutes each pass, and not long term.

The bridge activity will not combine with other projects in the watershed to have a cumulative effect on fish habitat because there are no instream projects known to occur at the same time. Stream crossings do occur with the outfitter guide trail permit in the project area during the summer but these crossings do not contribute a measurable amount of sediment that would change streambed embeddedness in Indian Ford Creek. Other projects occurring in the project area or the subwatershed would not combine with the bridge activity to have a cumulative effect because the bridge activity will not add fine sediment to the stream.

Measure: Large Wood (number of in-stream large wood pieces per mile)

Direct and Indirect Effects

In both action alternatives, hand thinning near the stream will only remove smaller conifers that do not provide shade along Indian Ford Creek and therefore would only remove small trees within the first 50ft along the stream. In the outer zone of the Riparian Habitat Conservation Area thinning with low-impact equipment would occur along approximately 1.2 miles of Indian Ford Creek Riparian Habitat Conservation Area under Alternative 2. In Alternative 2 , small trees (generally < 8" diameter) would be removed between 12 ft -50 ft from the Indian Ford Creek Riparian Habitat Conservation Area, and only trees less than 16" diameter would be removed between 50 ft – 100 ft. These trees would not qualify as large wood if their tops fell into the stream. Because there are no debris slide or landslide prone areas within the project area, the primary wood recruitment areas in the Glaze Forest Restoration project area is approximately 100 ft on each side of a channel (Benda et al. 2002). No large wood recruitment will be removed from the primary recruitment zone and stand densities will remain adequate to provide wood recruitment into the future decades (see Hydrology report). Thinning small trees from the 100ft wood recruitment zone may have a slight, long term beneficial effects of increasing growth on large trees and providing larger wood to the stream in future decades.

Within the floodplain, wood that could contribute to floodplain function will be left on site. Some wood will be removed by hand from Riparian Habitat Conservation Area that will not contribute to the Riparian Management Objectives because wood is moved to existing roads for removal or by burning. Wood in floodplains will be left on site.

Since no large wood that contributes to in-stream habitat will be removed, and no wood will be removed from active flood channels, there will be no effect directly or indirectly on in-stream wood and habitat for fish. There may be a long term slight beneficial effect on growth of riparian conifers that might eventually contribute large wood to the stream in future decades.

Cumulative Effects

There are no expected cumulative effects to large wood or pool development in the short term. Beaver activity may contribute some wood to the stream in the short term. Therefore, no cumulative effects to large wood densities or future recruitment rates are anticipated.

The area of analysis for cumulative effects on large wood is the Riparian Habitat Conservation Area within the project. Large wood is not moved by high flow because the stream is too small and the spring-fed flow is not large enough to flood and float wood. Recruitment of wood is from the riparian area adjacent to the channel. There are no short term effects to large wood or recruitment of large wood to Indian Ford Creek from the Glaze Project because no large trees are going to be removed from the 100ft recruitment zone. Because no large wood is removed from the 100ft wood recruitment zone in this project, no effect to large wood from this project will combine other past timber sales in the project area or present thinning in the subwatershed (Black Butte Fuels) or any future foreseeable projects (SAFR) (none of these projects will remove large wood from the 100ft recruitment zone of the stream).

Measure: Pool Frequency/ Pool Quality (pools per mile, pool depth, pools with large wood)

Direct and Indirect Effects

Pool frequency or pool quality will not be affected by the Riparian Habitat Conservation Area thinning treatments, burning or upland treatments in the action alternatives because in-stream wood will not be changed because of thinning set backs, the flow regime will not be changed and stream stability will not be changed (see Hydrology section). Pool formation processes will not be changed in the action alternative and therefore pools will not be directly or indirectly affected. Fish habitat will be maintained in the long term by promoting large tree character in the Riparian Habitat Conservation Area by thinning small trees within the primary recruitment zone. This benefit will maintain large tree development over future decades. Fish habitat will be maintained as large tree are recruited to the stream and form pools through natural processes.

Cumulative Effects

There are no cumulative effects to pools or pool quality expected for this project because no effects are expected at the site specific scale or over the subwatershed scale because wood recruitment will be protected. No past, present or future foreseeable projects will affect pools in the project area and therefore no cumulative effects on pools are expected.

The analysis area of influence is the reach within the project boundary. Large wood that forms pools is not transported in this stream and therefore the primary agent of pool formation is large wood within 100ft of the stream. No other projects in this reach will effect large wood and combine to have a cumulative effect with the Glaze Forest Restoration Project.

Beaver activity downstream of Black Butte Swamp and within the project area is within the stream corridor and selected aspen trees are currently being cut down. This will add to wood in-stream in the short term but these trees being cut are primarily aspen and small in size. This activity, combined with damming the creek will increase pool habitat in the short term, over the next few decades. This will potentially improve habitat for redband trout in the short term. Since the Glaze Project will not impact pools in-stream, there will be no cumulative effect on pools or fish habitat.

Measure: Off-Channel Habitat (percent side channels and off-channel pools)

Direct and Indirect Effects

No measurable direct or indirect effects will occur to side channel formation or off channel pool development from the burning, thinning and road use. In-channel projects that will effect off-channel habitats will not be done and thinning of smaller trees and the retention of wood in the flood plain will protect floodplain and in-stream wood. The temporary bridge installation and removal will not affect off-channel habitats because it will not alter the streambed outside of the existing road crossing. Mobilization of fine sediment will be short term (20 minutes each pass) and will not be to the magnitude to impact off-channel habitats downstream. Because the near stream riparian area will not be altered, there are no direct and indirect effects to off-channel habitats. No adverse effects to fish habitat will result.

Cumulative Effects

There are no cumulative effects to off-channel habitats because no measurable effects will result from the project at the site specific or watershed scale. Other ongoing, future or past projects will not contribute to this project to impact off-channel habitats.

The project area is located in the middle of the subwatershed, downstream of Black Butte Ranch and the springs which form Indian Ford Creek. The analysis area for cumulative effects on off-channel habitats is within the Indian Ford subwatershed. The Glaze project is not expected to influence off-channel habitats within the project area or within the subwatershed. Other projects that could impact off-channel habitats, such as side channels, could be the fluctuation of flow during the irrigation season upstream of the project area on Black Butte Ranch. At times the flow downstream of the project area becomes low enough to make some side channels too shallow to use by redband trout. The effects of water use on the stream will not combine with the effects of Glaze Project because the Glaze Project will not impact off-channel habitats. No other past, present or future foreseeable projects will have an impact on off-channel habitats.

Due to the temporary nature of the bridge installation and the small amount of turbidity mobilized during the crossing of the stream during installation and removal, the scale of the change from the project is small and not measurable on off-channel habitats and will not contribute cumulative effects to redband trout habitat.

Measure: Spawning Gravel Quality (percent fine sediment in spawning gravel)**Direct and Indirect Effects**

Sedimentation in Indian Ford Creek from activities associated with the Action Alternatives would be negligible because minimal detrimental soil acres would occur in Riparian Habitat Conservation Areas and haul road effects would be mitigated (see Hydrology Report).

Sedimentation to fish habitat from prescribed burning, hand thinning and road use in the Riparian Habitat Conservation Area will not have a measurable change on Indian Ford Creek because no increased in detrimentally compacted soil will occur and no fire line will be constructed in the Indian Ford Creek Riparian Habitat Conservation Area (see Hydrology report). Although minimal disturbance and compaction could occur in the Riparian Habitat Conservation Area from low impact ground based equipment, it would not be to the magnitude, extent, or duration to cause sedimentation in Indian Ford Creek. Soil effects from low impact ground-based equipment and mowing within the Riparian Habitat Conservation Area surrounding wetlands is not expected to cause sedimentation in Indian Ford Creek or to create excessive sedimentation in the wetlands (see Hydrology report). Because of the flat terrain and low erosion risk to the soil, no measurable increases in sediment reaching the stream will occur (see Hydrology report).

Log haul would not cause sedimentation in Indian Ford Creek because no new roads would be constructed within the Riparian Habitat Conservation Area. In addition, no landings would be constructed in Riparian Habitat Conservation Areas. Roads used in the Riparian Habitat Conservation Area will not increase runoff and sedimentation because water bars would be installed and haul will be during frozen conditions and on relatively flat ground.

The temporary bridge on Indian Ford Creek will cause a temporary increase in turbidity during installation and removal (estimated a few hours). Only fine sediment already instream will be mobilized and therefore no net increase in the sediment is expected. The short term increase in turbidity is not expected to measurably change the fine sediment percentage in spawning or rearing habitat downstream of the crossing. Some disturbance of individuals is expected in the immediate vicinity of the bridge. Only a few fish would be disturbed (estimated to be less than 15 fish), for a short period of time (2 hours) and would not impact survival or spawning success because no added amount of sediment would be added to the stream. For these reasons, the direct and indirect effects from the project are expected to be negligible. No adverse effects to fish habitat will result.

Cumulative Effects

No cumulative effects on stream sediment or fish spawning and rearing habitat are expected from past, present and future foreseeable projects and the Glaze Forest Management project.

The analysis area for cumulative effects on sediment involves the Indian Ford subwatershed. The temporary bridge could influence the stream downstream for several hundred yards from the turbidity caused by crossing the stream during installation and removal. This is not expected to combine with other projects in the subwatershed because there are no other projects which might cause a temporary increase in turbidity in the subwatershed. The stream is primarily spring-fed and no other in-stream projects causing turbidity near or upstream of the Glaze Project are foreseen. Due

to the short term nature of the bridge installation and removal, no overlap with other project effects in the subwatershed is expected.

The bridge installation and removal, along with the existing recreation use on trail crossings of the creek are not expected to contribute to measurable cumulative effects to the fish spawning and rearing habitat in Indian Ford Creek. Trail maintenance along the near stream area will reduce sedimentation to the stream and the effects from the Glaze Forest Management Project will not contribute to these effects. Sedimentation at the fifth field watershed scale will not be affected because no measurable increases in sediment delivery are expected from this project. Past influences from channel work upstream on Black Butte Ranch may still have an influence on the substrate quality of the creek but no added effects from Glaze Forest Management Project are expected.

Measure: Fish Passage (stream miles with fish passage)

Direct, Indirect and Cumulative Effects

There is no change to fish passage proposed in the action alternatives, and there will be no direct, indirect or cumulative effects to fish passage. Fish passage is limited by a culvert downstream of the project area but this project will not affect fish passage at the watershed scale because no in-stream work is proposed that would change fish passage.

Measure: Refugia (fish passage, water temperature, spawning and rearing habitat quality)

Direct, Indirect and Cumulative Effects

There is no change to refugia proposed in the action alternatives, and there will be no direct, indirect or cumulative effects. Refugia will not change because there is no change proposed for sediment, shade, fish passage or other habitat features. There will be no cumulative effects from this project that could contribute to the effects of other activities in the watershed.

Measure: Streambank Condition (percent stream bank instability, width to depth ratio)

Direct, Indirect and Cumulative Effects

There is no change to streambank condition proposed in the action alternatives, and there will be no direct, indirect or cumulative effects to streambanks. Streambanks will not be burned in fuel treatments and no change to flow regime or channel width will result from upland treatments (see hydrology section). A short 10 ft. long length of streambank will be rocked at the 2000300 rd ford after the temporary bridge is removed. This work will result in a slight improvement to the stability of the stream edge but it will not create streambank cover or restore the bank to grow riparian vegetation. The net effect of this work on overall reach or subwatershed scale is negligible. At the site specific scale the 10 ft. of stream edge will have less chance of washing fine sediment when used as a ford. The change in long term bank stability in the reach will remain little changed.

Measure: Floodplain Connectivity (distance of road fill restricting floodplain)**Direct and Indirect Effects**

Under the action alternatives, thinning treatments along Indian Ford Creek will maintain wood in flood plains, and maintain large wood that could potentially fall into Indian Ford Creek. These treatments will not change the frequency of flooding in the floodplain and will not change the exchange of wood between the main channel and the floodplain. Because most of these floodplains are forested, little change to the contribution of wood to the main channel will result because of trapping of floodplain wood in the floodplain by standing trees. Floodplain complexity will be maintained by this retention of floodplain wood. Access to flooded areas will not be changed by this alternative since no roads will be removed or added that restrict the floodplain. Wetlands that are adjacent to Indian Ford Creek will not be changed to effect flooding because no vegetation management will occur along Indian Ford Creek in wetlands.

The temporary bridge will not impact floodplain connectivity because the footings for the bridge will not restrict the channel and the bridge will only be installed for a short term basis. The floodplain will still be functional above and below the crossing and the rock left at the ford in the roadbed will not reduce the floodplain because it will not be high enough to reduce flooding over it. Over the reach and watershed scale there are no effects to floodplains expected from this project.

Cumulative Effects

Because there are no direct or indirect effects to floodplains in the project area or in the subwatershed, no cumulative effects are expected. Other past, present or future foreseeable projects in the watershed will not combine with this project to impact floodplains because this project will not change floodplain connectivity.

Summary of Effects to Fish and Fish Habitat

The effects of thinning the Riparian Habitat Conservation Area along Indian Ford Creek is not expected to cause a measurable change to the rearing or spawning habitat that redband trout would experience in Indian Ford Creek (Table FH-2). The temporary bridge will require crossing the stream with equipment approximately 6 times to install and 6 times to remove and will be limited to a maximum of 14 crossings. Sediment disturbed in this work is not adding a measurable amount of sediment to the creek that would impact fish. The short term disturbance to fish by driving in the stream and causing some short term turbidity is minor and would only impact a few individuals. This impact is short term (20 minutes each time) and is not considered adverse. The in-stream driving would disturb an estimated 15 fish or fewer, but will not decrease their survival or impact the population as a whole.

Table FH-2 Summary of effects of both Alternative 2 and 3 to redband trout and their habitat in Indian Ford Creek from the Glaze Forest Restoration Project.

Measure	Alt 1	Alt 2	Alt 3
Fish Populations- Disturbance to Individuals	no change	MIIH*	MIIH*
Water Temperature	no change	no change	no change
Streambed Embeddedness	no change	no change	no change
Large Wood and wood recruitment	no change	no change short-term, benefit long-term	no change short-term, benefit long-term
Pool Frequency/Quality	no change	no change	no change
Off-Channel Habitat	no change	no change	no change
Spawning Gravel Quality	no change	no change	no change
Fish Passage	no change	no change	no change
Refugia	no change	no change	no change
Streambank Condition	no change	no change	no change
Floodplain Connectivity	no change	no change	no change

* MIIH- May impact individuals or habitat but not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Fish Biological Evaluation- ESA and MSA Fish Effects Determinations

A Biological Evaluation was prepared to document and review the findings of the Glaze Forest Restoration Project for potential effects on listed fish species (Riehle 2008). The results of this evaluation are summarized in Table FH-3

This Biological Evaluation documents the review and findings of the Forest Service planned programs and activities for possible effects on species designated by the Pacific Northwest Regional Forester as Sensitive. It is prepared in compliance with the requirements of Forest Service Manual (FSM) [2630.3](#). The Columbia River Bull Trout (*Salvelinus confluentus*), Mid-Columbia steelhead trout and Chinook Salmon Essential Fish Habitat (*Oncorhynchus tshawytschaw*) are covered for this project under the Endangered Species Act – Section 7 Programmatic Consultation Biological and Conference Opinion And Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation Fish Habitat Restoration Activities in Oregon and Washington, CY2007-CY2012.

The following analysis addresses the potential effects of the Glaze Forest Restoration Project, on sensitive fish species. Changes to the R-6 Regional Forester's Sensitive Species List were instituted on November 28, 2000. Invertebrate species were not included and will not be covered under this BE. Project description and alternative descriptions are presented earlier in this report (page 10-11).

Consultation History

Ms. Jennifer O'Reilly of the USFWS Bend Field Office and Scott Hoefer of National Marine Fisheries Service were contacted by Mike Riehle (Sisters R.D. Fisheries Biologist) via phone and email (September 6-7, 2006). They discussed the conclusions of the Biological Evaluation in regarding the in-stream work in Indian Ford Creek related to the bridge and the proximity of the work to bull trout and steelhead trout habitat in the watershed. It was agreed that the project would not affect bull trout, steelhead trout or chinook salmon because the project was outside of the area occupied by these species and it was unlikely that fish could move into the project area or in the area of influence.

Bull Trout and Chinook Salmon

Because no habitat was documented for bull trout or Chinook salmon, summaries of the effects determinations were not provided. Habitat currently exists downstream of Alder Springs on Whychus Creek for these species. It was determined that no effects will result from the Glaze Project because no habitat exists in Indian Ford Creek or in the area of influence from the project.

The following is a summary of the effects and the determinations for listed fish species that occur in the project area or in the area of influence of the project.

Table FH-3. Table displays the threatened, endangered and sensitive (TES) fish species considered in the analysis of the Glaze Forest Restoration Project.

Species	Scientific Name	Status	Occur-rence	Effects Determination
Aquatic Species				
Columbia River Bull Trout	<i>Salvelinus confluentus</i>	T	HN, N	NE
Mid Columbia Steelhead	<i>Oncorhynchus mykiss</i>	T	HN, S	NE
Interior Redband Trout	<i>Oncorhynchus mykiss</i> ssp.	S	HD, D	MIIH
Chinook Salmon ¹	<i>Oncorhynchus tshawytschaw</i>	MS	HN, N	NE

¹Chinook salmon waters are designated Essential Fish Habitat by the Magnuson-Stevens Act.

Status

E	Federally Endangered
T	Federally Threatened
S	Sensitive species from Regional Forester's list
C	Candidate species under Endangered Species Act
MS	Magnuson-Stevens Act designated Essential Fish Habitat

Occurrence

HD	Habitat Documented or suspected within the project area or near enough to be impacted by project activities
HN	Habitat Not within the project area or affected by its activities
D	Species Documented in general vicinity of project activities
S	Species Suspected in general vicinity of project activities
N	Species Not documented and not suspected in general vicinity of project activities

Effects Determinations

Threatened and Endangered Species

NE	No Effect
NLAA	May Effect, Not Likely to Adversely Affect
LAA	May Effect, Likely to Adversely Affect
BE	Beneficial Effect

Sensitive Species

NI	No Impact
MIIH	May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
WIFV	Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
BI	Beneficial Impact

Chinook Salmon Essential Fish Habitat (Magnuson-Stevens Act)

NAE	No Adverse Effect
AE	Adverse Effect on Essential Fish Habitat

Effects Determination for Redband Trout

Alternatives 2 and 3

Direct: Some minor disturbance of individual fish may occur but this will be temporary (less than 20 minutes at a time) and will not be adverse because of the limited number of trips across the stream (estimated to be 14 crossings) and the small number of fish affected (estimated to be less than 15 trout based on professional knowledge of the area) compared to the entire population.

Indirect: Shade will be protected by not cutting trees that shade the creek. Wood recruitment will be maintained by restrictions on the proximity to be stream on sizes of trees cut. Runoff will be avoided through restrictions on the proximity to the creek that equipment can operate, using low disturbance logging equipment and logging techniques, and operating over frozen ground conditions during mechanical logging. No runoff effects are anticipated because of the low soil impact of the logging methods, relatively flat or gentle slopes, and the low risk of the soil type. Impacts to the wetland from using the logging road crossings will be mitigated by the season of use and the effects of sediment trapping in the wetland itself.

Cumulative Effects: The effects of the project are not measurable and will not be additive to those on private land upstream of the project or those ongoing trail activities conducted by special use permittee in the project area. Trail effects are local in nature and mitigated by trail maintenance required under the permit.

Mitigation measures are required (see Mitigation Measures section in Chapter 2).

Determination: May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species. This determination was made considering that shade will be protected by not cutting trees located along the creek. Runoff will be avoided through restrictions on the proximity to the creek that equipment can operate, using low disturbance logging equipment and logging techniques, and the frozen ground condition during mechanical logging. Any short-term disturbance from turbidity (20 minutes each pass) to a few individuals (less than 15 fish) is not expected to be adverse, nor will it impact the growth or survival of those individuals. No long term effect on the fish or their habitat is expected. No runoff effects are anticipated because of the low soil impact of the logging methods, relatively flat or gentle slopes, and the low risk of the soil type.

Effects Determination for Mid-Columbia Steelhead Trout

Alternatives 2 and 3

Direct: No in-stream work in habitat occupied by steelhead will be done in this project so there will be no disturbance to individuals. No steelhead trout are present in Indian Ford Creek but recent fry releases in Whychus Creek may result in some incidental seasonal rearing at the mouth of Indian Ford Creek, which is outside the project area or area of influence.

Indirect: Shade will be protected by not cutting trees that shade the creek. Wood recruitment will be maintained. Runoff will be avoided through restrictions on the proximity to the creek that equipment can operate, using low disturbance logging equipment and logging techniques, and operating over frozen ground conditions during mechanical logging. No runoff effects are anticipated because of the low soil impact of the logging methods, relatively flat or gentle slopes, and the low risk of the soil type. Impacts to the wetland from using the logging road crossings will be mitigated by the season of use and the effects of sediment trapping in the wetland itself.

Cumulative Effects: The effects of the project are not measurable and will not be additive to those on private land upstream of the project or those ongoing trail activities conducted by special use permittee in the project area. Trail effects are local and mitigated by trail maintenance required under the permit. There is no risk of combined effects downstream to potential steelhead rearing habitat because of the distance to potential habitat (>7 miles) and the lack of impact the project will have on that habitat.

Determination: No Effect to Mid Columbia Steelhead Trout is expected from the Glaze Forest Restoration Project. This determination was made considering that shade will be protected by not cutting trees that shade the creek. Sedimentation will be avoided through restrictions on the proximity to the creek that equipment can operate, using low disturbance logging equipment and logging techniques, and operating over frozen ground conditions during mechanical logging. No runoff effects are anticipated because of the low soil impact of the logging methods, relatively flat or gentle slopes, and the low risk of the soil type. No in-stream work will be done in habitat occupied by steelhead trout so there will be no disturbance to individuals.

Botany/Rare Plants/Invasive Plants

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Botanical Resources Report and Biological Evaluation for this project (Dewey, R. and M. Pajutee 2007). Additional information is contained in the full specialist report.

Desired Future Condition

Peck's penstemon

The occurrence of the rare endemic plant Peck's penstemon within the project area would be well-distributed within existing suitable habitats including forest openings, grassy meadows, and forest and meadow edges and be potentially able to disperse to unoccupied sites where suitable habitat has newly developed. Within forested areas, periodic fire would create canopy gaps, reduce the density of young trees and shrubs, and reduce duff thickness to the point of exposing bare mineral soil. In grassy meadows, thatch height/density and the incidence of shrubs and young trees would be periodically reduced by low intensity fire. Fire intervals would mimic the historic intervals of 4-25 years or an average of every 12 years.

Connectivity of habitat and availability of vectors for pollen and seeds would allow genetic exchange with populations outside the project area and/or establishment of new populations beyond the project area. Local populations would be sufficiently robust and resilient to permit loss of some individuals or habitat, and natural disturbances would not threaten persistence of the species at other than a very local scale within the project area. The desired future condition for this species is derived from the Species Conservation Strategy for Peck's penstemon (USDA Forest Service 2007) and the Whychus Watershed Analysis (USDA Forest Service 1998).

Other Native Plant Species

Varied physical settings would continue to provide a variety of habitats for a collectively high diversity of plant species. Old growth pine forest would include patches early to mid-seral species composition and structure. Aspen stands would exhibit mixed age classes. Wet meadows would exhibit variety in the age and species of included shrubs. Grassy meadows would have a low density of woody species, and a diverse collection of herbaceous species distributed in a complex spatial pattern relating to local topography, patchy, very localized applications of low intensity fire, and surface and subsurface water availability and movement that is relatively unaltered by upslope diversions and use. Where they pass through forested areas, perennial streams include varied size classes of in-stream wood, in various stages of decay, providing habitat for a diversity of non-vascular and small vascular plants. No invasive plants would occur.

Invasive Plant Species

The extent of non-native, invasive plant species would be on the decline. Direction within the existing Forest Invasive Plant Species EA would allow effective treatment of existing sites and prompt treatment of newly discovered sites. Forest staff, contractors and recreationists would be

aware of the primary importance of prevention as a means of limiting the spread of invasive plant species.

Existing Condition

Plant Associations found within the area are described in the Forest Vegetation section of this document. Vegetational Series within the project area (Hall 1998) include ponderosa pine, moist meadows, dry meadows, quaking aspen and willow. Special habitats (generally occupying a small percentage of total area within a larger forested project area) can account for a disproportionately large percentage of biodiversity within larger project areas. Special habitats within the Glaze project area include forest openings and edges, moist and dry meadows, ephemeral pools and intermittent and perennial streams. A pre-field review of the area found the following information.

Threatened, Endangered or Sensitive Plant Species

There are no federally listed Threatened or Endangered plant species known to exist within or nearby the project area. The Deschutes National Forest Sensitive Plant List in effect during the analysis of this project includes 31 taxa, either known or suspected to occur on the Forest. Only one of these taxa is known to occur within the project area. Another 15 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 found in the full specialists report in the project file.

On January 31, 2008 the Regional Forester released an updated version of the Sensitive Species List. In the accompanying letter it states: “The updated Regional Forester Sensitive Species List is included in Enclosure 1 will apply to all projects initiated on or after the date of this letter. Projects initiated prior to the date of this letter may use the updated Regional Forester Sensitive Species List transmitted in this letter or the Regional Forester Sensitive Species List that was in effect when the project was initiated. For the purpose of this letter, “initiated” means that a signed, dated document such as a project initiation letter, scoping letter, or Federal Register Notice for the project exists.” (USDA Forest Service 2008).

The Project Initiation Letter for Glaze Forest Restoration Project was signed on March 6, 2007. The Glaze Forest Restoration Project uses the previous Regional Forester’s Sensitive Species list that was in effect when the project was initiated.

A prefield review was completed for the project area only one sensitive plant species, Peck’s penstemon (*Penstemon peckii*), was found to occur within the project area. No other taxa are considered to have a high probability of occurrence within the project area while four species, the vascular plants Tall Agoseris (*Agoseris elata*), the sedge *Carex hystericina*, the moss *Scouleria marginata* and the lichen *Dermatocarpon meiophyllum* are considered moderately likely to occur within the project area.

Project surveys were conducted during several visits to the project area in the summer of 2006. Surveyed areas included the Glaze Meadow system, Black Butte Swamp, Indian Ford Creek and its associated riparian zone, the aspen community in the southwestern portion of the project area, and

both second growth and old growth ponderosa pine communities. Peck's penstemon was found to be distributed much as depicted by the Forest Sensitive Plant data GIS layers as of 02/2006. No other Threatened, Endangered or Sensitive Plants were located and species above will not be further addressed in the analysis.

An interesting liverwort species was found on the damp sediment of one of several ephemeral pools in the northeastern corner of Glaze Meadow. Abundant rosettes of the thallose liverwort *Riccia cavernosa* were detected. This is a first record of this species, and its subgenus, on Deschutes NF. The species has no special management status.

Background Relevant to Management of Peck's penstemon (*Region 6 Sensitive Species*)

Peck's penstemon is a central Oregon endemic, its range fully included in an area of about 485 square miles centered near Black Butte on the Sisters Ranger District of the Deschutes National Forest. Approximately 238,539 plants are known to exist in the world.

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 species appears well adapted and even dependent on frequent, low intensity fires and 64% of the global population occurs in frequent low intensity fire regime areas (Fire Regime 1) as discussed in the Conservation Strategy for the Species (USDA Forest Service 2007). It is typically found in relatively open forest stands, forest openings, old clear cuts and along roadsides, further supporting the understanding that it acts as an early seral species and benefits 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.

In the past decade, the importance of fire in creating and maintaining Peck's penstemon habitats has been observed in numerous situations. Many Peck's penstemon populations have experienced and flourished after low, moderate and even some high intensity burning during wildfires. After careful study, many prescribed burns have been ignited in forests containing the plant and fire is now considered the preferred tool for Peck's penstemon habitat maintenance (USDA Forest Service 2007).

Peck's penstemon has been observed to respond well to both wildfires and prescribed fires, often increasing greatly in size by producing multiple stems, and plants are often larger in burned area from increased available moisture and nutrient release. Increased sun may also stimulate flowering and pollinators have been seen to be prolific in burned, densely flowering populations. Plants recover quickly from fire, sprouting within weeks (USDA Forest Service 2007).

The two management status categories, "protected" and "managed", are utilized in both the previous (USDA Forest Service 1992) and current (USDA Forest Service 2007) Species Conservation Strategy for Peck's penstemon. Management recommendations of the strategy direct that within "protected" populations, "manipulations of the habitats, forest or meadow, will be designed to specifically maintain, enhance or restore penstemon populations. Treatments employed will be those that have shown through effectiveness monitoring in 'managed populations' to have successfully achieved the desired results." Also with regard to "protected" populations, the Species Conservation Strategy directs that "where penstemon habitat and penstemon population size and vigor appear to require management, enhancement projects should be initiated and may be integrated into larger project plans as opportunities arise."

During such treatments within "protected" populations, only incidental loss of individual plants should be allowed. Populations not given "protected" status automatically assume "managed" status. These populations are to be managed for the enhancement of Peck's penstemon habitat with existing or experimental forest management tools suspected to benefit 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.

Two populations of Peck's penstemon are recognized within the Glaze Forest Restoration Project. Each of these populations is essentially fully included within the Glaze project boundary. The larger of these populations occurs principally in the southern two thirds of the project area. This population has a "protected" management status, and, according to Deschutes National Forest GIS, occupies a total area of 423 acres, 420 of which occur within the project boundary. The second population occurs along the northern edge of the project area. This population, which has "managed" management status, occupies a total area of 0.45 acres, 0.23 of which are within the project boundary.

A little more than a third of the dry ponderosa pine forest within the project area was logged in the 1930's. As reported by Suna (2006) the Peck's penstemon population within the project area (the "Glaze" population) was first inventoried in 1989 during preparation of a draft Species Management Guide by staff of the Oregon Natural Heritage Database. Two permanent macroplots were established at this time. It was noted that cattle grazing had caused a "major disruption of flowering, fruiting, and reproduction" in the Glaze Meadow subpopulation. It was also noted that encroachment by lodgepole and ponderosa pine was occurring.

The Glaze population was resurveyed in 1992 at which time the full Glaze population was estimated to consist of 25,000 clumps. In 1999, grazing was discontinued and a prescribed underburn was conducted on Glaze Meadow.

A resurvey in 2005 noted that while the Glaze Meadow subpopulation appeared to have nearly doubled in size since 1992, the subpopulation within the ponderosa pine forest appeared to have markedly declined. The full Glaze population in 2005 was estimated to consist of 10,500 clumps. Plots revisited in 2006, 13 years after the last monitoring visit, found the population in decline. Duff depths had doubled and number of plant clumps in plots had declined from 260 to 189, a loss of

71 plants. In 1993 a year after the first prescribed burn and several years after a thinning had occurred in the area, 154 flowering stems were observed, in 2006 only 4 flowering stems were seen.

With our current understanding of the ecological behavior of Peck's penstemon, it is believed that the disturbance resulting from prescribed burning, and a sharp reduction in herbivory, have promoted population growth of the meadow subpopulation. Likewise, increasing canopy closure has led to deteriorating habitat conditions for the forest-dwelling Peck's penstemon plants, particularly those in the second growth ponderosa pine forest.

Invasive Plant Species

Aggressive, non-native, invasive plant species can displace native plant communities causing long-lasting management problems. In displacing native vegetation, invasive plant species can increase fire hazards, reduce the quality of recreational experiences, poison livestock, and replace wildlife forage. By simplifying complex plant communities, weeds reduce biological diversity and threaten rare habitats.

Review of a 02/2006 Forest invasive plants GIS layer indicates the presence of five invasive plant species within or immediately adjacent the project area. Although not included on the Forest invasive plant species list, Suna (2006) has reported the presence of cheat grass within the project area. Brief notes on each of these invasive taxa are provided below.

Cheat grass (*Bromus tectorum*): Cheat grass is a species of concern on the Forest. It is widely distributed on the Forest and is generally not tracked in databases or in GIS. This grass is widely known for being a highly aggressive competitor with native herbs and even shrubs, and for the broad range of native plant communities which it infests.

Knapweeds: Two species of knapweed may be adjacent to the project area, spotted knapweed (*Centaurea biebersteinii*) and diffuse knapweed (*Centaurea diffusa*). The knapweeds are understood to be the most aggressive noxious weeds, in upland settings, on Deschutes National Forest. 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.

An occurrence of spotted knapweed was newly documented along the 1012330 road near the southern boundary of the project area.

Bull Thistle (*Cirsium vulgare*): Local observations over the past decade have led to the understanding that bull thistle is not long persistent at specific sites. This is because although this tap-rooted, biennial species 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.

St. Johnswort (*Hypericum perforatum*): St. Johnswort is regarded as an emerging threat, at least on some portions of Deschutes National Forest. This rhizomatous species is causing local concern due to its apparent high rate of spread, and its resistance to manual, chemical and biological controls.

Dalmatian toadflax (*Linaria dalmatica*): Dalmatian toadflax spreads vegetatively by deep rhizomes and is capable of invading relatively undisturbed and open native plant communities. Because it is resistant to manual control, sites of this species are of particular concern, regardless of their size. The documented Dalmatian toadflax site adjacent to the 1012335 road was not relocated in the course of several directed visits and is currently assumed to be no longer extant.

Information concerning invasive plant occurrences within or immediately adjacent to the project area is included in Table B-1 below.

Table B-1. Invasive plant species present within or immediately adjacent to the Glaze Forest Restoration Project boundary. Information sources include the 02/2006 Forest invasive plants GIS layer and field reports from 2005 and 2006.

Scientific Name	Common Name	Weed Site Identifications	Total Net area of Infestation (acres)
<i>Centaurea biebersteinii</i>	Spotted knapweed	6150010CEBI2	N/A
<i>Centaurea biebersteinii</i>	Spotted knapweed	New site along 1012330 road at southern edge project area	0.01 (Approx.)
<i>Centaurea diffusa</i>	Diffuse knapweed	6150010CEDI3	N/A
<i>Cirsium vulgare</i>	Bull thistle	6150050CIVU	1.0
<i>Hypericum perforatum</i>	St. Johnswort	6150010HYPE	N/A
<i>Linaria dalmatica</i>	Dalmatian toadflax	6150216LIDA	0.0001

Environmental Consequences

Alternative 1 - No Action – Ecological Trends

Sensitive Plants

Measure: Probability of detrimental impacts.

Of the three alternatives associated with this project, the No Action Alternative poses the least short-term risk of damage to individual penstemon plants, but the greatest long-term risk to the health of existing plants and the quality of their habitat. Based on information presented above, it is anticipated that in the continued absence of fire or other disturbances that reduce canopy cover and the thickness of duff layers, habitat quality for Peck's penstemon within the forested portions of the project area will continue to decline as monitoring has demonstrated. This is of particular concern because 85% of the area occupied by Peck's penstemon within the project area occurs in proposed treatment units within either second growth ponderosa pine (52%), late seral ponderosa pine (25%) or aspen (8%).

Likewise, in the absence of periodic disturbances, a decline in habitat conditions is likely to occur for the 15% of the project area Peck's penstemon occurring within grassy meadows. There is evidence, that absence of periodic burning in the Glaze Meadow may be harmful to local penstemon habitat. The strong showing of the species in Glaze Meadow, both by number of clumps and the high percentage of stems in flower during the monitoring visit in 2005, suggests a positive response by the penstemon to the prescribed meadow burn in 1999. It is not possible to differentiate this response from the plant's likely positive response to the cessation of grazing that occurred in 1998. It is reasonable that the thick thatch that develops over time within unburned portions of the meadow poses a challenge to the vegetative and reproductive success of Peck's penstemon that is similar to that of thick duff layers. Similarly, it is expected that periodic reductions in the density of this thatch layer will promote both vegetative and reproductive vigor of penstemon plants within the meadow.

Alternative 2 and 3- Direct and Indirect Effects

Both action alternatives pose a greater short-term risk of damage to existing Peck's penstemon plants within the project area than doing nothing, but promise a greatest longer-term benefit to occupied and potential penstemon habitat within the project area. Because slightly less mechanized tree removal activity is planned under Alternative 3 (where only trees up to 6" diameter would be removed in old growth units) than under Alternative 2 (which would allow removal of trees up to 21" diameter in old growth units), it is anticipated that somewhat less risk of damage to individual penstemon plants would exist under Alternative 3 than with Alternative 2. The short-term risk of damage to individual plants is minimized by conducting the cutting and removal of trees only over snow or when the ground is frozen.

This mitigation was first used in the Glaze Commercial Thin Timber sale in the late 1980's (Gonzalez 1986, personal communication). Units were logged over a snow pack of 12 inches or frozen ground to minimize soil disturbance and plant damage. The plant population was revisited and described in 1990 and found to be abundant and colonizing lightly scarified skid trails and landing areas. Logging over frozen ground or at least 12" snow is an accepted mitigation for timber

harvest effects described in the Conservation Strategy for the plant.

Short-term risk of direct damage to existing penstemon plants would be primarily associated with the use of mechanized logging equipment and its capacity to crush plants or unintentionally displace soil and rip up plants as the equipment makes tight turns and, as necessary, fallen trees are drug to collection points. Project-related damage to existing plants is difficult to directly assess. A post-treatment assessment of soil surface area, within occupied penstemon habitat, experiencing displacement exceeding 10 cm vertically or laterally, is a practical, indirect means of assessing potential damage to the plant population.

As noted below, this project has been determined to pose a high risk of noxious weed introduction or spread. The potential for project-related movement of noxious weeds within the project area is of particular concern because many of the planned project treatments (tree removal, mowing, underburning) will inadvertently improve local habitat conditions for weeds. However, mitigations included in this document should substantially reduce the risk of project-related introduction and spread of invasive plant species.

Project-related benefit to occupied or potential penstemon habitat would be largely associated with decreased woody plant cover, both shrubs and trees (forested units), and thinning or locally complete removal of the duff (forest units) or thatch (meadow units) layer. Specific treatments that would contribute to these longer-term benefits to penstemon habitat would, in forested units and, dependent on specific unit prescriptions, include removal of trees of various size classes, mowing of small diameter woody materials, including shrubs, and low intensity underburning. In meadow units, the beneficial treatment would primarily be the localized use of prescribed fire. Estimates of total vegetative clumps, and percentage of stems with flowers in the few years immediately following treatments would, compared to similar estimates made in the early 1990s and in 2005, be a direct measure of change in habitat condition resulting from this project. Documentation of the effects of tree removal, prescribed burning and mowing in occupied Peck's penstemon habitat is provided in the current Species Conservation Strategy for this species (USDA Forest Service 2007).

Alternative 2 and 3- Cumulative Effects

This analysis considers the cumulative effects to Peck's penstemon (and invasive species) within Upper and Lower Indian Ford subwatersheds over the past 100 years to 10 years into the future. This analysis area was chosen because Peck's penstemon disperses by water and plant populations are generally confined to a particular subwatershed except for rare events when water flows cross into adjacent subwatersheds. Invasive species disperse by a number of agents but the most relevant project related cumulative effects for invasive species expansion and its impacts on rare and riparian habitats is concentrated in these subwatersheds.

Past management which has affected Peck's penstemon in the cumulative effects analysis area over the past 100 years includes: timber harvest, livestock use, big game grazing, fire suppression, wildfires, and road construction. In general when these actions involved heavy ground disturbance which crushed or uprooted plants, they contributed to the decline of the species. The population has a fragmented distribution indicating it has probably been lost from habitat areas it occupied in the past, especially on the 60% of private lands in the subwatershed.

Fire suppression has been a major factor in the decline of the species, since it requires light disturbance, bare soil, and sunny open conditions to produce abundant flowers and seed. The over allocation of water, water table changes, and removal of riparian vegetation, especially on the 60% of private lands along the stream, has degraded habitat for Peck's penstemon by reducing probability of germination success. Stream channels on private lands have been channelized, or diverted into ponds, thus reducing floodplain area, or tempering natural flood events which create habitat. This has caused a general drying trend in Peck's penstemon habitats.

Cattle grazing since the 1880s, particularly that within the Glaze Allotment, has until recently, resulted in much reduced vegetative and reproductive vigor within this species. Most riparian pastures on private lands have been plowed to remove willows, planted with non-native grasses and grazed for many years. It is likely that Peck's penstemon is no longer found on much of its historic range in the subwatershed. The plant has been observed surviving in isolated patches on some private lands (like the natural areas on Black Butte Ranch or the edges of the golf course).

On public lands, in the subwatershed, even where the plant is prolific, such as the Glaze Project area, the plant's population has declined by 60% over the past 13 years, largely due to habitat changes from fires suppression (USDA Forest Service 2007).

Recent Forest Service activities within the cumulative effects analysis area have generally improved habitat conditions for Peck's penstemon and increased flowering and seed production. The plants viability has been considered in project planning since 1986 in Timber sales and thinning projects such as: Glaze CT, Black Butte Ranch Fuels reduction, and Highway 20 Thinning. These projects have included mitigations to protect the plant and improved habitat conditions. By increasing sunlight, flowering and seed production are improved. Lightly scarifying the soil provides germination sites. Reintroducing fire causes prolific blooming and appears to increase seed production (USDA Forest Service 2007).

Detrimental effects of these activities include soil compaction which can lead to simplified plant communities with possible associated higher seed predation rates (USDA Forest Service 2007), and the spread of invasive plants.

Invasive plant populations are expanding in the subwatershed on public and private lands stimulated by the same activities that have impacted Peck's penstemon populations: timber harvest, grazing, and developments. Meadow areas along Indian Ford Creek and in Glaze Meadow have scattered or dense cheatgrass patches, which are often coincident with potential Peck's penstemon habitat and it is likely that cheatgrass has displaced Peck's penstemon plants. It is possible that past logging or grazing or both activities caused the infestation. Recent events, projects and uses such as grazing have contributed to an increasing presence of noxious weeds in the Indian Ford subwatersheds. Large scale thinning/fuels reduction projects such as the Highway 20 project and Black Butte Ranch Fuels Project have improved habitat conditions for weeds. Mechanical entries and resultant soil disturbance associated with road repairs, utility installations, have further promoted weed establishment and spread. Numerous weed sites along roadsides and within areas experiencing moderate to heavy recreational use by vehicles and equestrians provide additional opportunities for weed introduction and dispersal.

Foreseeable future actions in the next 10 years that may affect Peck's penstemon or invasive species in the subwatershed include: 1) The Indian Ford Cattle Allotment, which is likely to maintain both Peck's penstemon populations and invasive plants at current levels, 2) housing developments downstream of the project which are constructing structures on potential meadow/ forests habitats, 3) the SAFR Project which will create more open conditions for invasive plants to spread but will also improve Peck's penstemon habitat with thinning and fire, and 4) invasive plant control on public lands through the Deschutes/Ochoco Invasive Plant program, which should benefit Peck's penstemon and reduce invasive plant species.

Considered as a whole, the cumulative effect of greatest concern affecting Peck's penstemon populations in the subwatershed is the loss of habitat. This includes the historic loss of habitat on private lands through creation of pastures and ongoing loss of habitat on public lands through fire suppression. The project will have a beneficial cumulative effect to Peck's penstemon by helping reverse the trend of habitat loss caused by fire suppression and succession.

However, because these habitat changes increase the risk of invasive plants there is cumulative increase in the risk of invasive plant populations expanding in the subwatersheds. This risk can be partly mitigated but increased control efforts will be needed.

Invasive Species

Measure: Risk of weed spread.

Alternative 1 - No Action – Ecological Trends

Of the three alternatives associated with this project, the No Action Alternative poses the least risk of introducing, exporting, or moving existing weeds about within the project area. However, the differential in risk between this and the action alternatives appears to be relatively small. This is because of the three species of concern known to occur within the project boundary, two, *Cirsium vulgare* and *Bromus tectorum*, occur within meadows, where no entry by heavy equipment or other mechanical vectors is planned. The other documented, extant weed species within the project area is the knapweed, *Centaurea biebersteinii*, which occurs in a small site on the 1012330 road in the southern edge of the project area. This site should be relatively easy to flag and avoid disturbing during project-related activities.

Alternative 2 and 3- Direct and Indirect Effects

As noted previously, the action alternatives associated with this project, relative to the No Action Alternative, pose a higher risk of the introduction and spread of noxious weeds. The two action alternatives do not appear to differ substantially in the degree of risk that each poses. Actions to reduce, but not eliminate this risk, are included in the Mitigations section of this document.

Invasive Plant Species Risk Assessment

Forest Service Manual direction requires that Noxious Weed Risk Assessments be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading noxious weeds, Forest Service policy requires that decision documents

must identify noxious weed control measure that will be undertaken during project implementation (FSM 2081.03.29; November 1995).

Risk Ranking

Deschutes National Forest has developed a standardized noxious weed risk assessment process to be conducted as a part of the project planning process. Risk rankings are based on the following sets of criteria.

High Risk results if:

1. Known weeds in or adjacent to project area. YES
2. Any of vector #'s 1-8 in project area. YES
3. Project operations in or adjacent to weed sites. YES

Moderate Risk results if:

1. Any of vector #'s 1-5 are present in project area. YES

Low Risk results if:

1. Any of vector #'s 6-8 present in project area,
2. OR
3. Known weeds present in or adjacent to project area, even if vectors lacking.

Vectors ranked in order of weed introduction/spread risk:

1. Heavy equipment (implied ground disturbance). YES (Mitigated by work over snow/frozen ground and clean equipment requirements)
2. Importing soil/cinders/gravel. YES (Mitigated by requirements for weed inspections of sources)
3. Use by OHVs. NO
4. Grazing (long-term disturbance). NO
5. Pack animals (short-term disturbance) YES
6. Plant restoration. NO
7. Use by recreationists. YES
8. Presence of USFS project vehicles. YES

Using this system of analysis, the risk of introduction and spread of noxious weeds due to the implementation of the Glaze Forest Restoration Project has been determined to be **HIGH**. This rating is attributable to the presence of noxious weed sites within project units, the use of heavy equipment during unit treatments, importing gravel for bridge installation, pack animals- horses, Recreationists and Forest Service vehicles. Mitigation measures are required to reduce this risk.

Alternative 2 and 3- Cumulative Effects

The cumulative effects of the project on invasive species are defined and discussed above under Sensitive Plan cumulative effects.

Soils

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Soil Resources Report for this project (Craig, T. 2007). Additional information is contained in the full specialist report.

Background

Landscape Characteristics

The Glaze Restoration Project is located on the lower eastern flanks of the volcanic Cascade Range in Oregon, where essentially all landforms, rocks, and soil materials are derived from volcanism and glaciations. Landscapes within the planning area include areas of wet meadows, stands of aspen, and ponderosa pine forest.

Elevations within the planning area range from 3,800 to 4,200 feet. Mean annual precipitation is around 30 inches. Slopes within the planning area are generally flat, ranging from 2 to 4 percent. Dominant overlaying soils have developed from volcanic ash and pumice deposits that vary from 10 to 40 inches thick. These materials consist mainly of loose, fine sand size soil particles with little of no structural development.

The project area contains seven land type units based on similarities in landforms, geology, and climatic conditions that influence defined patterns of soil and vegetation (Soil Resource Inventory, Larsen, 1996). The biophysical characteristics of these land type units can be interpreted to identify productivity potentials and suitability's for natural resource planning and management.

Inherent Soil Quality

Wet and Dry Meadows

Approximately one third of the planning area consists of wet, non-forested areas, including meadows, depressions, and swampy areas. Indian Ford Creek is a small perennial stream which also flows through the planning area (see Hydrology/Fisheries reports). Soils in these areas are generally wet at least part of the year and vegetation consists of sedges, grasses, wetland forbs, willow and alder.

Ponderosa Pine Stands

Approximately two thirds of the planning area consists of well to excessively drained soils derived from a thin to moderately thick layer of volcanic ash over outwash materials. Vegetation consists primarily of ponderosa pine, bitterbrush, manzanita, and Idaho fescue. Surface soils are typically loamy sands and buried soils are gravelly sandy loams to very gravelly sands. Permeability is typically very rapid in both the surface soils and the subsoils.

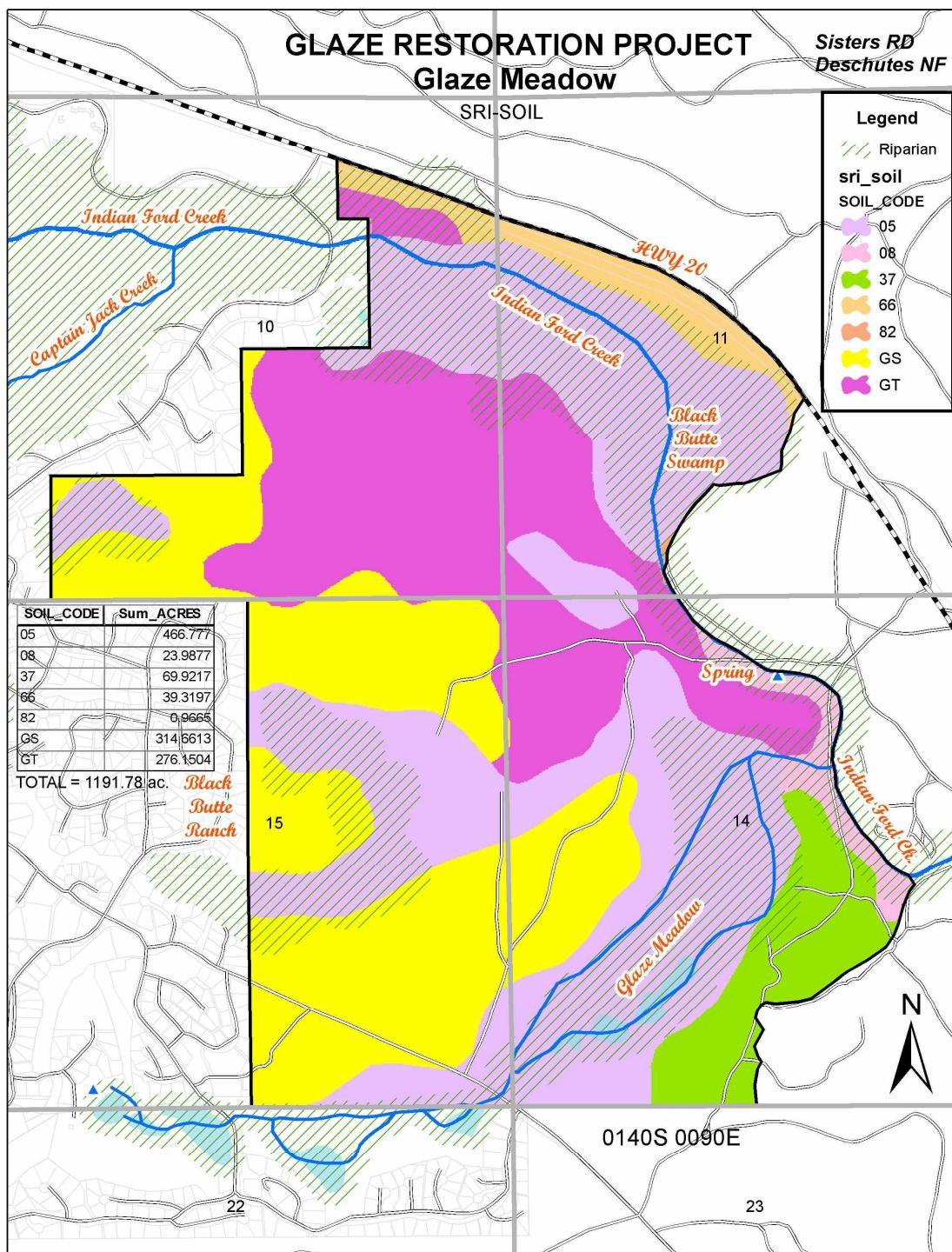
These soils are described in the Deschutes NF Soil Resource Inventory (SRI) as having high water infiltration rates and permeability's that are very rapid in both the surface soils and subsoil. Site productivity is described as a cubic foot Site Class of 5 and 6 and a Site Index of 60 to 85 for ponderosa pine (Larson 1976).

Aspen Stands

The planning area contains several areas of aspen stands representing some of the more unique and less extensive vegetation types on the Forest. Soils which have developed under aspen vegetation are characterized by their thick soil A horizon with dark mineral soil colors. This soil development results from large annual inputs of forest organic matter into the soil. In the case of aspen vegetation the source of annual organic matter is primarily from the loss of aspen leaves in the fall. The high productivity of shrubs, grasses, and forbs on these sites also contribute to the relatively large annual input of organics.

Over time conifer tree species have invaded many of these areas which have historically grown aspen, thus reducing the size and in some cases the vigor of these stands. While the vegetation has shifted from aspen to conifers in some of these areas the thick soil A horizon that occurred under historic aspen areas has not changed. Thus the thickness and color of the soil A horizon can be used to identify historic and or potential aspen restoration areas.

Figure S-1: Soil map showing Deschutes National Forest Soil Resource Inventory (SRI) soil mapping units.



Land Suitability and Inherent Soil Productivity

The suitable lands database for the Deschutes National Forest Land Resource Management Plan identifies areas of land which are considered to be suitable for timber production using criteria affecting reforestation potential (FSH 2409.13). This data was developed to designate a broad scale timber base area for forest wide planning purposes. 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 to resource values from management activities. All of the lands proposed for thinning from below were identified as suitable lands for timber production.

Sensitive Soil Types

Based on criteria for identifying soils that are sensitive to management (Deschutes Land and Resource Management Plan (Appendix 14, Objective 5), sensitive soils within the planning area include: 1) soils with seasonally high water tables 2) soils located within the designated Riparian Habitat Conservation Areas. Approximately 40 percent (420 acres) of the planning area contain areas with sensitive soils Table S-1.

Table S-1: Landtype acres that contain sensitive soils within the Glaze Meadow Project area (Soil Resource Inventory, Deschutes National Forest, 1996).

SRI Map Unit Symbol	Geomorphology (Representative landforms)	Type of Concern*	Landtype Acres
05	Wet Meadows	1&2	320
08	Bottomlands	1&2	62
GT	Wet and Dry Meadows	1&2	38

Management Concerns

- 1) Equipment operations on soils with seasonal water tables require additional mitigation measures to assure the conditions during operation will not result in resource damage.
- 2) Soils within sensitive riparian areas and adjacent to streams can increase the potential for sediment delivery following soil disturbance.

Proposed treatments in areas of sensitive soil types will be discussed under the direct and indirect effects of implementing the management activities under the proposed action.

Existing Condition

The current condition of soil within the Glaze Meadow Project area is directly related to soil porosity and the quantity and quality of surface organic matter within the planning area (Powers and Avery 1995). Ground disturbing management activities (i.e. timber harvest, road building, recreation) have caused some adverse changes to soil quality in previously managed areas, especially where mechanical disturbances removed vegetative cover, displaced organic surface layers, or compacted the soil.

Magnitude of Disturbances (Extent/Distribution/Degree/Duration)

Effects of soil disturbances on site productivity or hydrologic function of watersheds is dependent on the extent, distribution, degree and duration of the disturbance (Froehlich, 1976; Snider and Miller, 1985; Clayton et al., 1987; Seybold et al., 1999). Extent refers to the amount of land surface occupied by the disturbance expressed as a percentage of a specified area. Distribution of soil disturbance within a management area may likely be more important than the actual estimated extent. The distribution of a soil disturbance can occur as small evenly disturbed polygons, or in large polygons in one or a few locations and that can have very different effects on the soil's ability to function. Degree refers to the amount of change in a particular soil property such as soil porosity, bulk density, or strength and the depth to which that change occurs. And the duration of a disturbance is the length of time disturbance effects persist.

Extent, distribution, and in some instances, degree of disturbance can be mitigated by imposing management constraints such as limiting season of operation, spacing of skid roads and trails, and number of equipment passes (Froehlich, 1976). Degree and duration of effects are largely determined by inherent soil properties that influence resistance to, and ability to recover from, disturbance (Seybold et al., 1999). In some cases soil restoration activities are performed to shorten the duration of soil impacts. An example of a soil restoration activity would include subsoiling of compacted soils to accelerate their recovery (Powers et al., 1999).

Bounding Spatial and Temporal Changes within the Zone of Influence

The soil resource may be directly, indirectly, and cumulatively affected within each of the activity areas proposed within the project area. An activity area is defined as "the total area of ground impacted activity and its feasible unit for sampling and evaluating" (FSM2520 and Forest Plan, page 4-71). For this project proposal, activity area boundaries are considered to be the smallest identified area where the potential effects of different management practices would occur and thus are defined as the "zone of influence." Thus, the discussion of soil effects and soil quality standards will be focused on the units proposed for treatments. There are 30 activity areas within the planning area ranging in size from one to 150 acres. Where appropriate and relevant, the effects discussion is expanded to the planning area to provide additional context and intensity.

Assumptions

Quantitative analyses, literature reviews and professional judgment were used to evaluate the issue measures by comparing existing conditions to the anticipated conditions which would result from implementing the proposed actions. The temporal scope of the analysis is defined as short term effects being changes to soil properties that would generally revert to pre existing conditions within 5 years or less, also considered the effectiveness and probable success of implementing the management requirements, mitigation measures, and Best Management Practices (BMPs) which are designed to avoid, minimize or reduce potentially adverse impacts to soil productivity.

Soil Issues and Measures

Issues are used to formulate alternatives, prescribe mitigation measures, and analyze the environmental effects of management activities. Key issues regarding the Glaze Meadow Project were originally identified by the Interdisciplinary Team (IDT) and emphasized by the public during scoping. Although the soil productivity issue was not used to formulate and alternative, plans for projects must include provisions for mitigation of ground disturbances where activities are expected

to cause resource damage that exceed Regional and Deschutes Land and Resource Management Plan standards and guidelines.

Issue Statement: Soil Productivity and Proper Hydrologic Function

The proposed use of ground based equipment can potentially increase the amount and distribution of detrimental soil conditions within the individual activity areas proposed for mechanical treatments. The removal of trees from activity areas and application prescribed fire can potentially cause adverse changes in organic matter levels.

Issue Measures:

Detrimental Soil Disturbance - Change in extent of detrimental soil conditions following proposed harvest and mitigation treatments within the individual activity areas proposed for mechanical treatments.

Coarse Woody Debris (CWD) and Surface Organic Matter -Amount of coarse woody debris and surface organic matter that would likely be retained to protect mineral soil from soil erosion and provide both short and long term nutrient supplies for maintaining soil productivity on treated sites.

The existing condition of the soil resource was initially described in relation to each of the soil issues measures.

Measure: Detrimental Soil Disturbance

Natural Disturbances

There is currently no evidence of detrimental soil conditions from natural disturbance events within the Glaze Meadow Planning area. No recent large wildfires have occurred within the planning area. Although fires have occurred in the past enough time has passed since their occurrence that existing vegetation and forest litter are providing adequate sources of ground cover to protect mineral soil from water and wind erosion. Therefore, natural soil disturbances were not included as existing sources of detrimental soil conditions within any of the activity areas proposed for this project.

Management Related Disturbances

The extent, distribution, degree and duration of compacted soil can vary with the size and type of equipment used for forest vegetation management, volume and type of material being removed, frequency of entries, soil type and the soil conditions when the activity takes place (Froehlich 1976, Adams and Froehlich 1981, Gent et al. 1984, Snider and Miller 1985, Clayton et al. 1987, Miller et al. 1986, Page-Dumroese 1993). Soil monitoring results on local landtypes and similar soils have shown that from less than 5 to 30 percent of the unit area can be detrimentally disturbed by ground-based harvest systems depending on types of equipment used, harvest prescriptions, and soil conditions at the time of harvest (Deschutes Soil Monitoring Reports, 1995, 1996, 1997, 1999, 2005 and 2006).

The primary sources of detrimental soil conditions are associated with the transportation systems used for timber harvest and yarding activities. Temporary roads, log landings, and primary skid trails were constructed and used to access individual harvest units of past timber sales. Most project

related impacts to soils occurred on and adjacent to these heavy use areas. Mechanical disturbances include the removal of vegetative cover, displacement of organic surface soils, or compaction of the soil. Research studies and local soil monitoring have shown that soil compaction and soil displacement account of the majority of detrimental soil conditions resulting from ground based logging operations (Page-Dumroese 1993, Geist 1989, Powers 1999, Deschutes Soil Monitoring Reports).

Within the last decade limited areas within the planning area have been treated. Treatments have included the mowing of brush and the use of prescribed burning to both reduce fuels and provide a forest and meadow structure that will be more resistant to wildfires. While prescribed burning does remove some of the surface organic matter, this process is a natural part of these ecosystems which historically experienced low intensity fire. These types of treatments also help to reduce the risk of impacts to the soil resource which can result from a high intensity uncharacteristic fires that could occur as a result of lack of management.

Soil condition assessments were conducted for a representative sample of past activities that include the following general prescriptions; partial removal harvest, mowing of brush and prescribed burning. Qualitative assessments of soil disturbance were made by establishing line transects and recording visual evidence of soil disturbance at 5 foot intervals within previously harvested areas (Howes et al. 1983). Detrimental soil compaction was the primary disturbance category observed where equipment operations occurred on main skid trail systems, log landings, and existing roads.

Shovel probing was used to assess soil compaction using resistance to penetration as a measure. Soil displacement, as defined by FSM 2521.03, was more difficult to distinguish due to the establishment of native vegetation and the accumulation of forest litter. Observations suggested that equipment turns or movement generally caused more mixing of soil and organic matter than actual removal from a site. Based on the proportionate extent of overlap of sampled areas with the proposed activity areas, these field assessments results are included in the percentages of existing detrimental soil conditions displayed in Table S- 2.

Table S-2: Existing soil condition based on previous treatments and determined by transecting proposed activities and quantifying different soil disturbance classes.

EA Unit Number	Treatment Type	Unit Acres	Previous Treatment	Area of Existing Soil Disturbance Prior to Treatment	
				Unit Acres	Percent of Unit
1	2 nd Growth	43	Commercial Thin	6	15
2	2 nd Growth	93	Commercial Thin	14	15
3	2 nd Growth	120	Commercial Thin	18	15
4	2 nd Growth	142	Commercial Thin	21	15
5	Old Growth	68	None	0	0
6	Old Growth	45	None	0	0

7	Aspen/ Lodge	50	None	0	0
8	Grass Meadow	10	None	0	0
9	Grass Meadow	12	None	0	0
10	Grass Meadow	125	Rx burn	0	0
11	2 nd Growth	30	Com Thin/Rx Burn	5	15
12	Willow Meadow	42	Rx burn	0	0
13	Grass Meadow	15	None	0	0
14	Old Growth	9	None	0	0
15	Willow Meadow	31	None	0	0
16	2 nd Growth	5	Historic logging	0	0
17	Aspen	18	None	0	0
18	Old Growth	29	Hwy 20 Thin	3	10
19	Old Growth	12	Hwy 20 Thin	1	10
20	Aspen	3	None	0	0
21	Willow Meadow	1	None	0	0
22	Old Growth	150	None	0	0
23	Aspen	8	None	0	0
24	2 nd Growth	4	Shelterwood	1	15
25	2 nd Growth	8	Shelterwood	1	15
26	Old Growth	24	None	0	0
27	Old Growth	89	None	0	0
28	Pond	2	None	N/A	Pond
29	Old Growth	2	Hwy 20 Thin	0	15
30	Electric Sub	1	---	N/A	Substation

Existing areas of soil disturbance based on field monitoring:

Areas of commercial thinning	15%
Areas of prescribed burn	0%
Areas of shelter wood harvest	15%
Areas of Hwy 20 thinning	10%

Measure: Coarse Woody Debris and Surface Organic Matter

The effects of management activities on soil productivity as well as other desired soil functions also depend on the amount of coarse woody debris and surface organic matter retained or removed on affected sites. Due to the historical frequent fire occurrence within the ecological types in the planning area, there most likely were not large amounts of coarse woody debris in the past. Observations of prescribed burns indicate that recruitment of coarse woody debris is a significant process for maintaining adequate levels for desired soil functions. Prescribed fires commonly burn coarse woody debris on the ground while recruiting new materials through the killing of some trees as well as causing dead standing trees to fall to the ground. Observations indicate that through these processes coarse woody debris is maintained at an adequate level in areas of prescribed burns.

A balance between fuel management objectives and ensuring adequate amounts of coarse woody debris is an important goal for maintaining long term soil productivity. Using mycorrhizal fungi as a bio-indicator of productive forest soils, research studies were used to develop conservative recommendations for leaving sufficient coarse woody debris following management activities (Graham et al. 1994, Brown et al. 2003). A minimum of 5 to 10 tons per acre of coarse woody debris (greater than 3 inches in diameter) should be retained on dry, ponderosa pine sites and 10 to 15 tons of coarse woody debris per acre on mixed conifer sites to maintain soil productivity. A sufficient number of standing dead snags and /or live trees should also be retained for future recruitment of organic matter.

Conserving surface litter (i.e., organic materials such as pine needles, twigs and branches less than 3 inches in diameter) is also important for protecting mineral soil from erosion, buffering the effects of soil compaction, and supplying nutrients that support the growth of vegetation and native populations of soil organisms. The management goal is to provide a balance between fuel management objectives that will reduce the risk of soil impacts that may result from wildfire and the maintenance of enough surface litter to maintain soil functions.

It is expected that adequate amounts of coarse woody debris and surface organic matter currently exist to protect mineral soil from erosion and provide nutrients for maintaining soil productivity within the majority of activity areas. There are some older activity areas, where management activities likely resulted in less than desired amounts of coarse woody debris on the ground. In other portions of the project area, fire suppression has resulted in vegetation conditions that have fuel loadings in excess of historic conditions. Although current levels of coarse woody debris and surface litter are not known for all activity areas, it is expected that previously managed areas have been improving towards optimum conditions as additional woody materials have accumulated through mortality, windfall, and recruitment of fallen snags over time. Annual leaf and needle fall, small diameter branches, twigs and other forest litter have increased organic matter levels for soil nutrient cycling.

Target Landscape Condition

Primary management goals for this landscape are described in the Glaze Meadow Project Purpose and Need statement. Management goals for the soil resource are to maintain or enhance soil conditions at acceptable levels which allow the soil to function in a desirable manner. The extent of detrimental soil disturbances will be minimized through the application of management requirements and mitigation measures designed to minimize, avoid or eliminate potentially significant impacts, or rectify impacts in site specific areas by restoring the affected environment. The functioning of the soil is ensured by management prescriptions that retain adequate supplies of surface organic matter and coarse woody debris without compromising fuel management objectives and the risk of soil damage from large scale stand replacement wildfire.

Environmental Consequences

Introduction

The best information about the proposed actions (EA, Alternative Descriptions) was used in conjunction with the location of activities to analyze the potential effects on the soil resource. The potential for detrimental changes to soil physical properties was quantitatively analyzed by the extent (surface area) of temporary roads, log landings, and designated skid-trail systems that would likely be used to facilitate yarding activities within each of the proposed activity areas. Professional judgment was used to evaluate changes in the amount and composition of coarse woody debris and surface organic matter. These analyses also considered the effectiveness and probable success of implementing the soil mitigation and resource protection measures which are designed to avoid, minimize or reduce potentially adverse impacts to soil productivity.

Important Interactions

Forest thinning and fuel reduction treatments have the potential to cause soil disturbance and in turn affect the long term sustainability of forest ecosystems. The long term sustainability of forest ecosystems depends on the productivity and hydrologic function of soils. Ground disturbing management activities directly affect soil properties, which may adversely change the natural capability of soils and their potential responses to use and management. A detrimental soil condition often occurs where heavy equipment or logs displace surface organic layers or reduce soil porosity through compaction. Detrimental disturbances can reduce the soils ability to supply nutrients, moisture, and air that support soil microorganisms and the growth of vegetation. The biological productivity of soils also relates to the amount of surface organic matter and coarse woody debris retained or removed from affected sites. Therefore, an evaluation of the potential effects on soil productivity is essential for integrated management of forest resources.

The proposed management activities include commercial and non-commercial thinning of forest stands combined with fuel reduction treatments to reduce stand densities and hazardous fuels. Types of mechanical harvest equipment used in the thinning operation vary with the types of trees being removed. Thinning would include predominantly trees in the smaller diameter class. This may be accomplished manually using chainsaws or with the use of specialized low ground pressure machinery. Low ground pressure machinery would only be allowed to make a limited number of equipment passes to transport material to existing roads or other disturbed sites for use as firewood or processing wood fiber. Both hand piling and mechanical piling of slash may occur. Mechanical slash piling would be limited to working off of existing trails. Management activities also include

mechanical shrub and small tree treatments (mowing or mastication) and the use of prescribed fire to reduce fuel loadings and treat the shrub layer.

Soil condition assessments for similar soils and types of harvest equipment, research references, local monitoring reports, Glaze Meadow field surveys and observation were used to predict the potential extent, distribution, degree, and duration of detrimental soil disturbance associated with this project proposal (Deschutes Soil Monitoring Reports 1996, 1997, 1999, 2005 and 2006). Estimates for predicted amounts of detrimental soil conditions account for the expected amount of volume removal, the type of logging equipment, the spacing of skid trails, and the number of log landings that would be needed to deck accumulated materials. Since the same types of mechanical treatments are proposed on similar landtypes and ash influenced soils, the nature of the effects to the soil resource is similar for project activities that use ground based equipment to accomplish management objectives.

A combination of treatments including thinning trees from below, mechanical treatment of small trees and brush, and prescribed burning would be used to reduce the fuel loading in the planning area. Most of the slash generated from commercial harvest would be either hand piled or machine piled and burned on log landings and/or main harvester trails. Machine piling on temporary roads or main skid trails would have a minimal effect on the overall extent of detrimentally disturbed soil because equipment would operate off the same logging facilities used during yarding operations. The same designated trail systems would be used as primary travel routes. The use of specialized equipment such as tracked excavators with grapple arms and other low ground-pressure machines are capable of accumulating woody materials without moving appreciable amounts of topsoil into slash piles. Monitoring of these types of operations on similar soils on the District indicate that impacts would not exceed soil standards and guides (Soil Monitoring Report 2005).

Mechanical treatment of brush and small trees (mowing and mastication) would not cause detrimental soil displacement and increases in soil bulk density are inconsequential. The primary factors that limit soil compaction are the low ground pressure of the tractor and mowing heads, the limited amount of traffic (one equipment pass), and the cushioning effect of surface organic matter. These activities have been monitored in the past, and results show that increases in soil displacement and compaction do not meet the criteria for detrimental soil conditions (Soil Monitoring Report, 1997).

Prescribed fire would be used to reduce fuel accumulations in some of the activity areas proposed for mechanical harvest and non-commercial thinning as well as other activity areas where prescribed burning would be used exclusively to treat the shrub and grass layer and reduce natural fuels. Prescribed burning activities are conducted at times and under conditions that maximize benefits while reducing the risk of resource damage. The degree of soil heating depends upon fuel type (grass, brush, trees), fuel density, nature of the litter and duff layers (thickness, moisture content), and burn conditions at the time of ignition. For the treatment areas proposed with this project, natural fuel accumulations consist mainly of fine fuels (i.e., decadent brush, tree branches, and needle cast litter) that typically do not burn for long duration and cause excessive soil heating. Therefore, it is expected that there would be no detrimental changes in soil properties from prescribed burning activities in timber stands because soil moisture guidelines would be included in burn plans to minimize the risk for intense ground-level heating.

Prescribed burn plans would comply with all applicable standards and guidelines and Best Management Practices (BMPs) prior to initiation of burn treatments. Soil heating during spring

burns would be negligible because higher moisture levels at this time of year generally result in cooler burns with lower potential for causing severely burned soil. Fall burning would be conducted following brief periods of precipitation. Prescribed underburns in timber stands would be accomplished under carefully controlled conditions to minimize damage to standing trees. These activities are planned to meet fuel and visual management objectives without removing all of the protective surface cover. It is expected that adequate retention of coarse woody debris and fine organic matter (duff layer) would still exist for protecting mineral soil from erosion and supplying nutrients that support the growth of vegetation and populations of soil organisms.

Fuel reductions achieved through planned ignitions usually burn with low-to-moderate intensities that do not result in severely burned soils. The effects of low-intensity fire do not easily consume material much larger than 3 inches in diameter, and charring does not substantially interfere with the decomposition or function of coarse woody debris (Graham et al., 1994). The successful implementation of these proposed activities would likely result in beneficial effects by reducing fuel loadings and wildfire potential as well as increasing nutrient availability in burned areas.

In most cases existing roads and other existing fuel breaks would be used to effectively control the spread of fire within treatment units. The extent of disturbed soil would be limited to the minimum necessary to achieve fuel management objectives.

Under the proposed action, soil restoration treatments may be applied with a self-drafting winged subsoiler to reclaim and stabilize detrimentally compacted soil on specific roads and some of the primary skid trails and log landings following post-harvest activities. Additional treatment options for improving soil quality on disturbed sites include redistributing topsoil in areas of soil displacement damage and pulling available logging slash and woody materials over the treated surface.

Soils within the project area are well suited for tillage treatments due to their naturally low bulk densities and the absence of rock fragments within soil profiles. These sandy-textured soils have little or no structural development within the principal root development zone (4 to 12 inches in depth) where changes in soil compaction (bulk density) are assessed according to Regional direction (FSM 2521.03). Although equipment traffic during harvest operations can decrease soil porosity on these soil materials, compacted sites can be mitigated physically by tillage with a winged subsoiler (Powers, 1999).

The winged subsoiling equipment used on the Deschutes National Forest has been shown to lift and shatter compacted soil layers in greater than 90 percent of the compacted zone with one equipment pass (Craig, 2000). Subsoiling treatments have been implemented with good success due to the absence of rock fragments on the surface and within soil profiles. Although rock fragments can limit subsoiling opportunities on some landtypes, hydraulic tripping mechanisms on this specialized equipment help reduce the amount of subsurface rock that could potentially be brought to the surface by other tillage implements. Most of the surface organic matter remains in place because the equipment is designed to allow adequate clearance between the tool bar and the surface of the ground for allowing smaller logging slash to pass through without building up. Any mixing of soil and organic matter does not cause detrimental soil displacement because these materials are not removed off site. Since the winged subsoiler produces nearly complete loosening of compacted soil layers without causing substantial displacement, subsoiled areas on this forest are expected to reach full recovery within the short-term (less than 5 years) through natural recovery processes.

Although the biological significance of subsoiling is less certain, these restoration treatments likely improve subsurface habitat by restoring the soils ability to supply nutrients, moisture, and air that support soil microorganisms. Research studies on the Deschutes National Forest have shown that the composition of soil biota populations and distributions rebound back toward pre-impact conditions following subsoiling treatments on compacted skid trails and log landings (Moldenke et al., 2000). The subsoiling specialist and trained crew members work with the equipment operator to identify locations of detrimentally compacted soil. Implementation and effectiveness monitoring is then conducted on treatment areas to assure that soil resoration objectives have been met.

Direct Indirect and Cumulative Effects

The magnitude and duration of potential effects, both physical and biological changes in soil productivity, depend on the intensity of site disturbance, the timing and location of activities, and the inherent properties of the volcanic ash-influenced soils within affected activity areas. Direct effects occur at essentially the same time and place as the actions that cause soil disturbance, such as soil displacement and compaction from equipment operations. Indirect effects occur sometime after or some distance away from the initial disturbance, such as increased runoff and surface erosion from previously compacted areas. Cumulative effects include all past, present, and reasonably foreseeable actions that cause soil disturbance within the same activity areas proposed with this project.

Alternative 1 - Direct and Indirect Effects

Measure: Detrimental Soil Disturbance

Under Alternative 1 (No Action), the management activities proposed in this document would not take place. No additional land would be removed from production to build roads or logging facilities for harvest and yarding operations. There would be no cumulative increase in detrimental soil conditions above existing levels. Although disturbed soils would continue to recover naturally from the effects of past management, the current extent of detrimental soil conditions would likely remain unchanged for an extended period of time.

Soil productivity would not change appreciably unless future stand-replacing wildfires cause intense ground-level heating that results in severely burned soils. Detrimental changes to soil properties typically result from extreme surface temperatures of long duration, such as the consumption of large diameter logs on the forest floor. Although hazardous fuels have been reduced in some previously managed areas, fire exclusion has resulted in undesirable vegetation conditions and excessive fuel loadings in other portions of the project area (see Fire/Fuels Section). Alternative 1 would defer fuel reduction opportunities at this time.

If a large amount of fuel is present during a future wildfire, soil temperatures can remain high for an extended period of time and excessive soil heating would be expected to produce detrimental changes in soil chemical, physical, and biological properties. Severe burning may cause soils to repel water, thereby increasing surface runoff and subsequent erosion (Robichaud et al. 2005). The loss of protective ground cover would also increase the risk for acelerated wind erosion on the loose, sandy textured soils which are widespread throughout the project area.

Measure: Coarse Woody Debris and Surface Organic Matter

In the short term, the amount of coarse woody debris and surface litter would gradually increase or remain the same. In forested areas, coarse woody materials will continue to increase through natural

mortality, windfall, and recruitment of fallen snags over time. Short-term nutrient sources will also increase through the accumulation of small woody material from shrub and tree branches, annual leaf and needle fall, and decomposition of grass and forb plant materials.

In the long term, the accumulation of coarse woody debris and forest litter would increase the potential for intense wild land fires which may completely consume heavy concentrations of fuel and ground cover vegetation. High-to-extreme fire hazard and potential for excessive soil heating exists when downed woody debris exceeds 30 to 40 tons per acre (Brown et al., 2003). Intense ground-level fire would likely create areas of severely burned soil and increase the potential for accelerated wind erosion. The loss of organic matter would adversely affect ground cover conditions and the nutrient supply of affected sites. Over time, burned areas would have increased levels of coarse woody debris as fire killed trees are recruited to the forest floor.

Alternative 1 - Cumulative Effects

Measure: Detrimental Soil Disturbance

Under Alternative 1 (No Action), the extent of detrimental soil conditions would not increase above existing levels because no additional land would be removed from production to build temporary roads and logging facilities. The effects of past and current management activities were previously described under Existing Condition of the Soil Resource. The primary sources of detrimental soil conditions from past management are associated with existing roads and ground-based logging facilities which were used for previous timber management activities.

Measure: Coarse Woody Debris and Surface Organic Matter

Under Alternative 1, the amount of coarse woody debris and surface organic matter will gradually increase over time. In the long term, the accumulation of coarse woody debris and forest litter would increase the risk for wildland fires.

Alternative 2 - Direct and Indirect Effects

The proposed management activities are identified in the Alternative Descriptions (EA, Chapter 2). Alternative 2 is designed to restore desired vegetation conditions by implementation of commercial and non-commercial tree thinning and a combination of various fuel reduction treatments in these areas as well as in the wet and dry meadows. The nature of the effects to the soil resource has already been described under “Important Interactions” in the Environmental Effects section.

Measure: Detrimental Soil Disturbance

The use of ground-based equipment for vegetation management treatments would increase the amount and distribution of soil disturbance within the proposed activity areas. The development and use of temporary roads, log landings, and trail systems are the primary sources of new soil disturbance that may result in adverse changes to soil productivity. Most soil impacts would occur on and adjacent to heavy-use areas where multiple equipment passes typically cause detrimental soil compaction. Mitigation and resource protection measures would be applied to avoid or minimize the extent and distribution of soil disturbance in random locations between main skid trails and away from log landings.

Specialized equipment with lower ground pressures than harvest equipment used in the past, are increasingly being used in these types of thinning operations. One type of equipment is the harvester forwarder machinery. This equipment typically has a cutting head mounted on a 30 foot boom. This allows the harvester to cut and process materials while making parallel passes across the harvest unit at a spacing of approximately 60 feet. Harvested materials are positioned so they can be reached from alternate harvester trails by the forwarder machine. This results in two types of trails within the harvest unit (1) those that been driven across only one time by the harvester (ghost trails) and (2) trails that have been driven across by the harvester followed by the forwarder (harvester-forwarder trails). Because trees area limbed and toped at the time of felling there are no landings within the harvest unit. Once the forwarder has collected harvested materials they are piled next to a haul road prior to loading on log trucks. Soil monitoring of this type of operation has shown that soil disturbances resulting from equipment operation are not to a degree which would be considered detrimental (Craig and Howes 2005).

A second type of harvest operation which is increasingly being used in this type of thinning is the use of “all season vehicles”. These machines are much smaller than most other types of equipment and work well when small diameter (8 inch diameter at base height) trees are removed. Again, soil monitoring of this type of operation has shown that soil disturbances are not to a degree which would be considered detrimental.

Non-commercial thinning by hand felling small-diameter trees with chainsaws would not cause additional soil impacts because machinery would not be used for yarding activities. Mechanical shrub and slash treatments would be accomplished using low ground-pressure machinery and soil disturbances from these activities are not expected to qualify as a detrimental soil condition.

The depth of compaction from only one or two equipment passes would not reduce soil porosity to levels that would require subsoiling mitigation to restore soil physical properties. On gentle to moderately sloping terrain, the maneuvering of equipment generally does not remove soil surface layers in large enough areas to qualify as detrimental soil displacement (FSM 2520, R-6 Supplement). The dominant sandy-textured soils within the project area are not susceptible to soil puddling damage due to their lack of plasticity and cohesion. Prescribed underburns in timber stands are conducted under carefully controlled conditions that maximize benefits while reducing the risk of resource damage.

Table S-3 displays existing and predicted amounts of detrimental soil conditions in acres and percentages for each of activity areas. Surface area calculations (acres) of designated areas such as roads, main skid trails, and log landings were used to determine existing and expected areas of soil disturbance. Again if specialized equipment is used in place of traditional types of logging equipment the amount of detrimental soil impacts would be less than what is predicted in Table S-3.

Table S-3: Existing and predicted amounts of detrimental soil conditions in acres and percentages for each activity area.

EA Unit Number	Treatment Type	Unit Acres	Area of Existing Soil Disturbance Prior to Treatment		Estimated Detrimental Soil Condition after Treatment	
			Unit Acres	Percent of Unit	Unit Acres	Percent of Unit
1	2 nd Growth	43	6	15	9	20
2	2 nd Growth	93	14	15	19	20
3	2 nd Growth	120	18	15	24	20
4	2 nd Growth	142	21	15	28	20
5	Old Growth	68	0	0	3	5
6	Old Growth	45	0	0	2	5
7	Aspen/ Lodge	50	0	0	2	5
8	Aspen/Grass Meadow	10	0	0	1	2
9	Grass Meadow	12	0	0	1	2
10	Grass Meadow	125	0	0	2	2
11	2 nd Growth	30	5	15	6	20
12	Willow Meadow	42	0	0	0	0
13	Grass Meadow	15	0	0	1	2
14	Old Growth	9	0	0	1	5
15	Willow Meadow	31	0	0	0	0
16	2 nd Growth	5	0	0	1	5
17	Aspen	18	0	0	1	5
18	Old Growth	29	3	10	1	15
19	Old Growth	12	1	10	2	15
20	Aspen	3	0	0	1	5

21	Willow Meadow	1	0	0	0	0
22	Old Growth	150	0	0	8	5
23	Aspen	8	0	0	1	5
24	2 nd Growth	4	1	15	1	20
25	2 nd Growth	8	1	15	2	20
26	Old Growth	24	0	0	1	5
27	Old Growth	89	0	0	4	5
28	Pond	2	N/A			
29	Old Growth	2	0	15	1	20
30	Substation	1	N/A			

Under Alternative 2, an estimated total of approximately 70 acres of soil is currently impacted by existing roads, logging facilities, and recreation trails. It is predicted that the direct effects of the proposed harvest and yarding activities would result in a total increase of approximately 53 acres of additional soil impacts associated with trail systems and log landings. Soil compaction would account for the majority of these impacts. The proposed actions would, however, comply with Deschutes Land and Resource Management Plan standards and guidelines SL-3 and SL-4 and Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) for maintaining or enhancing soil productivity.

Measure: Coarse Woody Debris and Surface Organic Matter

The measure for coarse woody debris and surface organic matter was evaluated qualitatively based on the probable success of implementing appropriate Best Management Practices and recommended guidelines that address adequate retention of these important landscape components to meet soil productivity and wildlife habitat objectives (see Wildlife Section and Chapter 2 Mitigation). A minimum amount of 5 to 10 tons per acre of coarse woody debris on ponderosa pine sites and 10 to 15 tons per acre on mixed conifer or lodgepole pine sites is recommended to ensure desirable biological benefits for maintaining soil productivity without creating an unacceptable fire hazard.

The proposed harvest activities would reduce potential sources of future coarse woody debris. However, harvest activities also recruit debris to the forest floor through breakage of limbs and tops during felling and skidding operations and when processing logs using a harvester forwarder machine. Existing down woody debris would be protected from disturbance and retained on site to the extent possible. Understory trees, damaged during harvest operations, would also contribute woody materials that provide ground cover protection and a source of nutrients on treated sites. It is expected that enough broken branches, unusable small-diameter trees, and other woody materials would likely be available after mechanical thinning activities to meet the recommended guidelines for coarse woody debris retention.

Fuel reduction treatments would potentially reduce coarse woody debris and some of the forest litter by burning logging slash and natural fuel accumulations. Most of the logging slash generated from

commercial harvest would be machine piled and burned on log landings and/or along main skid trails. Prescribed burning would occur during moist conditions to help ensure adequate retention of coarse woody debris and surface organic matter following treatment. Fuel reductions achieved through planned ignitions usually burn with low-to-moderate intensities that increase nutrient availability in burned areas. Low intensity fire does not easily consume material much larger than 3 inches in diameter, and charring does not substantially interfere with the decomposition or function of coarse woody debris (Graham et al., 1994). Any dead trees killed from prescribed burn treatments will eventually fall to the ground and become additional sources of coarse woody debris. Depending on the rate of decay and local wind conditions, many of the small-diameter trees (less than 10 inches) would be expected to fall within the short-term (less than 5 years).

A cool-temperature prescribed burn would remove some of the surface litter and duff materials without exposing extensive areas of bare mineral soil. Some of the direct and indirect beneficial effects to the soil resource include: 1) a reduction of fuel loadings and wildfire potential, 2) increased nutrient availability in localized areas, and 3) maintenance of organic matter that supports biotic habitat for mycorrhizal fungi and microorganism populations, 4) increase in available soil moisture due to removal of vegetation in overstocked stands.

The management requirements, mitigation measures, and project design elements built into Alternative 2 are all designed to avoid, minimize, or rectify potentially adverse impacts to the soil resource from ground-disturbing management activities. Operational guidelines for equipment use are included in project design elements to provide options for limiting the amount of surface area covered by logging facilities and controlling equipment operations to locations and ground conditions that are less susceptible to soil impacts in random locations of activity areas. Existing logging facilities would be reutilized to the extent possible. The short-term effects of only one or two passes by specialized machinery are not expected to qualify as a detrimental soil condition (Craigg and Howes 2005). If grapple skidders are used they would only be allowed to operate on designated trails. Other examples include avoiding equipment operations during periods of high soil moisture and operating equipment over frozen ground or a sufficient amount of compacted snow. The successful application of these management practices would help lower the estimated percentages of detrimental soil conditions displayed in (Table S-3).

The project area is located on the eastern flanks of the Cascade Mountain Range where frozen ground and during short periods ample snowfall accumulations provide favorable winter logging conditions. By harvesting over frozen ground or compacted snow, the direct and indirect effects to soils is greatly reduced or eliminated. Soil displacement and compaction are not a major concern when equipment is operated under conditions and in locations which are suitable for winter logging activities. There is no potential for soil puddling damage because dominant soils lack plasticity and cohesion, and equipment operations are discontinued during wet weather conditions. Best results are achieved by harvesting over frozen ground (at least 6 inches in depth) or on a compacted snow base (at least 12 inches in depth) if the soil is not frozen. If the compacted snow base begins to melt due to warmer temperatures or rain-on-snow events, harvesting operations would be discontinued until freezing temperatures and/or additional snowfall allows operations to continue. If project implementation includes the use of winter logging operations, it is anticipated that there would be very little or no visual evidence of soil compaction, rutting, displacement, or loss of protective plant and litter cover within activity areas.

All reasonable Best Management Practices (BMPs) would be applied to minimize the effects of road systems and timber management activities on the soil resource. A variety of BMPs are available to

control erosion on roads and logging facilities. The BMPs are tiered to the Soil and Water Conservation Practices Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Oregon Department of Forestry evaluated more than 3,000 individual practices and determined a 98 percent compliance rate for BMP implementation, with 5 percent of these practices exceeding forest practice rules (National Council for Air and Stream Improvement, 1999).

Soil moisture guidelines would be included in prescribed burn plans to minimize the potential for intense ground-level heating and adverse effects to soil properties. Under all action alternatives, guidelines for adequate retention of coarse woody debris and fine organic matter are included as management requirements to assure both short-term and long-term nutrient cycling on treated sites.

If the Responsible Official selects an action alternative, the management requirements, project design elements and mitigation measures are to be implemented during and following project activities to meet the stated objectives for protecting and maintaining soil productivity.

Alternative 2 (Proposed Action) - Cumulative Effects

Measure: Detrimental Soil Disturbance

Alternative 2 would cause some new soil disturbances where ground-based equipment is used for mechanical harvest and yarding activities during this entry. The combined effects of current disturbances and those anticipated from implementing the project activities were previously addressed in the discussion of direct and indirect effects. The majority of project-related soil impacts would be confined to known locations in heavy use areas (such as roads, log landings, and main trails) that can be reclaimed through soil restoration treatments. Estimates of existing and predicted amounts of detrimental soil conditions were previously displayed and summarized in (Table 3). Treatment activity areas are not expected to exceed the Deschutes Land and Resource Management Plan standard of 20 percent detrimental soil impacts following treatment. If any of the activity areas proposed for mechanical treatments do exceed the Deschutes Land and Resource Management Plan standard of 20 percent detrimental soil conditions soil restoration activities will be implemented to meet the standard.

Mechanical shrub and slash treatments would be accomplished using low ground pressure machinery and soil disturbances from these activities are not expected to qualify as detrimental soil compaction due to the low ground pressure of the equipment, the limited amount of traffic, and the cushioning effect of surface organic matter. Monitoring results have shown that brush mowing activities would not increase the cumulative amount of detrimental soil conditions within activity areas (Soil Monitoring Report, 1997). Slash disposal by the hand pile and burn method would not cause a measurable increase in detrimental soil conditions because machinery would not be used and burning small concentrations of slash materials is not expected to cause severely burned soil. Fuel reductions achieved through prescribed underburning in timber stands are conducted at times and under conditions that result in low-to-moderate intensity burns that do not cause detrimental changes in soil properties.

Measure: Coarse Woody Debris and Surface Organic Matter

As previously described for the direct and indirect effects, it is expected that Alternative 2 would comply with the recommended management guidelines that ensure adequate retention of snags, coarse woody debris, and fine organic matter for surface cover, biological activity, and nutrient supplies for maintaining soil productivity on treated sites.

Under Alternative 2, project implementation includes the application of management requirements, project design elements and mitigation measures during and following project activities to meet stated objectives for protecting and maintaining soil productivity. Operational guidelines for equipment use provide options for limiting the amount of surface area covered by logging facilities and controlling equipment operations to locations and ground conditions that are less susceptible to detrimental soil impacts within activity areas.

All reasonable BMPs would be applied to minimize the effects of road systems, fuels and timber management activities on the soil resource. The BMPs are tiered to the Soil and Water Conservation Practices Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values.

Alternative 3 - Direct and Indirect Effects

Similar to Alternative 2, Alternative 3 is designed to restore desired vegetation conditions. Like Alternative 2, Alternative 3 includes commercial and non-commercial tree thinning along with various types of fuel reduction treatments. Alternative 3 differs from Alternative 2 in that it addresses concerns regarding removal of “commercial” size trees in old growth areas by limiting thinned tree diameter to 6 inches in old growth stands. Alternative 3 also eliminates the use of low impact equipment use in Riparian Habitat Conservation Areas and only allows hand treatments within these areas.

Measure: Detrimental Soil Disturbance

Soil disturbance resulting from Alternative 3 is expected to be very similar to that which is described in Alternative 2. In Alternative 3 the limited equipment operation in Old Growth areas would still occur and therefore predicted soil impacts would be the same as Alternative 2. The elimination of equipment within Riparian Habitat Conservation Areas would result in less soil disturbance in these areas. However, none of the soil disturbance predicted in Riparian Habitat Conservation Areas is expected to be detrimental. This is due to the fact that only low impact equipment would be allowed to work in Riparian Habitat Conservation Areas and operations would only occur during times when the ground is frozen. Thus, again there would be no difference in the predicted soil disturbance between Alternative 2 and 3.

Measure: Coarse Woody Debris and Surface Organic Matter

Direct and Indirect Effects to coarse woody debris resulting under Alternative 3 would be the same as that described in Alternative 2.

Alternative 3 Cumulative Effects

Measure: Detrimental Soil Disturbance

Cumulative detrimental effects to the soil resource are predicted to be the same for Alternatives 2 and 3.

Measure: Coarse Woody Debris and Surface Organic Matter

Alternative 3 would comply with the recommended management guidelines that ensure adequate retention of snags, coarse woody debris, and fine organic matter for surface cover, biological activity, and nutrient supplies for maintaining soil productivity.

All reasonable BMPs would be applied to minimize the effects of road systems, fuels and timber management activities on the soil resource. Therefore cumulative effects resulting from project design and required mitigation would be the same for both Alternative 2 and 3.

Heritage Resources

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Cultural Resources Report for this project (Zettel, D. 2007). Additional information is contained in the full specialist report.

Affected Environment

Between 1981 and 1997, seven different projects have inventoried all or part of the current project analysis area for cultural resources. These previous surveys covered approximately 90% of areas of potential effect in the project analysis area. Areas not in previous inventories are low probability areas, mostly marsh or swamp locations.

Through these past surveys, 17 heritage resource sites have been located and recorded. Sites are defined by having 10 or more artifacts or the presence of features such as a cave, rock art, fire pit remains, or structure (Table HR-1). Isolates are defined as not having any features and locating less than 10 artifacts. The sites are mostly prehistoric (10 sites) with four historic site areas and two historic travel routes. One site has both historic and prehistoric components. One of the travel routes is listed on the National Register (Santiam Wagon Road) but the segments in and adjacent to the current project are under Hwy 20 and a 1950s Railroad Grade subsequently made into a graveled road. Four sites have been evaluated as eligible for inclusion on the National Register of Historic Places with SHPO concurrence. Eight sites and one travel route are either unevaluated or have not received SHPO review of the evaluation. Three sites have been evaluated as not eligible with SHPO concurrence.

The site evaluations were completed 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).

There are eleven prehistoric sites in the project area. Seven of these sites are unevaluated and four are eligible. There are six historic sites in the project area. Three are not eligible, two are unevaluated and one is listed.

Cultural Plants

The Land and Resource Management Plan for Deschutes National Forest directs (Chapter 4, CR-6) that management of Native American cultural resources be coordinated with the appropriate Tribe. This requires, at minimum, that notification and opportunity for involvement be provided when projects are proposed within areas of known concern.

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.

No areas of specific tribal interest resources were identified in the project area. No significant populations of tribal use plants or locations of tribal traditional use are known. However, Suna (2006) reports the presence, within the project boundary, of 28 plant species of cultural interest to the Confederated Tribes of the Warm Springs Reservation. These plants are valued as sources either of food or raw materials. The majority of these plants are common trees or shrubs on Sisters Ranger District. Within the project boundary, more than half of these plants tend to be associated with moister habitats such as Black Butte Swamp, Indian Ford Creek, Glaze Meadow and the aspen stands.

Further surveys by Brigette Whipple, Cultural Resources Anthropologist/Ethnographer for the Confederated Tribes of Warm Springs and Warm Springs Geo Visions found species identified as of interest to the Tribe including: bearberry, tule, wild rose, quaking aspen, chokecherry, vine maple, juniper, and yarrow. Ms. Whipple commented that fire would be beneficial in promoting many of these plants as would improvements to the areas hydrology to provide wetter meadows.

Environmental Consequences

Alternative 1 –Ecological Trends

No effects are expected to prehistoric and historic cultural resources if no action occurs.

If no action occurs no improvements to fire dependent plant habitats will occur and some species will decline.

Alternative 2 and 3 - Direct and Indirect Effects

Project activities will be designed to avoid impacts to eligible or unevaluated historic resources (historic and prehistoric sites and routes) that have the potential to reduce or alter characteristics that may contribute to National Register eligibility. There is no difference in the effects or mitigations of Alternatives 2 and 3.

Potential project activities that could impact heritage resources include:

- Landings in heritage site areas
- Slash piles in heritage site areas
- Skidding and hauling through heritage site areas

- Fire line construction or hand tool mop up in heritage site areas
- Burning in heritage site areas when perishable site components are present (such as wooden structures or features)

The actions above can cause a change in the distribution of artifacts within a site area. This can change the relationships between artifacts which is a key attribute to understanding what activities occurred in a site and when. Additional changes can be actually enlarging the site area by spreading artifacts along a road or skid trail, removing hydration rinds from obsidian artifacts from concentrated heat of pile burning, and breakage of artifacts into fragments increasing the artifact count and possibly making tools unrecognizable.

The effect of the changes above, if they were to occur, would be a reduction of what we could learn about past people in this area by reducing the data potential of the site through the above changes. If enough of the above changes occur, it could reduce the data potential of a site enough to lose its eligibility for the National Register of Historic Places. Boundaries of resource effects are the specific site locations for spacial boundaries. Temporal boundaries are more difficult since any changes since the formation of the site will persist. For the purposes of cumulative effects, we will consider known past projects at each site location and any identifiable impacts on the ground such as a road through the site or erosion.

Both action alternatives are expected to benefit plants of cultural interest which are fire evolved species, and should benefit from increased sunlight, moisture, and bare mineral soil provided by thinning and prescribed fire. Habitat would benefit from treatments on 1192 acres.

Alternative 2 and 3 - Cumulative Effects

With the above mitigation measures no cumulative effects will occur to prehistoric or historic sites.

Cumulative effects to cultural plants are similar to those discussed in the Botany section. Invasive plants are a risk to cultural plant habitats and mitigation measures are required.

Scenic Resources

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Scenic Resources Report for this project (Pajutee, M. 2008). Additional information is contained in the full specialist report.

Desired Future Condition



Desired Future Condition

A previously thinned and burned area adjacent to the project area

Desired Landscape Character

The landscape character goal for the Glaze Project area is to achieve a natural-appearing old growth forest ecosystem for public enjoyment of large, old-tree environments (Deschutes Land and Resource Management Plan, MA-27). It should achieve and maintain a visual mosaic of large trees with stands of younger trees and species diversity where biologically possible. Changes should not be dominant to the casual forest visitor (Deschutes Land and Resource Management Plan, MA-21). Spacing of trees would be variable with clumps of trees, small openings, and patches of trees. Character trees, snags, and small openings, to highlight special features within the landscape, are desirable and encouraged (Deschutes Land and Resource Management Plan MA-21, MA- 27). Where feasible, diversity in vegetation species, age and size classes would be encouraged (such as stands of younger trees), but the primary character would be vast stands of ponderosa pine, with strong elements of large yellow pines.

Along the Special Permit horse trails, the Metolius-Windigo Trail, and in the urban/forest interface more open forests would allow views of large trees, small gaps, aspen groves, riparian hardwoods, meadows, and occasional glimpses of Black Butte.

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, character trees, and younger trees offering scenic diversity as seen from sensitive viewer locations, such as from the permitted horse trails or the Metolius -Windigo Trail. The visual signs of low intensity fire, such as some blackened bark and shrub skeletons would be evident but not dominant.

Ponderosa Pine-Middleground

Ponderosa pine viewed as Middleground will be managed to provide a strong textural element. The presence of large trees with full crowns is an important part of this landscape element. Immature stands are an essential component in the landscape because they help provided strong color contrasts, and eventually become replacements for the larger, old growth trees that perpetuate the desired coarsely-textured character. Visible 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.

Existing Condition

Background

The landscape is 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 ecology and processes. The planning area may seem to be a natural appearing landscape to the casual forest visitor. However, others may perceive that the landscape no longer contains the components such as open park-like stands of large pine and traces of wildfires which are part of the characteristic landscape of Central Oregon and unique sense of place.

Distance Zone

There are two primary distance zones that occur within the project area as viewed from a viewer location or a travel corridor, such as an access or travel route. The area is primarily viewed as **Foreground** (0-1/2 mile) and **Middleground** (1/2-5 miles) landscape area.

Visually Sensitive Areas

The interface between National Forest lands in the project area and private lands at Black Butte Ranch, the permitted horse trails, and the Metolius/Windigo Trail are visually sensitive. Management activities within these areas need to be carefully designed and implemented to minimize short-term impacts on the scenic resource.

Scenic Quality and Integrity

High-density vegetation obscures views of areas with high natural scenic quality, including large old ponderosa pine trees, aspen groves, meadows, rock outcroppings, and distant views. This reduces

the scenic integrity. There is a need to maintain, enhance, and promote the inherent scenic qualities of open park-like stands of ponderosa pine, diverse riparian areas, Glaze Meadow, and the background of Cascade peaks.

The planning area encompasses low elevation ponderosa pine forests, meadows, aspen groves, and a small stream located in east of the Oregon's Cascade mountain range. The current landscape condition has been created by past harvest activities and the suppression of natural wildfires. The project area consists of two forest settings: 1) second growth black bark ponderosa pine stands of various ages and size classes and 2) remnant stands of old-yellow bark ponderosa pine trees often intermixed with younger trees.



Second growth forest area with dense growth of young trees and brush



Old growth forest area, small trees obscure large pine

Half the area consists of second growth black bark ponderosa pine stands that were clear-cut in the 1930's and have few remaining large trees. Large old stumps are evident throughout this area. Second growth forest areas have closed canopies and are more uniform than historical old growth forests which were more open and had small gaps, patches of trees and clumps of larger trees. The area generally meets the condition of a Slightly Altered Landscape with Medium Scenic Integrity Level (or modification).

The other half of the area has remnant old growth forests dominated by large orange bark trees and smaller trees. Trees in the area are more crowded than in the past when low intensity fire every 4-25 years thinned out smaller trees. Most of the forest landscape has missed about 10 cycles of low intensity fire. Some limited reintroduction of fire has occurred. Large trees are now often hidden by young trees. The area generally meets the condition of a Slightly Altered Landscape with Medium Scenic Integrity Level (or modification).



Aspen grove with dead and dying trees and encroaching conifers

In both areas overstocked, high density stands have led to higher fire risks and degraded scenic quality along travel corridors (trails/old roads). The depth-of-field view deep into the forest from trails/old roads is mostly restricted to within the immediate foreground area of the landscape due to the high level of vegetation density.

Many aspen groves in the project area are unraveling with many dead and dying trees. Conifers have invaded these aspen areas with fire suppression. Riparian areas are also dense but lacking in the species

diversity of aspen and hardwoods that once occurred. Meadows have been burned with prescribed fire in the past decade and appear generally natural except for exotic cheatgrass patches brought in by past cattle grazing. Potential views of the meadows are obscured by dense trees.

Approximately 1 ½ miles of the Metolius-Windigo Trail crosses the eastern side of the project area in forest areas which were clear-cut in the 1930's. This old harvest activity is evident in the visual foreground over the entire length of the trail. Depth of field views into the forest are restricted as described above. However, the young forest is generally natural appearing and old stumps have deteriorated so the trail corridor generally meets the condition of a Slightly Altered Landscape with Medium Scenic Integrity Level (or modification).



Existing Condition

Scenery along the
Metolius-Windigo
Trail

Glaze Meadow is in
the background

Environmental Consequences

Analysis Issue: *Will project activities effect scenic quality? How can project activities minimize the effects to scenery visible from horse trails and walking trails (roads)?*

Measure: *Short term changes to scenery and time period for fuels cleanup.*

Important Interactions

Scenic effects are analyzed based on how each of the alternatives changes the existing scenic character and integrity. Scenic character refers to the naturally established landscape patterns that make each landscape identifiable or unique. Scenic integrity is the state of naturalness, or conversely, the state of disturbance created by human activities or alteration. Activities analyzed that can affect scenic resources include timber harvest and associated activities (temporary roads, landings, post-harvest cleanup), aspen restoration and meadow enhancement (visual diversity), burning (both prescribed and wildfire), insect and disease epidemics, and mowing brush.

Both short-term (0-5 years) and long-term effects (5 years and beyond) were analyzed on scenic resources from the proposed alternatives, specifically on landscape character, scenic quality, and scenic integrity level. The short-term effect from the proposed management activities would be most evident to the visiting public would be activities visible within the immediate foreground (0-300 feet), and the middleground (300 feet to 1/2 mile), particularly along roadways and trails.

It is predicted that visual impacts from proposed activities could be mitigated so that areas would meet the Land and Resource Management Plan standards under the visual quality objective of retention. This means debris from thinning would be cleaned up within one year. New equipment choices allow concurrent removal of slash and low cut stumps. Logging over snow or frozen ground would minimize soil disturbance. The reintroduction of fire is an essential process in naturally evolved old growth forest ecosystems and adds to the representation of landscape ecology that is a management goal of the area (Deschutes Land and Resource Management Plan MA-27). The visual effects of fire are part of the landscape character.

The unit of measure for the environmental effects, specifically on scenic resource from the proposed management activities, can be categorized into two distinctive areas. They are: 1. Acres (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, such as road and trail, following implementation. This analysis takes into account both short and long-term effects.

Alternative 1 (No Action) – Ecological Trends

Under this Alternative there would be no vegetation management activities and thus none of the visual impacts associated with the activities (such as stumps and slash piles). Scenic integrity and landscape character would not change in the short-term, but there would be a greater risk of impact from severe disturbances (insects, disease or wildfire) over the long-term. It is expected that increasing amounts of dead and dying trees would be visible, as stands become denser. The dense stands that create a “tunnel effect” along trails would remain dense, and opportunities for views into the forest or of the meadow would continue to be screened by thick understories. Views of the

signature open park-like stands would continue to degrade as understories grow. Ecological processes, such as insects and diseases, wind throw, snow damage, dead and down trees would continue. The area would be at risk of losing key scenic elements to wildfires.

There would be no restoration of riparian areas, aspen stands or meadows, and visual diversity from these forest elements would continue to decline.

Alternatives 2 and 3 – Direct and Indirect Effects

Under the action alternatives, about 1,200 acres are available to be treated as part of a restoration strategy. Every acre will not be treated with all activities because some have been thinned and may only need prescribed fire or mowing. Other areas may be inaccessible or protected as wildlife clumps. The proposed treatment activities, which include mowing, underburning, and forest thinning, are expected to alter the existing landscape character from a more uniform and dense forest to a more open and variable condition.

Proposed vegetation activities under each of the action Alternatives would result in short-term visual impacts associated with the activities (e.g. changes in textures and color from removing trees). Each of the action alternatives would move the current scenic resource more toward the desired conditions stated in the Deschutes National Forest Land and Resource Management Plan direction.

Vegetation management activities would likely be visible in the foreground and middleground of 90-100% of the trails and old roads under both action alternatives. Required mitigations such as logging over snow or frozen ground, low cutting stumps in the Metolius-Windigo trail corridor and concurrent slash removal are expected to greatly reduce visual impacts. None of the activities would be visible from distant vistas, such as Black Butte and are expected to blend into the landscape.

The proposed activities are expected to enhance long-term scenic quality on 80-100% of the project area by as reducing stand densities, promoting large trees, restoring aspen stands and meadows, and reducing unauthorized roads. The majority of actions proposed under all of the action Alternative are thinning and underburning.

Thinning is expected to enhance the long-term scenic quality and improve scenic integrity, with the more intensive thinning under Alternatives 2 having the greatest benefit because it will remove more small to medium size trees around existing old growth. However, short-term alterations would be more visible under Alternatives 2 since more trees would be removed and the remaining stands would be more open. Alternative 3 where only very small trees (less than 6" diameter) are removed in old growth stands would have the least visible short-term effects, but would also be the least effect on enhancing long-term scenic quality in old growth. The effects of both action alternatives would be the same in second growth forests because they would be treated in the same way.

The “tunnel-effect” along the scenic corridors of trails would be altered and diversified, offering filtered views into forest stands, meadows, and distant peaks. Densely stocked stands would be opened up and the desired quality of open park-like stands would be met on many acres. This scenic enhancement along trails would be the best under Alternative 2 and least under Alternative 3 because more trees would be removed around old growth trees in Alternative 2.

Prescribed underburning would be visible on more acres under Alternative 2 because of the increased likelihood of creating more appropriate conditions for reintroduction of fire in riparian areas, because more fuels are removed during thinning. Alternatives 3 would have slightly fewer acres underburned so would have less of a visual impact than under Alternative 2. However, the effects of underburning (blackened trees and reduction of shrubs) would be short-term (in some cases, as short as one growing season), and can be mitigated. Both fuel treatment activities of mowing and/or under burning of the forest floor, are expected to increase the ground cover components in 1-2 years, and add diversity to the foreground landscape. Within the Metolius Scenic Views allocation near the Metolius-Windigo horse trail, prescribed fires would required to be natural in shape and generally less than 5 acres.

Under each of the action alternatives, approximately 79 acres of aspen would be restored, and 236 acres of meadows would be maintained (removal of smaller encroaching conifers and some prescribed fire). These actions would enhance scenic diversity, equally under both action alternatives.

The residual stumps, slash and debris following fuels treatment activities are expected to be minimal and blend well with existing environment. Treatments will not be highly noticeable to casual visitors after clean-up treatment activities are completed within 1 year. The effect(s) of smoke on local residents in and around Sisters area could be a concern as it could affect scenic views. This is mitigated through smoke management guidelines.

The installation of the temporary Acrow bridge would be a visible change however, after removal and restoration the visual condition of the current over-wide ford would be improved and appear more natural. Use of existing roads as temporary haul roads would result in some widening and rutting. Visual impacts to roads would be mitigated by a protective cover of snow and frozen ground.

Under both the action alternatives the resulting landscape is generally expected to meet scenic standards and guidelines.

Alternatives 2 and 3 – Cumulative Effects

This cumulative effects analysis considers the visual changes apparent to the casual user within the project area from the 1990's to approximately 10 years into the future, the time span that reflects when effects from this project have ceased or become similar to background. This period was chosen since this is when the Deschutes Land and Resource Management Plan was enacted and created the current special management allocations.

The project area was chosen as the cumulative effects analysis area because gated roads and the area closure isolates it from much of the rest of the forest. The project area cannot be seen from any major roads or recreation developments. Past, present, or reasonable foreseeable future actions which have affected or may affect recreation in the project area (Table SR-1) include:

Table SR-1. Past, Present, and Future Activities in the Cumulative Effects Analysis Area

Project	Time Period	Effects
Black Butte Stables Special Use Permit	Current and future	Trail changes- deeper and dustier
Glaze CT Timber Sale	Through 1991	Logging activities and prescribed burning
Glaze Cattle and Horse Grazing Allotment	Through 1995	Visual changes to meadows, riparian areas and shrubs from grazing and trampling
Black Butte Fuels Reduction	Mid 1990's	Thinning activities and prescribed burning
Highway 20 Project	Mid 1990's	Thinning activities and prescribed burning
CEC Power Pole replacement	2004	Small scale logging and ground disturbance

In the past 18 years users have been subjected to disturbances from forest management activities several times as the projects listed above were completed. These activities have caused temporary displacement of users and visual changes. These effects have been generally been short in duration and many out of area users now perceive the area as quite natural in appearance. Some users from out of the area even believe it to be like a wilderness (Hermann, D and V. Herring Conversation Record, May 26, 2006). Other more discerning users are aware of stumps, old skid trails, and prescribed fire.

Visual conditions in much of the area have greatly improved since the closure of the cattle allotment because more flowers, grasses and riparian vegetation are visible. Removal of cattle fences is ongoing and has improved the recreational setting for both user safety and scenery.

It is expected that with mitigation measures including, restricted seasons of operations, thinning operations over frozen ground or snow, educational outreach, and timely cleanup of fuels, there will be no cumulative effect scenic resources in the project area because ground disturbance will be minimized and thinning residues will be promptly removed. Visual changes from activities such as prescribed fire will affect some users as they have in the past but these changes are part of the ecology of an old growth forest and expected to be of a short duration (approximately 5 years). Over the long term visual quality will be enhanced by the more naturally spaced, mosaic of trees in the second growth forest and more visible large trees in the old growth forest under both action alternatives.

Recreation Resources

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Recreation Resources Report for this project (Pajutee, M. 2008). Additional information is contained in the full specialist report.

Existing Condition

The Glaze project area is off the beaten path with limited access and visibility for the general public. Recreational use in the area is light. Most users are residents or visitors from Black Butte Ranch, horse riders on trail rides, or horse riders passing through on the Metolius-Windigo trail. Some users access the area over a footbridge at Indian Ford Creek for birding or walking.

Recreational Developments

Recreation developments include a portion of the Metolius-Windigo Horse Trail, and 6 miles of shared roads/horse trails (which incorporated several level 1 and 2 roads into the system). The Indian Ford Creek bridge area is problem dispersed camping spot for long term residents (people who camp illegally for weeks or months while working in the Sisters area). Other dispersed camping occurs occasionally in this location. The Recreational Opportunity Spectrum for the area is “Roaded Natural”.

Area Closure to Vehicles

The area has been closed to motorized vehicles, including off highway vehicles such as ATV's or motorcycles, since 2000 under a Special Area Closure Order. This is to protect special biological communities and implements Forest plan direction for the Metolius Old Growth Management Area. Vehicle trespass, primarily by ATV users occurs.

Special Use Permittee, Outfitter/Guide

Black Butte Ranch began operating horse rides on the ranch and the adjoining National Forest soon after the resort development was completed in 1979. Various individuals have held the special use permit. The current permit holder began operations in 1993 by purchasing the Outfitter/Guide business. Currently Black Butte Stables provides guided horseback rides in the Glaze Meadow and Old Growth area. They provide horses, saddles and guides and take the customer on mostly short rides, usually less than 2 hours in duration.

The current permit holder is limited to 8,000 user days in the Glaze Old Growth area. A user day is 1 user for a day or a portion of a day. For example 1 person going on a 1 hour ride is 1 user day. This limit was determined in the 1996 Decision Memo to reissue the permit. It is based on the standard and guidelines in the Deschutes Land and Resource Management Plan which states “current outfitter guide use of the horse trail should not negatively impact the wildlife values of the Glaze Meadow Old Growth Area”.

The limit is based on past use, with the assumption that additional use beyond that would cause impacts to wildlife. There are no plans to expand this use without further analysis.

Current use averaged for the last 7 years 2000-2006 is **5,254** user days (Table R-1).

Table – R-1 Black Butte Stables – User Days 2000-2006

Year	2000	2001	2002	2003	2004	2005	2006
User Days	5,306	6,500	5,381	4,230	5,768	5,054	4,336

There are 4 different tours given from the Black Butte Stables area in the Glaze Meadow area. They are the $\frac{1}{2}$ hour tour, 1 hour tour, $1\frac{1}{2}$ hour tour and 2 hour tour. The use is usually between the months of June and August. The season lasts from Memorial day until Labor day. Use can be broken down as follows (Table R-2):

Table – R-2 Black Butte Stables – Average Tour Use based on June, July and August 1992.

Tour Time	$\frac{1}{2}$ hour tour	1 hour tour	$1\frac{1}{2}$ hour tour	2 hour tour
Users	499	2897	862	579
Percentage of Use	10%	60%	18%	12%

This breakdown of use is pretty consistent and continues about the same today. The 1 hour tour goes to the second bridge (where current beaver dam is) and then makes a loop. The $1\frac{1}{2}$ hour tour usually makes it to the top of Gobbler's Knob. The 2 hour tour usually goes around Glaze Meadow and utilizes the Metolius Windigo Trail. The tour length is dependent upon the group, guide and riding ability.

The Forest Service manages these trails through the permit holder who performs trail maintenance work. The special use permit designates which trails are available to the outfitter guide operation. They are not considered Forest Service system trails and Forest Service trail crews do not maintain them. The Forest Service provides guidance and monitors the Outfitter/Guide. The Outfitter/Guide is responsible for contacting the Forest Service before beginning any major project such as bridge replacement or sawing blow down trees out of the trail. Since the late 1980's improvements such as a trial bridge crossing, closures of excess trail, and dust and erosion abatement with manure or woodchips, and installation of trail depth monitoring points have been done.

In 2007, a portion of the trail was flooded by a beaver dam on Indian Ford Creek. The Outfitter/Guide was allowed to use an existing road to make a loop to the south and avoid the water.

The permittee has expressed concerns about the effects of the project on wildlife and impacts to visual quality from thinning activities. They felt the area was not in urgent need of treatment and were displeased with other thinning projects which created slash piles and opened forests to allow more ATV trespass (Hermann, D and V. Herring Conversation Record, May 26, 2006). This issue is addressed in this analysis and under the previous section on Scenic Resources.

Other Recreational Use

Several Black Butte visitors and residents board horses at the Black Butte Stables and ride on the trail system. Some mountain bikers and a few hikers use the trails, but not many due to the trail surface and horse traffic. Birding has become more popular and groups from Black Butte Ranch

maintain nest boxes the area. On a small butte adjacent to the project area called Gobbler's Knob illegal OHV use has increased in the last few years and conflicts between users occur. The number of other recreational users is not known, however, it is significantly less than the use from Black Butte Stables.

Other Special Uses

Other special uses in the area include the 115 KV aerial power line to the Black Butte Ranch substation. This power line is permitted to Central Electric Cooperative Inc. and runs along the 1012-330 road and 1012-339 on the south end of Glaze Meadow for approximately 3400 feet with a 30 foot wide right of way.

Environmental Consequences

Analysis Issue: Will project activities effect recreational activities in the area? How can project activities minimize the effects to scenery visible from horse trails and walking trails (roads)? (see Scenic Resources)

Measure: Displacement of users.

Alternative 1 (No Action) – Ecological Trends

Under the No Action Alternative there would be no displacement of recreational uses and no changes to forest recreation settings from restoration activities in the short term. Forest trails would not be impacted.

In the longer term there is a risk that disturbances to the area from wildfire, insects or disease, could result in broad changes in recreation settings (see Forest Vegetation and Fire and Fuels analysis). This could alter the aesthetic quality of settings, the quality of riparian habitat, and by reduce the thermal cover from high summer temperatures and exposure (Evers 2000, Omi 1997). Recreationists would not be able to visit forest areas if wildfire suppression activities were to occur. Fire area closures for public safety have affected nearby recreation areas six times since 2002 as large fires burned.

As the forest grows visual conditions will continue to change as more small trees and brush obscure views of larger trees and understories in old growth areas. Second growth area will remain uniform and lack diversity in spatial arrangements and size of trees.

Alternatives 2 and 3 – Direct and Indirect Effects

Important Interactions

The types of proposed activities that may affect recreation use in the planning area are tree thinning and removal, prescribed burning, and mowing that may occur on or adjacent to roads and trails.

Tree thinning and fuel reduction activities may displace recreationists in the short-term. Displacement may be directly due to physically closing access to areas during vegetation

management activities, or because of noise and visibility. People would be unable to use existing roads in the area that are used a temporary haul routes or they may find using them more difficult. Indirect effects can be due to altering the setting. This displacement will be mitigated by the timing of the thinning operations which are required to occur in the winter over snow or frozen ground when the area receives little use. As discussed above, since most use from Black Butte Stables occurs between the months of June and August, winter operations and spring or fall burning, or fall subsoiling will have minimal impacts on the majority of users which visit the area on trail rides.

Thinning activities would have the longest duration effect on use by recreationists (several months), while prescribed burning and mowing would only physically prevent recreationists from visiting areas during implementation of the activity (one day to several weeks). Because of the requirements for thinning operations over snow or frozen ground, operations may occur over several winters because of a limited window of appropriate conditions.

Thinning and prescribed burning activities can also impact trails if heavy equipment travels across trail treads or harvest debris falls across the trails. Operating over snow or frozen ground will minimize these impacts and reduce the duration of the effect. Trail cleanup will be specified as part of thinning operations.

Hand thinning may occur in dry summer conditions in aspen groves or riparian areas. This could cause some temporary disturbance in a few areas where trails are close by.

An indirect effect from thinning and creating more open conditions in the project area is the increased ability for people to illegally drive vehicles especially off highway vehicles through the open forest (the project area is relatively flat). This effect can be mitigated through better signage, education, and enforcement.

Noise and visibility of timber harvest and post-sale activities could impact opportunities for solitude and isolation provided in the area. Some people may be disturbed by the visual changes caused by the treatments, including blackened trees from prescribed burning. These changes will lessen over time and be most apparent in the first 5 years. Over time visual quality in the area will be improved because of increased “natural” variability in second growth stands which are currently uniform and increased visibility of large trees in old growth areas where small trees may obscure tree views.

Alternative 2 would cause the most displacement and visual changes to recreational users because of more intensive treatments in old growth areas and more treatments in riparian corridors. Because Alternative 3 treats only very small trees in the old growth area and less of the riparian area these impacts would be less on about half of the project area.

Proposed activities are predicted to reduce the risk of severe disturbances on the acres they occur, and thus would reduce the potential impacts to forest settings for recreation by maintaining more sustainable thermal cover and aesthetic background for recreation activities, and protecting trails. Alternative 2 is more effective in reducing this risk than Alternative 3 on about half of the project area.

Alternatives 2 and 3 – Cumulative Effects

This cumulative effects analysis considers displacement of recreational uses and magnitude of visual changes apparent to the casual user within the project area from the 1990's to approximately 10 years into the future, the time span that reflects when effects from this project have ceased or become similar to background. The project area was chosen as the analysis area because gated roads and the area closure isolates it from much of the rest of the forest. This period was chosen since this is when the Deschutes Land and Resource Management Plan was enacted and created the current special management allocations.

Past, present, or reasonable foreseeable future actions which have affected or may affect recreation in the project area include (Table R-3):

Table R-3. Past, Present, and Future Activities in the Cumulative Effects Analysis Area

Project	Time Period	Effects
Black Butte Stables Special Use Permit	Current and future	Trail changes- deeper and dustier
Glaze CT Timber Sale	Through 1991	Logging activities and prescribed burning
Glaze Cattle and Horse Grazing Allotment	Through 1995	Displacement due to cattle and visual changes from grazing and trampling
Black Butte Fuels Reduction	Mid 1990's	Thinning activities and prescribed burning
Highway 20 Project	Mid 1990's	Thinning activities and prescribed burning
CEC Power Pole replacement	2004	Small scale logging and ground disturbance

In the past 18 years recreational users have been subjected to disturbances from forest management activities several times as listed above. These activities have caused temporary displacements and visual changes. These effects have been short in duration and many out of area users now perceive the area as quite natural in appearance, some even believing it to be like wilderness (Hermann, D and V. Herring Conversation Record, May 26, 2006). Other more discerning users are aware of stumps, old skid trails, and prescribed fire.

Visual conditions in much of the area have greatly improved since the closure of the cattle allotment and more flowers, grasses and riparian vegetation are visible. Removal of cattle fences is ongoing and has improved the recreational setting for both user safety and scenery.

It is expected that with mitigation measures including, restricted seasons of operations, educational outreach, and timely cleanup of fuels, there will be no cumulative effect on recreation or special uses in the project area because most users will not be present in the area during activities, ground disturbance will be minimized, and thinning residues will be removed. Visual changes will affect some users as they have in the past but these changes are expected to be of a short duration (approximately 5 years) and over the long term visual quality will be enhanced by the more naturally

spaced, mosaic thinning in the second growth forest and more visible large trees in the old growth forest.

Roads

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Engineering Specialists Report for this project (Hedges, C. 2008). Additional information is contained in the full specialist report.

Existing Condition

There is no private ownership within the project area. The western and southern sides of the planning area share a boundary with Black Butte Ranch and another private ownership. State Highway 20/126, and Forest Service lands border the northern and eastern side of the area. Currently, motorized vehicle access within the planning area is limited to administrative use of the road system, according to an area closure order implemented on October 4th, 2000 under direction of the Deschutes National Forest Land and Resource Management Plan. Public vehicle travel on the road system and off-highway vehicle travel, including snowmobiles, is prohibited. This is called the Glaze Old Growth Area Closure, Number 01-001. The Metolius-Windigo Trail traverses the planning area from northeast to southwest. The designated trail route and roads within the area see recreational use via horseback, mountain bike, and foot travel.

The Glaze Old Growth Area Closure appears to have been generally effective since it's inception in 2000. Off-highway vehicle tracks have been seen in the planning area adjacent to private developments. A breach of a road closure on NFSR 1012204, outside of the planning area, shows recent use and would allow vehicle access to the Area Closure.

In the future, it is likely that land management activities will continue, requiring administrative use of the road system. All of the Forest Service system roads within the planning area are Maintenance Level 1, closed to all but administrative and permitted traffic, according to the current area closure order (Table RD- 1). These roads are native or aggregate/cinder surfaced, acceptable for high clearance passenger vehicles and commercial log haul vehicles at low speeds.

Some segments of the planned commercial haul route, outside of the planning area, have Maintenance Level 3 type road surfaces. Maintenance Level 3 roads are maintained for low speed travel by passenger cars, and can have a surface of cinder, aggregate, or asphalt. User comfort and convenience are low priorities. National Forest System Road (NFSR) 1012330, named Old Santiam Road, was formerly used as a logging railroad spur line, and more recently as a commercial log haul route. NFSR 1012339 provides access to a Central Electric Cooperative power substation. NFSR 1012335 makes several crossings of meadow habitat, and would not be suitable for commercial vehicle traffic during periods of high water table or saturated soil conditions.

NFSR 2000300 fords Indian Ford Creek, on the northeast side of the planning area. In 1984 a single lane bridge was removed from this crossing and relocated to Indian Ford Campground. Non-system temporary roads, referred to as unauthorized roads, exist and are generally in stable condition, showing signs of wheel track re-vegetation since their last use. Many of these roads are being used as permitted and non-permitted horse trails.

Table RD-1 National Forest System Roads within the project area

NFSR#	BEGIN	END	LENGTH (Mi)	SURFACE TYPE
1012207	1012212	1012213	0.30	Native
1012208	1012207	End of Road	0.10	Native
1012212	1012207	End of Road	0.26	Native
1012213	Private Land	1012207	0.21	Native
1012330	MP 0.90	End of Road	0.53	Pit Run Aggregate
1012335	1012330	2000300	0.99	Native
1012337	1012335	End of Road	0.32	Native
1012339	1012330	End of Road	0.13	Aggregate
2000300	MP 0.66	MP 1.19	0.53	Native
2000345	2000300	End of Road	0.30	Native

Roads Analysis

No changes to the National Forest system roads in the area are planned. A project area road analysis was not required by the decision maker.

Road Densities

The majority of this land is allocated as Management Area 27, Metolius Old Growth, with the remainder as Management Area 21, Metolius Black Butte Scenic. Within the Metolius Old Growth Area, plan direction calls for the closure and natural re-vegetation of roads that are no longer needed.

Since there are no specific open road density guidelines for these management areas, the forest deer summer range guideline of 2.5 miles per square mile is applied. The entire planning area will remain under the existing Glaze Old Growth Area Closure, which limits motorized access to persons with an authorized permit, public safety and emergency personnel, and Forest Service employees on official business. Commercial use of the road system would be permitted under all alternatives of this document.

Currently, there exist 3.7 miles of National Forest system roads within the Glaze Planning Area. This area encompasses about 1200 acres. System road density equals 1.97 miles per square mile of planning area (Table RD-2).

Current unauthorized road length is approximately 4 miles. Unauthorized road density equals 2.1 miles per square mile of planning area.

Table RD-2 Glaze Project Area Road Densities

ROAD STATUS	ROAD DENSITY (Mi per Sq Mi)	FOREST PLAN GUIDELINE (Mi per Sq Mi)
System Roads Within Closure Area	1.97	N/A
Open System Road	0.00	2.5
Unauthorized Roads	2.1	N/A

Environmental Consequences

Background on Haul Routes

The National Forest Road System within the planning area is generally in stable condition. Haul road mileages are displayed in Table RD-3. Some road segments through meadow areas show wheel rutting. Commercial use without reconstruction on some road segments would require seasonal restrictions, and/or road maintenance surface spot rockering. Some roads would require road reconstruction if used as haul routes (see Design Criteria section).

Because of the potential for resource damage to NFSR 1012335, which passes through a wet meadow, NFSR 2000300 will be used as a haul route. A 50 foot, temporary modular steel Acrow bridge would be installed on an existing system road at an old bridge crossing on Indian Ford Creek and removed and rehabilitated after the project ends. The bridge would be primarily located in the existing road footprint. It may be slightly wider (approx. 10 ft wider) than the existing footprint but removal of live vegetation including trees would be extremely limited by required measures to protect shade and all fill and bridge materials would be removed after harvest activities are completed.

Table RD-3 Haul Roads to be used in the Glaze Forest Restoration Project

Road Type	MILES
System Haul Roads in the Glaze Project Area	2.9
System Haul roads outside of the Glaze project area	4.2
Temporary haul roads on unauthorized roads	2-3.5*
Total Haul Roads	9.1 – 10.6

* Miles vary by equipment type used for harvest

Alternative 1 -No Action – Ecological Trends and Ongoing Maintenance

There would be no road construction, reconstruction, or additional maintenance associated with this alternative. The Glaze Old Growth Area Closure would remain in effect. Unauthorized road density would not change. The road system would be used by persons with an authorized permit, public safety and emergency personnel, and Forest Service employees on official business. Road system monitoring and maintenance would continue in response to condition surveys and future activities based on Deschutes Forest Plan guidance. Breaches of the motor vehicle area closure will likely

occur at the current low level. Improvements to NFSR 2000300 ford across Indian Ford Creek would not occur and the ford would remain over-widened and soft.

Alternative 2 and 3 –Direct and Indirect Effects Common to Both Alternatives

Road reconstruction and pre-haul road maintenance would be the same under both Action Alternatives. The road system will remain under the Glaze Old Growth Area Closure, after project activities are completed, and all system roads will be used under each action alternative. Road maintenance activities associated with both action alternatives will include surface spot rocking, possible entrance gate reconstruction, appropriate surface and drainage maintenance, and seasonal use restrictions at wet meadow/seep areas. Road density would not increase and all Level I roads would be closed after harvest activities.

Road maintenance activities associated with both action alternatives will include surface spot rocking, possible entrance gate reconstruction, appropriate surface and drainage maintenance, and seasonal use restrictions at wet meadow/seep areas. The road system will remain under the Glaze Old Growth Area Closure, following activities, and all system roads will be used under each action alternative.

Alternative 2 and 3 Cumulative Effects

This analysis considers cumulative effects to roads within the project area from the 1990's to approximately 10 years into the future, the time span that reflects when effects from this project have ceased or become similar to background. The project area was chosen as the analysis area because gated roads and the area closure isolates it from much of the rest of the forest. This period was chosen since this is when the Deschutes Land and Resource Management Plan was enacted and created the current special management allocations and created the current travel restrictions.

Within the planning area, Central Electric Cooperative will continue to maintain their above and below ground power lines, and power substation, utilizing the road system under a special use permit. The Metolius-Windigo Trail and other points of interest will continue to be visited and used by the public. Trail maintenance activities will occur, using the road system access points. Non-motorized recreational use is likely to increase. Other Forest Service management activities, such as allotment fence removal, forest plan monitoring, and resource surveys will continue at current levels. The existing road system should be maintained for these uses, and should remain adequate and economical.

Adjacent to the planning area, the effectiveness of the Glaze Old Growth Area Closure is jeopardized by a breach of the closure on NFSR 1012204. Privately owned forest land adjacent to the planning area could be developed into residential properties in the future. This type of development could put a strain on the existing road system.

As described above in the action alternative effects section, with proper timber haul road reconstruction and maintenance, restricted haul periods to protect native surface road / meadow crossings, and possible gate reconstruction, the Glaze Forest Restoration project would not have any

adverse effects to the transportation system and would therefore, not incrementally add to cumulative transportation effects.

Economics

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects as analyzed in the Economics Report for this project (Tandy, B. 2008). Additional information is contained in the full specialist report.

Important Interactions

Activities associated with the Proposed Action or its alternative may generate various economic benefits and costs, depending on design. The economic values provided under these alternatives may be less than associated costs. Agency costs associated with planning and administration are not included, but are expected to be similar under the action alternatives.

Management activities, which incur costs and generate impacts, can also change the risk and intensity of wildfires and their associated costs and impacts. Cost and benefits associated with reducing the risk of moderate to high severity wildfire were not assigned a dollar value though there would likely be changes in resource values such as increases or decreases in wildlife habitat, recreation use and other ecosystem services, and costs associated with wildfire suppression. Non-market values are also briefly discussed.

Market Values

Factors that can affect economic value are the amount of sawtimber versus chip/pulpwood, the volume available for sale, and the costs of required brush disposal and road reconstruction. The market value for pulp and chip may be considerably lower than for sawlogs, and could deter potential purchasers. It is estimated, depending on the alternative, that a majority of the trees proposed for removal from the project area would not be considered suitable for milling into saw logs, but only suitable for chips/pulp.

This project does not have the same objectives as a traditional timber sale, which primarily would be to offer wood products in the most cost efficient manner. The objectives are restoration of ponderosa pine old growth habitat and fire hazard reduction. Cost efficiency is desirable, but should not drive the project. Much of the work done on National Forests, other than traditional timber sales, are funded through a variety of means, including appropriated funds, partnerships with other agencies or private entities, and service or stewardship contracts. Those options would be considered as ways to fund the restoration work under this project, as well as through viable timber sales.

There are opportunities to use timber sales to remove material when receipts from sale of the material cover the costs for conducting the timber sale operation. However, since a majority of the trees proposed for removal to meet restoration objectives have very low market value (chips/pulp), a timber sale may not be the most cost efficient way for removing that material. Consequently, alternative funding methods are recommended for a discussion on optional methods that may be available to do vegetation management and restoration work under stewardship authorities).

Assumptions regarding values of possible wood products were based on estimated market value in the 4th quarter of 2007 for various sizes for ponderosa pine, the primary species to be removed. If the market improves the values would increase, and conversely, if the markets go down, the values

would be less. Another assumption was that the wood products would be hauled to Gilchrist, Oregon.

The following assumptions were used in appraising the value of products under the different alternatives:

- The average selling value for logs delivered to the mill is displayed in the following table. The log price information in this table is from the Oregon Department of Forestry website on Log Price Information from Region 5 – Klamath Unit, 2007 4th Quarter. Ponderosa pine would be the primary species harvested.

Log Size	Value / mbf
6"-8"	\$250
8" to 14"	\$325
14" to 22"	\$400

- Logging costs were based on similar recent offerings.
- Hauling costs were based on haul to Gilchrist, Oregon.
- Chip prices used were \$35/ton.

Non-Market Values

The preceding economic analysis was presented from the view of resource utilization, where wood-fiber is a market commodity. The economic principles are fairly well understood and are an important consideration in overall project design and resulting consequences.

Another economic aspect of resource management consideration is the values of “ecosystem services”. Ecosystem services can include purification of air and water, generation and preservation of soils and renewal of their fertility, protection of stream channels and banks from erosion during high water, and provision of aesthetic beauty and intellectual stimulation that lift the human spirit. Direct relationships and clear principles for accounting for such things are only beginning to be developed, including how to quantify the value of the forest in its current condition, or the value of standing timber as a form of “natural capital”, the biophysical structure that provides ecosystem services (Hawken et al. 1999).

While some ecosystem services may be on a much larger scale than would be measurably affected by this project (e.g. partial stabilization of climate) some of the proposed actions, on a local-scale, can affect certain ecosystem services, and are discussed under the other resources in this Chapter.

Wildfire Costs

One of the purposes of this project is to reduce fire hazard and thus the risks from wildfire. It is important to understand there would be costs associated with impacts from a potential wildfire (to people, property and resources) and related wildfire suppression expenditures. Costs to ecosystem services are described qualitatively under the other sections on effects to resources in this Chapter. The average costs of wildfire suppression were estimated by reviewing the average per acre costs of suppression activities in Central Oregon over the last twenty years.



There is a considerable range to suppression costs, and expenditures are dependent on a variety of factors. Assumptions were made that the more fuel that is removed from the landscape, particularly relating to crown bulk densities, the less severe a wildfire would be and the lower the suppression costs. However, there are many factors that affect suppression costs that cannot be determined at this time; where a wildfire starts (wilderness or populated areas), and the conditions under which a wildfire may burn (wind speed and direction, fuel moistures, terrain, immediate risks to people, access, etc). The average suppression cost should only be used for comparison purposes, and may not reflect actual costs of suppressing a future wildfire in the project area.

As can be seen in Table E- 1, the costs/acre for suppressing small wildfires can be significantly greater than the costs/acre for suppressing large wildfires, but clearly the total costs would be less for smaller fires than for large ones. It is assumed that firefighters would be better able to control wildfires under the alternatives that reduce surface and ladder fuels and crown bulk densities the most, thus keeping the overall size of wildfires smaller and resulting in lower total costs for wildfire suppression.

Table E-1. Average Costs per Acre for Wildfire Suppression from 1987-1997.

Size of Wildfire	Deschutes National Forest Average costs	Sisters Ranger District Average Costs
0.0-0.25 acres	\$6,575/acre	\$3,290/acre
0.26-9.9 acres	\$4,101/acre	\$3,305/acre
10 – 99 acres	\$3,065/acre	\$2,808/acre
100-299 acres	\$1,954/acre	\$1,886/acre
300-999 acres	\$2,133/acre	\$2,133/acre
1,000-4,999 acres	\$825/acre	\$825/acre
5,000 + acres	\$286/acre	\$286/acre

Table E-2 below shows the costs per acre for more recent wildfires on the Sisters Ranger District, again demonstrating that smaller fires cost far more per acre to suppress than larger fires. In addition, suppression costs have greatly increased with costs for more recent fires such the 2006 Black Crater Fire (\$1,595/acre) more than 5 times the average cost of fires of similar size class ten years ago. This indicates a trend of rising costs for local wildfires.

Table E-2. Recent Wildfire Sizes and Costs on Sisters Ranger District.

Incident Name	Ignition Date	Acres Burned	Cause	Suppression Cost	Suppression Cost/Acre
				Actual	Actual
Jefferson	8-Jul-96	3,689	Human	6,000,000	1,626
Park Meadow	24-Aug-96	598	Lightning	3,000,000	5,017
Square Lake	19-Aug-98	113	Lightning	1,000,000	8,850
Cache Creek	2-Aug-99	382	Lightning	1,600,000	4,188
Eyerly	9-Jul-02	23,573	Lightning	10,702,142	454
Cache Mountain	23-Jul-02	3,887	Lightning	7,000,000	1,801
Link	5-Jul-03	3,590	Human	8,300,000	2,312
B&B Complex	19-Aug-03	90,681	Lightning	40,300,000	444
Black Crater	23-Jul-06	9,407	Lightning	15,000,000	1,595
Lake George	7-Aug-06	5,550	Lightning	18,000,000	3,243
GW	31-Aug-07	7,564	Lightning	7,700,000	1,018

Employment

The primary effect on local communities would be in terms of employment provided by preparation, implementation and administration of fuel reduction and forest health activities by alternative. The alternatives provide a variety of activities that would require widely varying equipment and skills. The level of benefit to local communities would depend on the capacity of existing contractors residing in the area in terms of skills and equipment, the labor force available to these contractors, the amount of existing work they have under contract, their desire to acquire larger contracts, new contractors seeking opportunities, and other contracting requirements such as programs for small

businesses. The level would also depend on the amount of funding received for activities over the next 5+ years.

It is unknown how many and what type of jobs could be created by stewardship contracting opportunities in Central Oregon, or the extent to which they could support or enhance the social well-being and economies of rural communities. However, forest health and fuel reduction employment could help diversify the local economy some, and help increase the community capacity or resiliency (Committee of Scientists 1999).

Another economic benefit from fuel reduction and forest health activities in the GLAZE Project area is a supply of wood products to mills in Eastern and Central Oregon and the Willamette Valley. Secondary benefits to employment in the wood products industry could result when this project is implemented.

Environmental Consequences

Effects of Alternative 1 – No Action

Alternative 1 would result in no active management of the resources except for custodial activities such as fire suppression, routine maintenance and the associated economic benefits related to those activities. Alternative 1 would generate no goods or services to the local and regional economies, except those related to emergency actions. In relation to likely employment within the closest counties to the Glaze project area, this alternative would produce the fewest natural resource related jobs in the short and long term.

Non-market values, or ecosystem services, would not be directly affected under this alternative; however, there would be an increased risk of impacts to many of the local services due to the current areas at risk of high severity, uncharacteristic wildfire, insects and disease. There would be no potential net savings in wildfire-related costs and benefits. See descriptions under Alternative 1 (No Action) under the other resources addressed in this Chapter for an understanding of non-market values as they currently exist.

Effects Common to the Action Alternatives

Non-market values of ecosystem services would be enhanced under the action alternatives, though short-term impacts would be expected on many of the services (e.g. visual impacts during the project implementation). See discussions under the other resources in this Chapter for an understanding of effects on relevant local ecosystem services.

The action alternatives are compared in terms of total costs and total product values. Table E-3 summarizes the estimated costs of vegetation and fuels treatments. Table E-4 summarizes the volume and value of products produced. Table E-5 summarizes the net value of each alternative (total costs minus total product values). Both of the action alternatives have net values that are “in the red” (costs exceed the value of products), due to the large number of acres identified for prescribed burning, mowing, small tree thinning and other treatments with little or no product value.

Costs:

The estimated costs of vegetation and fuels treatments is displayed in table E-3. The costs of the vegetation and fuel treatments were estimated based on recent treatments in projects on the Sisters

Ranger District. Mechanical thinning costs were estimated for thinning/harvesting systems such as cut-to-length and feller-buncher systems. Hand thinning costs were estimated for hand thinning both with and without the use of a small mechanical thinning system such as an ASV or Bobcat with a shear. Hand thinning was prescribed for acres with poor access, or for resource concerns (e.g., riparian areas) or areas with very little potential for product recovery.

Volume and Value:

The volume and value of products produced is displayed in table E-4 by potential sawlog volume and chip/pulp volume. Sawlog volume is displayed based on the potential volume per acre. Volumes/acre from mechanical thinning in the 2nd growth stands are predicted to average approximately 3.5 mbf (thousand board feet)/acre. Volumes/acre from mechanical thinning in the old growth stands are predicted to average approximately 0.75 mbf/acre.

Table E-5 summarizes the net value of each alternative (total costs minus total product values).

Table E-3. Costs of Vegetation and Fuels Treatments by Alternative.

Treatment	Cost/Acre	Alternative 2		Alternative 3	
		Acres	Costs	Acres	Costs
Mechanical Thinning +Fuels Clean-up	\$800	758	\$606,400	435	\$309,600
Hand / Mechanical Thinning + Fuels Clean-up	\$600	91	\$54,600	350	\$210,000
Cut Encroaching Meadow Conifers + Fuels Clean-up	\$50	236	\$11,800	236	\$11,800
Mowing	\$100	100	\$10,000	100	\$10,000
Prescribed Underburn (forests)	\$200	874	\$174,800	874	\$174,800
Prescribed Underburn (grass meadows)	\$100	162	\$16,200	162	\$16,200
Total			\$873,800		\$732,400

Table E-4. Product Volumes and Values by Alternatives.

Treatments that produce Sawlogs	Alternative 2		Alternative 3	
	Acres	Total Sawlog Volume (mbf)	Acres	Total Sawlog Volume (mbf*)
Mechanical Thinning 2 nd Growth (3.5 mbf/ac)	387	1355	387	1355
Mechanical Thinning Old Growth (0.75 mbf/ac)	371	278	0	0
Totals	758	1633	387	1355
Total Log Selling Value \$300/mbf		\$490,000		\$407,000
Treatments that produce chip/pulp	Acres	Chip / Pulp Tons	Acres	Chip / Pulp Tons
Chip / Pulp Material 5 ton/ac	758	3790	387	1935
Total Chip Selling Value \$35/ton		\$132,650		\$67,725
TOTAL PRODUCT VALUE		\$622,650		\$474,725

*mbf = 1000 board feet

Table E-5. Summary of Costs and Values for Alternatives 2, and 3.

Activity	Alternative 2	Alternative 3
Total Costs	\$873,800	\$732,400
Total Product Values	\$622,650	\$474,725
Net Value	-\$251,150	-\$257,675

Effects of Alternative 2

Under Alternative 2, total costs are estimated at \$873,800 and total product values estimated at \$622,650, resulting in an estimated net value of -\$251,150, which is \$6,525 less than Alternative 3.

Of the 758 acres proposed for mechanical thinning, 51% of the acres (387) are in 2nd growth stands and 49% of the acres (371) are in old growth stands. Consequently, under Alternative 2, approximately 51% of the acres (2nd growth stands) are predicted to yield product values that would exceed harvest costs and approximately 49% of the acres (old growth stands) are predicted to yield product values that would be less than harvest costs.

It is assumed that the costs of wildfire suppression in stand conditions created under Alternative 2 would be the least of both the alternatives because it would be the most effective in reducing crown bulk densities and the risk of moderate and high severity wildfire across the project area.

Effects of Alternative 3

Under Alternative 3, total costs are estimated at \$732,400 and total product values estimated at \$474,725, resulting in an estimated net value of -\$257,675, which is \$6,525 more than Alternative 2.

The main economic consideration in Alternative 3 is the 6" diameter limit on trees that could be thinned and harvested in the "old growth" portion of the project area. In terms of costs for management, Alternative 3 would harvest trees only up to the 6" diameter limit, consequently, there would be limited (to no) potential product value as a result of the thinning in the "old growth" portion of the project area, consequently, these acres were analyzed for hand thinning and fuel treatment under Alternative 3. Since no trees above 6" diameter can be thinned and harvested, the product value of the material that can be thinned/harvested under Alternative 3 is much less than under Alternative 2. Consequently, of the two action alternatives, this alternative has the lowest net value (or highest deficit) at -\$257,675.

Of the 387 acres proposed for mechanical thinning, all of the acres (2nd growth thinning) are predicted to yield product values that would exceed harvest costs. Thinning in the old growth stands is limited to trees less than 6" diameter, consequently, 259 acres were changed from mechanical thinning to hand thinning and 153 acres were dropped because small tree thinning had already taken place on those acres under the Highway 20 Project.

It is assumed that the costs of wildfire suppression in stand conditions created under Alternative 3 would be considerably less than under the no-action alternative, but more than under Alternative 2, because it would not reduce crown bulk densities much (an important factor in crown fires), consequently, the risk of moderate and high severity wildfire would be less than the no action alternative but more than Alternative 2.

Other Disclosures

Civil Rights and Environmental Justice

See earlier discussion of consultation and the involvement on the project of Native American Tribes. There have been no issues or concerns raised with adverse effects to Native American Tribes.

There are no known direct, indirect, or cumulative effects on Native Americans, minority groups, women, or civil rights beyond effects disclosed in the Deschutes Land and Resource Management Plan.

Environmental Justice means that, to the extent practical and permitted by law, all populations are provided the opportunity to comment before decisions are made and are allowed to share in the benefits of government programs and activities affecting human health and the environment.

Executive Order 12898 on environmental justice requires federal agencies to identify and address any disproportionately high and adverse human health or environmental effects on minority and low income populations. The action alternatives would have no disproportionately high or adverse effects to minority or disadvantaged groups qualifying under the environmental justice order. Scoping and widely circulated media articles have raised no issues or concerns associated with the principles of environmental justice. The action alternatives do not have a disproportionately high and adverse human health effects, high or adverse environmental effects, substantial environmental hazard or effects to differential patterns of consumption of natural resources. All interested parties will continue to be involved with commenting on the project and the decision making process.

Congressionally Designated Areas

No congressionally designated areas such as Wild and Scenic Rivers would be adversely affected by the proposed activities. No significant irreversible or irretrievable commitment of resources would occur under Alternative 2 (Proposed Action) or Alternative 3.

Prime Farm and Forest Lands and Wetlands

The Secretary of Agriculture issued Memorandum 1827 which is intended to protect prime farm lands and range lands. The project area does not contain any prime farmlands or rangelands. Prime forestland is not applicable to lands within the National Forest System. National Forest System lands would be managed with consideration of the impacts on adjacent private lands. Prime forestlands on adjacent private lands would benefit indirectly from a decreased risk of impacts from wildfire. There would be no direct, indirect, or cumulative adverse effects to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9500-3, "Land Use Policy."

Potential effects to wetlands are extensively discussed in the Hydrology Section of this analysis. The analysis concluded there are no negative impacts of the action alternatives to wetlands.

Compliance with Other Policies, Plans Jurisdictions

The alternatives are consistent with the goals, objectives and direction contained in the Deschutes National Forest Land and Resource Management Plan and accompanying Final Environmental Impact Statement and Record of Decision dated August 27, 1990 as amended by the Regional Forester's Forest Plan Amendment #2 (6/95) and Inland Native Fish Strategy, and as provided by the provisions of 36 CFR 219.35 (f) (2005), which address Management Indicator Species.

Implementation of Alternative 1 (No Action), Alternative 2 (Proposed Action), or Alternative 3 would be consistent with relevant federal, state and local laws, regulations, and requirements designed for the protection of the environment including the Clean Air and Clean Water Act. Effects meet or exceed state water and air quality standards.

Irretrievable and Irreversible Commitment of Resources

NEPA requires that environmental analysis include identification of "...any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. No significant irreversible or irretrievable commitment of resources would occur under Alternative 2 (Proposed Action) or Alternative 3.

- Irreversible: Those resources that have been lost forever, such as the extinction of a species or the removal of mined ore. The proposed activities would result in a commitment of rock for road maintenance.
- Irretrievable: Those resources that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of way or road.

CONSULTATION AND COORDINATION

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

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