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Draft Environmental Impact Statement

Spears Vegetation Management Project

Lookout Mountain Ranger District
Ochoco National Forest

Crook and Wheeler Counties, Oregon

Spears Vegetation Management Project

Draft Environmental Impact Statement

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Abstract: This Draft Environmental Impact Statement (EIS) describes the effects of implementing five alternatives to manage fuels and vegetation in the Spears Project Area. The project area is located about 20 miles northeast of Prineville, Oregon within the Marks Creek Watershed and Veazie Creek Subwatershed. The project area encompasses nearly 39,200 acres.

Alternative 4 is the preferred alternative and would treat fuels and vegetation on approximately 16,740 acres, including 4,935 acres of commercial harvest. An estimated 12.3 million board feet (MMBF) would be harvested. Alternative 1 is the no action alternative and does not treat any acres. Implementation of any action alternative would necessitate amending the Forest Plan. Alternative 2 is the proposed action and would treat approximately 17,000 acres and harvest approximately 15.4 MMBF. Alternative 3 does not include any commercial timber harvest and would treat approximately 15,500 acres. Alternative 4 was developed in response to concerns related to road construction. Alternative 5 was developed in response to concerns related to wildlife habitats. Alternative 5 would treat approximately 15,850 acres and harvest approximately 8.9 MMBF.

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision-making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. City of Angoon v. Hodel (9^{th} Circuit, l986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

Send comments to Katherine Farrell at the address listed above or via e-mail to *comments-pacificnorthwest-ochoco@fs.fed.us*.

Comments must be received by June 15, 2007

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CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

Document Structure

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

Chapter 1. Purpose and Need for Action: The chapter 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.

Chapter 2. Alternatives, including the Proposed Action: This chapter 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 other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.

Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource.

Chapter 4. Consultation and Coordination: This chapter provides a list of preparers and agencies consulted during the development of the EIS.

Index: The index provides page numbers by document topic.

Appendices: The appendices provide more detailed information to support the analyses presented in the environmental impact statement.

Additional documentation, including more detailed analyses of project area resources, may be found in the project record located at the Lookout Mountain Ranger District office in Prineville, Oregon.

Purpose and Need for Action

The purpose and need for this proposal was derived from evaluating current planning direction identified in the Forest Plan, identifying desired future conditions, and comparing them to the existing conditions in the project area. The 1998 Marks Creek Watershed Analysis, the May

2002 Addendum to the Marks Creek Watershed Analysis, and the December 2002 Bandit II Environmental Assessment were used as a basis for the existing condition. The purposes of this proposal are to:

1. Maintain and increase the abundance of late and old structure (LOS).
2. Reduce fuels and the potential for high-intensity wildfires.
3. Maintain conditions that would currently support low-intensity fires.
4. Reduce the susceptibility of the landscape to large-scale infestation by insects and disease.
5. Enhance hardwood communities, such as aspen and cottonwood.
6. Increase riparian vegetation and large tree structure in RHCAs.
7. Increase early-seral species composition.

This action responds to the goals and objectives outlined in the Ochoco National Forest Land and Resource Management Plan as amended (Forest Plan), and helps move the project area towards desired conditions described in that plan.

Late and Old Structure (LOS), Early-seral Species Composition, and Infestations by Insects and Disease

The Forest Plan (p. 4-12) identifies a goal of maintaining forest health for present and future uses. The Forest Plan (p. 4-3) also has a goal to "maintain or enhance ecosystem functions to provide long-term productivity of forest resources and biological communities." The objective associated with this goal is to provide for all seral stages of plant associations, with a distribution that is ecologically sound. The Interim Ecosystem Standard in the Eastside Screens (Appendix B, p. 4) states "characterize … [the] watershed for patterns of stand structure … and compare to the historic range of variability." The Ochoco National Forest Viable Ecosystems Management Guide (Simpson et al. 1994) is a tool for analyzing each seral/structural stage for the plant associations found on the Ochoco National Forest. Managing an ecosystem within its range of natural (or historic) variability is a scientifically defensible way to maintain diverse, resilient, productive, and healthy systems (Swanson et al. 1994).

The vegetative conditions in the Spears project area were characterized with the Viable Ecosystems Model (Simpson et al. 1994). This model was used to compare existing seral structural conditions to the historic range of variability (HRV). The model focuses on relationships between combinations of vegetation structure and species composition. Based on the comparison of seral structural conditions, there are too many areas dominated by trees from 5 to 20.9 inches in diameter at breast height (dbh) and not enough areas dominated by large trees (greater than 21 inches dbh). Many areas have dense tree stocking in the understory and the abundance of species such as Douglas-fir and grand fir (late-seral species) has increased.

Late and old structure (LOS) is the vegetative stage in which large trees are common. Large trees are 21 inches dbh or larger. Historically, the amount of LOS within the project area would have ranged from approximately 10,600 to 20,200 acres. Today, the amount of area classified as LOS is approximately 5,650 acres, which is well below the HRV.

LOS is classified into two types, multi or single strata. Multi-strata LOS has several strata of trees present. Single-strata LOS is more open and has a single stratum of large trees and young trees are absent or only a few exist in the understory. Historically, the single strata condition was the most common type of LOS in the project area, ranging from approximately 8,000 to 15,000 acres in abundance. Approximately 1,900 acres of single-strata LOS exists within the project area. Historically, multi-strata LOS ranged from 2,600 to 5,300 acres in the project area. Currently, there are approximately 3,700 acres classified as multi-strata LOS in the project area. Today, about 65 percent of the existing LOS is multi-strata compared to about 25 percent historically.

The current departure from historic LOS conditions is primarily a result of past timber harvest (which removed large trees from the landscape), the Hash Rock Fire of 2000 (in which an estimated 940 acres of LOS were lost), and fire exclusion. Fire exclusion over the past 90 years has encouraged the establishment and development of late-seral, shade-tolerant understory trees such as grand fir within what were once open stands of primarily early-seral large trees. Historically, stands were less dense, contained a higher percentage of fire-tolerant species such as ponderosa pine and western larch, and had more open understory conditions. When stands become denser, additional competitive stress is placed on the remaining large trees. Trees under competitive stress are less vigorous, grow slower, and are more prone to being killed by insects and disease. Dense multi-strata stands are also more prone to stand replacement wildfire due to the presence of ladder fuels and increased canopy density.

Given the relatively low amount of large trees and the time and growth needed to develop large trees, it is important to take action now to increase the resiliency of large trees and increase growth rates in smaller trees by reducing competition. Competition from intermediate and suppressed trees in ponderosa pine stands reduces growth of the large dominant and codominant trees (Cochran 1993). Removing small and medium sized trees (trees less than 21 inches dbh) will reduce competitive stress and reduce the amount of area with overstocked stands. Overstocked stands are slow growing because of competition and are less resistant to insects and disease. Removing trees less than 21 inches dbh would reduce stand density and move multi-canopied (multi-strata) stands towards single canopied (single-strata) stands. This would maintain these stands longer into the future. Based on the low levels of LOS in the project area, there is a need for (1) increasing the abundance of LOS within the Spears Project Area, especially single-strata LOS; (2) maintaining the existing amount of LOS; (3) maintaining existing large trees and encouraging the development of additional large trees; and (4) reducing competition among trees and reducing susceptibility to infestations by insects and disease.

Removing smaller, understory trees would:

1. Maintain and increase the future abundance of LOS by reducing competition. Precommercial and commercial thinning would reduce stand densities to recommended stocking levels. This would encourage increased growth rates on the remaining trees allowing them to become large trees more rapidly. Precommercial and commercial thinning would also remove trees with damage or disease and those weakest trees unlikely to ever become large trees. Reducing stand densities, removing ladder fuels, and reducing fuel loadings would also improve the likelihood of younger/smaller trees reaching large tree size without being killed in a wildfire.

Precommercial and commercial thinning would remove understories which have developed in the absence of frequent, low-intensity wildfire, moving stands from multi towards single strata. Precommercial thinning and underburning will maintain stands which are currently single strata by removing small trees before they develop into a full canopy stratum.

2. Maintain LOS by reducing the likelihood of a stand replacement wildfire. Removing ladder fuels and reducing crown densities through precommercial and commercial thinning would raise canopy base height, reduce canopy bulk density, and reduce the potential for a high-intensity wildfire. Treatment of activity-generated and natural fuels would reduce surface fire intensity, lower flame heights, and reduce the potential for large trees to be killed.

3. Improve stand health by increasing vigor and reducing susceptibility to insect and disease related mortality. Reducing competition would allow the large trees to maintain or increase vigor, thus reducing their susceptibility to being killed by insects and disease. Precommercial and commercial thinning would reduce the number of smaller trees, thus increasing the growing space available for the remaining large trees. Underburning would also reduce the number of small trees, although it is mostly effective on only the smallest trees or fire-intolerant species, such as grand fir.

(4) Increase early-seral species composition. Precommercial and commercial thinning, as well as underburning, will favor the retention of species which were more abundant historically. Fire-tolerant, early-seral species such as ponderosa pine and western larch would be favored for retention while fire-intolerant species such as grand fir would be targeted for removal. Stands of predominately fire-tolerant species would be more likely to survive a future wildfire.

Fuels

The Forest Plan (p. 4-9) identifies a goal to "Provide for the ecologically sound use of prescribed fire as a cost-effective management tool for achieving resource management objectives." The Forest Plan (p. 4-10) also identifies objectives related to prescribed burning. These objectives relate to reducing wildfire intensities to support a cost-efficient fire protection organization, and emulating the natural role of fire in maintaining environmental diversity and site productivity.

Since the Forest Plan was developed, there have been several efforts that stress the importance of reducing hazardous fuels and restoring healthy ecosystems. In April 1999, the General Accounting Office (GAO) in a report to Congress concluded that "the most extensive and serious problem related to the health of national forests in the interior West is the over-accumulation of vegetation." The GAO report criticized the Forest Service for not having "clear goals, objectives, direction, and budgets that adequately address ecosystem restoration and maintenance needs."

In April 2000, the Forest Service responded with "A Cohesive Strategy for Protecting People and Sustaining Resources in Fire-Adapted Ecosystems" (Cohesive Strategy). This strategy addresses the hazards and risks from unnatural over-accumulations of fuels in high-frequency, low-intensity fire regimes, and the wildfires in these regimes which burn at high levels of severity. The purpose of the Cohesive Strategy (p. 10) is to restore and maintain health in fire-adapted ecosystems across the interior West. The Cohesive Strategy outlines prescribed fire and mechanical fuels treatments to reduce the hazards and risks.

Later that same year, the National Fire Plan was developed with the intent of actively responding to severe wildland fires and their impacts to communities. The National Fire Plan recognizes that wildland fires play an integral role in many forest and rangeland ecosystems; however, decades of fire exclusion efforts have disrupted the natural fire regimes.

In August 2001, a 10-Year Comprehensive Strategy for reducing wildland fire risks was issued. The Comprehensive Strategy outlines an approach to "reduce the risks of wildfire to communities and the environment."

In August 2002, the President announced the Healthy Forests Initiative (HFI). The HFI recognized that "forest and rangelands of the West have become unnaturally dense, and ecosystem health has suffered" and that "these unhealthy forests, overloaded with fuels, are vulnerable to unnaturally severe wildfires." Congress responded in part to the HFI by passing the Healthy Forest Restoration Act to help reduce hazardous fuels and restore healthy forest and rangeland conditions.

In July 2005, the Crook County Community Wildfire Protection Plan (CWPP) was approved. This plan designated a large portion (more than half) of the Spears project area as Wildland Urban Interface (WUI). In the Crook County CWPP, this area was identified as an area to expedite WUI hazardous fuels treatments. This WUI area includes all land in the project area southeast of U.S. Highway 26, all private property, and lands northwest of U.S. Highway 26 for its entire length. U.S. Highway 26 is a major egress and ingress route for the Marks Creek watershed. Unplanned ignitions have the potential to affect private property, recreation users, and the electronic equipment at Viewpoint communication site. In November 2006, the Wheeler County CWPP was approved. The Wheeler County CWPP also identified WUI in the northeast portion of the Spears project area.

Historically, the dominant disturbance factor in the project area was frequent, low-intensity fire that eliminated the majority of seedlings and saplings. Most of the Spears project area had a short fire return interval, typically returning every 5 to 25 years. Frequent, low-intensity fires helped to maintain open stands of large trees, dominated by ponderosa pine. These frequent fires resulted in low levels of surface fuels. In the absence of frequent, low-intensity fires, forest stands in the project area have developed multi-canopy conditions, stocking levels have increased, ladder fuels have increased, surface fuels have increased, and the abundance of late-seral, fire-intolerant species (such as grand fir) has increased. These changes from historic conditions have left forested stands susceptible to high-intensity wildfire, with an increased potential for the unwanted loss of trees, water quality, soil productivity, wildlife habitat, and other forest resources. High-intensity wildfires caused by these conditions also limit the suppression options available to firefighters, decreasing the safety, efficiency, and economy of fire suppression.

Hardwood Plant Communities

The Forest Plan (p. 4-3) identifies a goal of maintaining "native, historic, and desirable introduced plant and animal species and communities." The Forest Plan (p. 4-32) identifies a desired future condition where hardwoods such as cottonwood, aspen, alder, and willow will be more common along streams, meadows, and wet areas. In other words, the desired future conditions is to have well distributed and vigorous hardwood communities across the project area. The Forest Plan standards and guidelines (p. 4-121) state “manage aspen stands to produce a vigorous population, forest-wide.” The 1998 Marks Creek Watershed Analysis (p. 114) recommends that aspen and cottonwood stands be re-invigorated by thinning conifers within and adjacent to clones.

Both cottonwood and aspen grow in self-perpetuating clones in areas of locally high moisture such as meadows, seeps, and adjacent to streams. Conifer trees are encroaching into aspen and cottonwood stands in the project area. These conifers compete with the hardwood trees for light, moisture, and growing space. Since the hardwood trees are not shade tolerant, they can be shaded out by the encroaching conifers, which results in loss of vigor for the hardwoods in the short term, and can lead to loss of the clone(s) in the long term. There is a need for more vigorous aspen and cottonwood stands.

Removing conifer trees within and adjacent to aspen and cottonwood stands would reduce competition for light, moisture, and growing space. Reducing competition would also improve the vigor of hardwood stands and prevent a decline in the abundance, distribution, and extent of hardwood communities within the project area.

Riparian Habitat Conservation Areas (RHCAs)

In 1995, the Decision Notice for the Inland Native Fish Strategy (INFISH) was signed and amended the Ochoco Forest Plan. The INFISH established Interim Riparian Management Objectives for several fish habitat features.

The Forest Plan emphasis for riparian areas is to manage streamside vegetation and habitat to maintain or improve water quality. Forest Plan goals for riparian vegetation includes providing “an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems; and habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities” (INFISH, pp. A-1 to 2).

The amount and type of vegetation in riparian areas plays an important role in the maintaining and improving both water quality and fish habitat. The increasing amount of conifers in RHCAs prevents woody vegetation such as alder, willow, aspen, and shrubs from expanding. Conifers within RHCAs compete with these species for nutrients. Many of these broadleaf species are shade-intolerant; throughout the project area conifers are shading these brushy, shrubby species, and they are losing vigor. The roots of woody vegetation helps to stabilize streambanks and the stems act as a roughness element that reduces the velocity and erosive energy of over bank flow during high water events. Conifers do not provide the same bank stabilizing function as these brushy, shrubby species.

Based on stream surveys, the project area is deficient in the amount of large woody material in streams. Large woody material provides aquatic habitats and shade for streams. Redband trout, like many other salmonids, have evolved in stream systems in which large woody material helps retain organic and inorganic particulate matter that is important for channel stability, biological diversity, and productivity (Nakamura and Swanson 1993). Large wood influences habitat for fish and other aquatic organisms by serving as energy dissipaters, flow deflectors, and dams. Large woody material in streams and the adjacent flood plain provides streambank stability, decreases flow velocities, increases storage time (decreases downstream flood risk), and stores sediment. Large trees are needed in RHCAs because they become large woody material when they fall.

There is a need for fewer conifers within RHCAs. Reducing the amount of conifers within RHCAs would (1) encourage alder, willow, aspen, and other broadleaf species to expand, and (2) increase the growth rates of remaining conifers in RHCAs so they grow larger and can eventually provide future large wood to streams.

Proposed Action

The Lookout Mountain Ranger District is proposing to manage vegetation through commercial timber harvest, precommercial thinning, and fuel reduction activities to meet the purpose and need. The proposed action includes approximately 6,172 acres of commercial harvest, 11,160 acres of precommercial thinning, and 196 acres of thinning in hardwood stands. Fuel reduction activities include approximately 15,464 acres of prescribed fire, and 3,015 acres of grapple and 718 acres of hand piling. Commercial harvest includes tractor, skyline, and helicopter logging systems. Areas identified as tractor logging are areas where heavy equipment, such as logging tractors/skidders, will be used to remove a commercial product. Road construction activities include 18.0 miles of new road construction, and 12.0 miles of reconstructing roads on an existing road bed. Newly constructed roads and roads that are reopened would be closed after harvest activities are complete. A complete description of the proposed action (Alternative 2) is contained in Chapter 2.

Project Area

The project area is located about 20 miles northeast of Prineville, Oregon. U.S. Highway 26 bisects the project area. The project area lies within portions of T. 12 S., R. 19 E.; T. 12 S., R. 20 E.; T. 13 S., R. 18 E.; T. 13 S., R. 19 E.; T. 13 S., R. 20 E.; T. 14 S., R. 18 E.; T. 14 S., R. 19 E.; Willamette Meridian. Map 1 (vicinity map) displays the project area.

The project area is comprised of approximately 39,200 acres primarily within the Marks Creek watershed. Marks Creek flows into Ochoco Creek, approximately 6 miles above Ochoco Reservoir, and is a part of the Deschutes/Crooked River Basin. Elevations range from 5,985 feet above sea level on Wildcat Mountain on the western edge of project area to 3,360 feet where Marks Creek joins Ochoco Creek.

There are several tracts of private land (2,325 acres) within the project area boundary.

Forest Plan Direction

This project is tiered to the 1989 Final Environmental Impact Statement (FEIS) for the Ochoco National Forest Land and Resource Management Plan (Forest Plan), as amended by the 1995 Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (Eastside Screens), the 1995 Inland Native Fish Strategy (INFISH), and the 2006 Pacific Northwest Region Invasive Plant Program EIS. The Forest Plan direction, including standards and guidelines, are based on these documents and were used in developing the proposed activities.

There are 13 Forest Plan management areas in the project area. A management area is "composed of lands with similar capabilities or characteristics" (Forest Plan, p. 4-45). Each management area has specific goals, desired future conditions, and standards and guidelines. The location of these management areas is depicted on Map 2. The emphasis for each of the management areas is briefly described below.

MA-F3 Mill Creek Wilderness - Protect the Wilderness ecosystem. Manage use to maintain a natural setting and preserve solitude (Forest Plan, p. 4-52). The project area includes approximately 3,650 acres of the Mill Creek Wilderness. No activities are proposed within this management area.

MA-F5 Research Natural Area - Allow natural processes to occur for research purposes (Forest Plan, p. 4-56). The project area includes approximately 1,000 acres of the Ochoco Divide RNA. No activities are proposed within this management area.

MA-F6 Old Growth - Habitat will be provided for wildlife species dependent upon old-growth stands (Forest Plan, p. 4-58). The project area contains an estimated 821 acres of allocated old growth.

MA-F7 Summit Historic Trail - Protect the existing integrity of the Summit Trail. Enhance and interpret significant segments for public enjoyment and education. Pristine segments will be managed to protect, interpret, and preserve their historic qualities (Forest Plan p. 4-60). The project area includes an estimated 972 acres of the Summit Historic Trail management area.

MA-F13 Developed Recreation - Provide safe, healthful, and aesthetic facilities for people to utilize while they are pursuing a variety of recreational experiences within a relatively natural outdoor setting (Forest Plan, p. 4-71). The project area includes 69 acres within the developed recreation management area.

MA-F14 Dispersed Recreation - Provide and maintain a near-natural setting for people to utilize while pursuing outdoor recreation experiences (Forest Plan, p. 4-72). The project area includes 52 sites that were identified in the Forest Plan as dispersed recreation sites.

MA-F15 Riparian and RHCA - Manage streamside vegetation and habitat to maintain or improve water quality. The INFISH delineated Riparian Habitat Conservation Areas (RHCAs) where riparian-dependent resources receive primary emphasis. These RHCAs include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems. RHCAs encompass the MA-F15 management area and are overlaid on other management areas. RHCAs are shown on the Fish Distribution Map (Map 3 located at the end of this EIS). There are an estimated 4,546 acres within RHCAs.

MA-F16 Bandit Springs Recreational Area - Provide dispersed, nonmotorized recreational opportunities within a setting where most management activities are generally not evident to the casual observer. Periodic manipulation of vegetation to meet recreation and visual objectives for the area will be apparent to the user. Timber stands will be managed to develop and maintain resistance to catastrophic events that would detract from the recreational experience (Forest Plan, pp. 4-76 and 4-77). The Bandit Springs Recreation Area is 1,580 acres.

MA-F20 Winter Range - Manage for big game winter range habitat (Forest Plan, p. 4-82). The project area includes an estimated 3,824 acres of winter range.

MA-F21 General Forest Winter Range - Manage for timber production with management activities designed and implemented to recognize big game habitat needs (Forest Plan, p. 4-84). The project area includes an estimated 2,428 acres within this management area.

MA-F22 General Forest - Produce timber and forage while meeting the Forest-wide standards and guidelines for all resources. In ponderosa pine stands, management will emphasize production of high value (quality) timber (Forest Plan, p. 4-86). There are an estimated 16,792 acres of general forest within the project area.

MA-F25 U.S. Highway 26 Visual Corridor - Maintain and enhance the scenery for travelers along U.S. Highway 26 (Forest Plan, p. 4-93). The project area includes 5,586 acres within the U.S. Highway 26 Visual Corridor.

MA-F26 Visual Management Corridors - Maintain the natural-appearing character of the Forest along major travel routes, where management activities are usually not evident or are visually subordinate to the surrounding landscape (Forest Plan, p. 4-95). The project area includes approximately 400 acres in visual management corridors outside the U.S. Highway 26 corridor.

Decision Framework

The responsible sfficial for this proposal is the Forest Supervisor of the Ochoco National Forest. The responsible oOfficial will decide whether to:

1. Select the proposed action, or
2. Select an action alternative that has been considered in detail, or
3. Modify an action alternative, or
4. Select the no-action alternative, and
5. Identify what mitigation measures and monitoring will apply.

The responsible official will decide whether to conduct commercial timber harvest, precommercial thinning, hardwood thinning, and fuels reduction activities in the Spears project area. The decision will be determined by how well each alternative provides the best mix of prospective results in regard to the purpose and need, the issues, types and levels of effects, and public comments. The responsible official will consider:

1. Would LOS be maintained and increased? Would the amount of single-strata LOS be increased? Would stand density be reduced to remove competitive stress on large trees? Would the management activities result in more large trees being maintained over time, as well as encourage the development of additional large trees?

2. Would the density and species composition of forested stands be modified towards a balance of seral/structural stages as described by the historic range of variability? Would the susceptibility of the landscape to large-scale infestation by insects and disease be reduced? Would forested stands shift toward dominance by early-seral, fire-tolerant species such as ponderosa pine and western larch?

3. Would surface fuels, ladder fuels, and stand density be reduced to decrease the susceptibility to high-intensity wildfire? Would the abundance of late-seral, fire-intolerant species (such as grand fir) be reduced? Would fire regimes move toward those that occurred historically?

4. Would maintenance underburning occur to maintain conditions that currently support low-intensity fires?

5. Would the vigor of hardwood stands be improved? Would the competition with conifers be reduced? Would the abundance, distribution, and extent of hardwood communities within the project area be maintained or increased?

6. Would the proposed activities contribute toward meeting the interim Riparian Management Objectives contained in INFISH? Would the proposed activities in RHCAs encourage alder, willow, aspen, and other broadleaf species to expand? Would the proposed activities accelerate the development of large trees so they provide future large wood to streams?

Public Involvement

The Notice of Intent (NOI) was published in the Federal Register on June 2, 2006. The NOI requested public comment on the proposal by June 26, 2006. On May 23, 2006, as part of the public involvement process, the agency mailed letters to 63 individuals, organizations, adjacent landowners, and other potentially interested organizations, including tribal agencies.

Forest Service staff also met with members of the Crook County Natural Resources Planning Committee to discuss the Spears Project on three occasions (March 27, 2006, June 6, 2006, and January 4, 2007). Two field trips to the project area were held. The first field trip was on June 6, 2006, and the second was on August 30, 2006.

The Spears Project has also been listed in the Ochoco National Forest Schedule of Proposed Actions since the Spring 2006 edition.

In response to public involvement efforts, the Forest Service received comments from nine individuals, organizations, groups, and tribes. Using these comments from the public, the interdisciplinary team developed a list of issues to address.

Issues

The Forest Service separated the issues into three groups: significant, other, and non-significant issues. Significant issues were defined as points of discussion, debate, or dispute about environmental effects that may occur as a result of the proposed action. Significant issues were used to develop alternatives and design elements or resource protection measures. Other issues were defined as concerns related to the proposed action. Non-significant issues were identified as those: (1) outside the scope of the proposed action; (2) already decided by law, regulation, Forest Plan, or other higher level decision; (3) irrelevant to the decision to be made; or (4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)."

Significant Issues

The Forest Service identified two issues from the scoping comments that led to alternative development. The first issue related to road construction. Comments suggested that the proposed action included too much road construction. Other comments suggested that the road density in the project area was too high and should be reduced. Some comments indicated that roads cause fragmentation and affect water quality. Alternative 4 was developed with an emphasis on using existing roads and minimizing new road construction. Alternative 4 does include some new road construction; new road segments are generally less than 0.25 miles.

Other comments related to roads suggested that additional roads should be closed. All of the newly constructed roads in Alternatives 2, 4, and 5 will be closed after use. In addition, some currently open roads will be closed and other roads will be decommissioned. The amount of road construction, reconstruction, closure, and decommissioning varies by alternative. The alternative descriptions in Chapter 2 provide information on road work included in each alternative. The differences between alternatives are measured by the amount of road construction, reconstruction, and decommissioning.

The second issue that led to developing an alternative was related to wildlife. Comments related to wildlife included concerns about habitat for goshawks, pileated woodpeckers, elk, cavity-nesting birds, and neotropical migratory birds. Alternative 5 was developed by comparing the proposed action to a variety of wildlife habitats such as pileated woodpecker feeding habitat (pfh), goshawk post-fledging areas (PFA), elk satisfactory cover (70% canopy closure) in winter range, connective corridors (Eastside Screens), and special habitats such as aspen and cottonwood stands. Alternative 5 was developed to include a greater emphasis on variable density thinning and retention of dense patches of vegetation within these wildlife habitats. The differences between alternatives are measured by the activities within and changes to goshawk and pileated woodpecker habitat. For elk, the differences between alternatives are measured by the change in the Habitat Effectiveness Index (HEI).

One commenter suggested that the project should establish conditions for effective winter range use by deer and elk. All of the alternatives were designed to meet Forest Plan standards for winter range. Alternative 5 was developed with an added emphasis on wildlife habitat including habitat in winter range. The effects of each of the alternatives on winter range are disclosed in Chapter 3 under the elk section.

One commenter stated that they supported variable density thinning that allows young forests to develop into more complex and resilient forests. All of the action alternatives include variable density thinning. Alternative 5 was developed with an emphasis on wildlife habitat and includes a greater emphasis on variable density thinning and retention of dense patches of vegetation in certain wildlife habitats.

In the scoping letter and the Notice of Intent to prepare an EIS, the Forest Service indicated that it was considering an alternative that included only precommercial thinning and prescribed fire activities. Several comments suggested that an alternative should be considered that did not include commercial harvest or road construction. Other comments suggested that an alternative should be considered that included a diameter limit of 10 or 14 inches dbh. Alternative 3 does not include any commercial harvest, road construction, and limits thinning to trees less than 12 inches dbh.

Some commenters suggested that snags should be harvested, while others suggested that snags should be retained and additional snags should be created. The level of snags across the project area varies. In the Hash Rock Fire area, there are many snags. Over the last 30-35 years, about 7,500 acres have been harvested. These areas are deficient in snags. Across the project area, the number of snags is estimated to average about 65 percent of the maximum potential population. The Eastside Screens indicates that snags should be maintained at 100 percent of potential population levels. Because the amount of snags is less than 100 percent of potential population levels, none of the alternatives include harvesting snags with the exception of snags that pose a safety hazard.

Other Issues

Some comments indicated that commercial harvest and precommercial thinning should only be allowed in RHCAs where these actions would benefit riparian management objectives. Part of the Purpose and Need for this project is to encourage vegetative diversity in RHCAs and increase the future availability of large wood. All of the activities in RHCAs in the action alternatives have been proposed to promote attainment of riparian management objectives.

One commenter stated that the proposed action should not create or leave excessive levels of untreated slash. All of the action alternatives include activity-fuels treatments, such as underburning, grapple piling, and hand piling. In addition, where precommercial thinning is proposed in some plantations, slash will be lopped.

A few comments expressed concerns related to effects on soils. Chapter 3 includes a discussion of the expected effects on soils. Appendix B includes a unit-by-unit analysis of soil conditions.

Two commenters suggested that the effects of OHV use needed to be considered and that targeted mitigation to reduce OHV use needed to be included in the EIS. Where appropriate, the effects of OHV use are discussed under the cumulative effects sections in Chapter 3. Targeted mitigation to reduce OHV use was not considered in detail in this EIS because it is outside the scope of this project. However, the Deschutes and Ochoco National Forests are beginning a Travel Management project that will result in identifying roads, trails, and areas where motorized use, including OHVs, will be allowed.

One commenter suggested that the primary cause of decline in hardwood communities is excessive livestock grazing. There are several causes for hardwood decline including competition with conifers, stream down cutting, excessive vegetation upslope of hardwoods, road diversions, and browse by both livestock and wildlife. All action alternatives include reducing conifer competition in several aspen and cottonwood stands. In conjunction with thinning conifers, fencing would be constructed around many of these stands to reduce browse pressure.

One commenter suggested that the hydrologic impacts of roads should be analyzed. The Water Quality discussion in Chapter 3 includes a discussion of the hydrologic impacts of roads.

One commenter stated that the project area contained unroaded areas adjacent to the Mill Creek Wilderness and the Ochoco Divide Research Natural Area (RNA) and that the EIS should fully analyze any effects to roadless areas and values. The Draft EIS does not analyze effects to roadless areas and values because there are no inventoried roadless areas within the project area. The areas identified as "unroaded" by the commenter are generally small. Several of these small areas are in the Bandit Springs Recreation Area, which is adjacent to the Mill Creek Wilderness. As mentioned previously, the emphasis in this area is to provide dispersed, nonmotorized recreational opportunities within a setting where most management activities are generally not evident to the casual observer. None of the alternatives include any road construction in the small areas within the Bandit Springs Recreation Area that the commenter identified as unroaded. The Bandit Springs Recreation Area would continue to be managed for non-motorized recreation. Southwest of the Bandit Springs Recreation Area, the commenter identified an area primarily in Sections 18 and 19, between the Mill Creek Wilderness and U.S. Highway 26. This area has already been developed and includes several roads and evidence of past logging activities. Roads in this area include U.S. Highway 26, 3350, 3350-100, 3350-102, 3350-103, 3350-209, and unclassified roads that are not numbered. Another area the commenter identified as unroaded encompasses the Ochoco Divide RNA and straddles the watershed boundary. This area is only partially within the project area. None of the alternatives proposed any road construction in this area, with the exception of a short spur road to access Unit 887 in Alternative 2. This short spur road would come off the 2630-013 in Section 36. This area has already been developed and contains several roads including the 2630-015, 2630-016, the 450 and 452 roads, and an "unclassified" road between the 2630-013 road and the 452 road. None of the areas identified by the commenter, with the possible exception of the area around the Ochoco Divide RNA, are undeveloped. Management emphasis within the Ochoco Divide RNA is to allow natural processes to occur for research purposes and education. None of the alternatives would alter the character of the Ochoco Divide RNA.

Several commenters stated that the Agency must prioritize fuel treatment in areas that protect homes and communities. During the development of the proposed action, the interdisciplinary team identified several fuel treatment emphasis areas, including areas within the WUI. Fuel reduction activities were proposed in these areas to tie into treatment areas from past activities. These areas were labeled as fuel compartments and are displayed on Map 15 along with the Crook County identified WUI. Lands identified by Wheeler County have not yet been included in the Ochoco GIS system and are not displayed on Map 15. The following paragraphs describe the fuel compartments with an explanation of the areas to protect, past activities, and units identified in the Spears proposal that would reduce fire hazard.

Fuel Compartment A: This emphasis area runs along Road 27, U.S. Highway 26, and access to private property. Within this area, maintenance burning and thinning along Highway 26 would occur. Within plantations slash would be lopped. Spears units (718, 719, 722, 723, 727, 729, and 401) have been interlinked with previously treated areas such as those from the McGinnis and Harpo timber sales and the Cougar underburn project. Spears units, combined with the Hash Rock fire and previous activities are designed to provide a buffer to the private property in this fuel compartment.

Fuel Compartment B: This emphasis area partially surrounds the Ochoco Divide RNA, and runs along U.S. Highway 26 and Roads 2630 and 2210. These roads have been identified as ingress/egress routes. Within this area, maintenance burning and thinning along Highway 26 would occur. Within plantations slash would be hand piled or lopped. The combination of treatments in this area is to increase the probability of a successful suppression action should an unplanned ignition occur in or near the RNA.

Fuel Compartment C: This emphasis area includes NFS lands adjacent to private property and U.S. Highway 26. Within this area, maintenance burning and thinning along U.S. Highway 26 would occur. This area includes Hamilton Butte. Underburning on and near Hamilton Butte occurred in the 1980s, 1990s, and in 2004. Activities in this area would tie the proposed Spears units with previous underburning and with thinning that occurred under the Harpo Timber Sale. Spears units in this area include 559, 560, 562, 876, 878, and 925. Spears units, combined with the previous activities, are designed to provide a buffer to the private property in this fuel compartment and increase the probability of successful suppression should an unplanned ignition occur.

Fuel Compartment D: This emphasis area includes NFS lands adjacent to private property and U.S. Highway 26. Within this area, maintenance burning and thinning in previously treated units along U.S. Highway 26 would occur. Units will be grapple piled and/or underburned. There has been little management activity in the areas bordering private property to the south and west during the past 20 years. A high percentage of the area along private property contains hazardous conditions. Activities in this area are designed to reduce surface and ladder fuels and reduce the hazardous conditions. Fuel reduction in this area would reduce the likelihood that an unplanned ignition will spread from NFS lands to private lands or vice versa. At this time, the private property adjacent to the National Forest is largely undeveloped and is used for livestock grazing and some timber production.

Fuel Compartment E: This emphasis area includes areas along Road 3350 and U.S. Highway 26. These roads have been identified as ingress/egress routes. Within this area, maintenance burning and thinning of previously treated areas would occur. Thinning units will be grapple piled and/or underburned. This area also includes the Jim Elliott Old Growth Management Area (OGMA). Previous treatments along the west and southwest side of the OGMA occurred as part of the Thunder Project (timber sale and underburning). The east-northeast side of the OGMA has had little activity in the past 20 years. It is possible that an unplanned ignition on the east-northeast side could enter the OGMA and render it unsuitable for pileated woodpeckers. If an unplanned ignition were to occur on a 97th percentile day, most of the OGMA would be expected to burn at high intensity because of the existing fuel loading and vegetation in the OGMA block. Spears units 109, 110, 163, 171, 174, 212, 814, 816, 818, 828, 832, 833, 935, 940, and 941 would reduce fuels near the OGMA and reduce the likelihood of an unplanned ignition spreading into the OGMA.

Fuel Compartment F: This emphasis area includes areas along Road 3350 and the Mill Creek Wilderness. Within this area, maintenance burning and thinning of regeneration in previously treated units would occur. Regeneration units will be grapple piled and/or underburned. Spears units within this area are interlocked with previous treatments of the Felix and Harpo Timber Sales and Felix and Jackson Creek underburn projects.

Fuel Compartment G: This emphasis area includes areas along the Mill Creek Wilderness boundary. Within this area, maintenance burning and thinning of previously treated areas would occur. Thinning units will be grapple piled and/or underburned. The Spears units would provide protection from unplanned ignitions entering the Mill Creek Wilderness and the Highway 26 corridor from unplanned ignitions in adjacent forested areas.

Fuel Compartment H: This emphasis area includes areas along Roads 2620, 2610, and 2610-150. These roads have been identified as ingress/egress routes. Within this area, maintenance burning and thinning of previously treated areas would occur. Thinning units will be grapple piled and/or underburned. This area includes a goshawk nest site and post-fledging area. During the past 20 years, several underburning and timber harvest activities have occurred. Spears units 306, 858, 860, 862, 863, and 946 would link with previously treated areas and provide a measure of protection to the ingress/egress routes and the goshawk nesting area.

Non-significant Issues

Comments that were determined to be non-significant included statements such as reduce or remove livestock grazing or develop a long-term management strategy for the entire Lookout Mountain Ranger District. Other comments suggested that the purpose and need for action should be redefined to include restoration and wildlife were also determined to be non-significant.

Some commenters suggested that trees greater than 21 inches dbh should be harvested to allow younger stands room to grow. This comment was not considered in detail because the amount of LOS across the landscape is deficient (see the Purpose and Need for Action). In addition, the Eastside Screens (part of the Forest Plan) already decided that all live trees greater than or equal to 21 inches dbh be maintained, unless the amount of LOS is above the HRV.

One commenter stated that the project area contains many openings from past activities that have not successfully regenerated. The commenter suggested that the alternatives include reforestation activities in these areas. The available data for the project area indicates that in the last 3 decades there have been 112 units which were harvested with a regeneration prescription. With a regeneration prescription, reforestation is usually needed to restock the area following harvest. The Forest Plan (p. 4-205) indicates that stocking standards require a minimum of 50 trees at least 4-1/2 feet tall be present before a stand can be certified as stocked. Out of 112 units, there are 10 units which have not been certified as stocked. Of those, five units (totaling 38 acres) were not planted because they were specifically harvested to provide telemark ski opportunities in the Bandit Springs Recreation Area; there are no plans to stock these five units. In the other five units, planting occurred in 2003. The number of trees per acre in these units range between 258 and 285 trees per acre; however, the trees are not yet taller than 4-1/2 feet. (The April 6, 2007, Silvicultural Input for this project includes additional information.)

CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Introduction

This chapter describes and compares the alternatives considered for the Spears Vegetation Management Project. It includes a description of each alternative considered. Maps of each alternative are located in Appendix C. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the proposed action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been already decided by other decisions, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. One alternative was briefly considered, but dismissed from detailed consideration. An alternative that would include harvesting trees greater than 21 inches dbh was eliminated from detailed study because it was inconsistent with the purpose and need.

Alternatives Considered in Detail

The Forest Service developed five alternatives in detail, including the no action and proposed action alternatives. Alternatives 4 and 5 were developed directly in response to issues raised by the public.

Alternative 1 (No Action)

Alternative 1 is the no action alternative. This alternative serves as a baseline for comparison of the effects of all of the alternatives. Under the no action alternative, no activities would be implemented to accomplish the stated purpose and need for the Spears Vegetation Management Project.

Routine activities such as road maintenance and suppression of unplanned fires would continue. Activities authorized under separate decisions would also continue. These activities include livestock grazing and noxious weed treatments. Recreational use of the area, including camping, hunting, and motorized and non-motorized uses, would also continue.

Alternative 2 (Proposed Action)

Alternative 2 is the proposed action. This alternative was developed to respond to the purpose and need. The proposed action includes approximately 6,172 acres of commercial harvest, 11,160 acres of precommercial thinning, and 196 acres of thinning in hardwood stands. Fuel reduction activities include approximately 15,464 acres of prescribed fire, and 3,015 acres of grapple piling, and 718 acres of hand piling. Commercial harvest includes tractor, skyline, and helicopter logging systems. Areas identified as tractor logging are areas where heavy equipment, such as logging tractors/skidders, will be used to remove a commercial product.

No trees greater than 21 inches dbh, live or dead, would be cut except those necessary to be removed for safety reasons or road construction.

Stands selected for commercial and precommercial thinning have a large component of pole and small sized (less than 21 inches dbh) trees with dense stocking conditions. The objective of these treatments is to move stands towards late and old structural stage conditions in a more rapid timeframe than would occur with no treatment. Maps 4, 5, and 6 display the commercial harvest and road work, precommercial thinning and hardwood treatments, and fuels treatments for Alternative 2.

Commercial harvest on slopes less than 35 percent would be implemented with ground-based harvest systems and the activity fuels will either be treated with prescribed fire, grapple piling, or hand piling. Where there are short, steep pitches in tractor logging units, these areas may be harvested by methods such as pulling cable. On steeper slopes, such as those over 35 percent, a skyline or helicopter harvest system would be employed for soil protection. Helicopter harvest systems are also designated for areas with concerns about using ground-based systems. Map 4 displays the logging systems associated with commercial harvest.

Stands selected for fuels reduction activities are (1) stands with either commercial timber harvest or precommercial thinning where fuels are present as a result (activity fuels), (2) stands that exhibit a high level of fuels resulting from the natural accumulations of material, or (3) stands that currently exhibit low-intensity fire conditions and require periodic treatment to maintain that condition. The objective of these fuel reduction activities are to move stands towards or maintain conditions with lower fuel loadings to approximate conditions when fire occurred at lower intensities and higher frequencies.

Stands selected for hardwood thinning contain aspen or cottonwood clones where conifers are encroaching and competing with the hardwoods. After thinning is complete in these stands, slash will be treated with a combination of methods including lop and scatter, arranging slash to protect sprouts, and/or hand piling. Temporary exclosures will be constructed to protect sprouts in fourteen hardwood stands. Caging of individual sprouts will occur in five hardwood stands.

Appendix A includes a description of the proposed treatments and a table showing the prescriptions for each unit included in Alternative 2.

Road construction activities include 18.0 miles of new road construction, and 12.0 miles of reconstructing roads on an existing road bed. Newly constructed roads and roads that are reopened would be closed after harvest activities are complete.

The Roads Analysis Report for the Bandit II Project Area was updated for the Spears project and is contained in the project record. The following is a list of roads that will be constructed; these roads will be closed after harvest activities are complete.

2210101-542	2620000-878	3300500-127b	3300529-125	3350000-212
2600100-847	2620014-517	3300502-126	3300529-806	3350011-210
2600350-738	2620031-559	3300504-112	3300550-105	3350102-185
2610026-851	2630013-887	3300504-118	3300550-202	3350102-189
2610050-825	2630020-524	3300516-138	3300550-207	3350102-845
2610300-535	2700000-748	3300529-115	3300550-809	3350200-191
2620000-304	3300500-108	3300529-120	3350000-160	

The following is a list of roads that will be constructed; these roads will be decommissioned after harvest activities are complete.

2600014-815	2610021-891	2610155-565a	2700555-752b
2600209-707	2610100-863	2610155-565b	3350000-821
2610000-865	2610150-303	2700555-752	3350102-705

The following is a list of roads that will be reconstructed for use during harvest activities.

2600013	2610153	2620035	3300503	3350018
2610024	2610159	2630013	3300504	3350102
2610056	2620011	2630020	3300529	3350200
2610058	2620013	3300504-139	3300550	3350209

The following is a list of roads that will be closed after harvest activities are complete.

2600012	2600350	2610024	2610159	3300550
2600013	2600400	2610025	2700655	3350214
2600017	2610013	2610153	3300516	
2600310	2610022	2610155	3300527	

The following is a list of roads that will be decommissioned after harvest activities are complete.

2600014	2610025	2630021	3300517	3350024
2600254	2620030	2700554	3300550	3350100
2610012	2620032	2700559	3300551	3350214
2610013	2620039	3300504	3350023	3350308

Three Forest Plan amendments are needed to implement this alternative. The first amendment would allow timber harvest activities in multi-strata LOS in the Douglas-fir Plant Association

Group (PAG). The Douglas-fir PAG is currently within the Historic Range of Variability (HRV) for multi-strata LOS and below the HRV for single-strata LOS. Timber harvest would occur in multi-strata LOS within the Douglas-fir PAG to reduce competition and maintain large trees in this area; these stands would be converted to single-strata LOS. Following treatment, multi-strata LOS would be below HRV. The second amendment would allow commercial timber harvest within connective corridors. This activity is designed to maintain existing large trees and promote development of additional large trees within corridors; however, commercial harvest would reduce the canopy closure to less than two-thirds of site potential. The third amendment would allow precommercial thinning, hand piling, and underburning in the Stewart Springs Old Growth Management Area (OGMA). These activities are proposed to improve the longevity of large ponderosa pine on south and west facing slopes. The activities are consistent with the objectives for OGMAs, but are not consistent with the standard and guideline that indicates vegetative management is not allowed.

Table 1. Summary of activities included in Alternative 2.

Fuel Reduction Activities (acres)	
Underburn Activity Fuels	9,953
Underburn Natural Fuels	5,511
Grapple Pile	3,015
Hand Pile	718
Total	**19,197**
Commercial Harvest (acres)	**6,172**
Logging Systems (acres)	
Tractor	5,366
Skyline	82
Helicopter	724
Total	**6,172**
Noncommercial Activities (acres)	
Precommercial thinning	11,160
Hardwood thinning	196
Total	**11,356**
Total Activity Acres (Many activities overlap the same acres, e.g. activity fuel treatments overlap with commercial harvest and precommercial thinning activities.)	**16,942**
Total Project Area Acres	**39,200**
Road Management (miles)	
Construction	18.0
Reconstruction	12.0
Decommissioning	6.5
Estimated Volume from Commercial Harvest (million board feet)	15.4

Alternative 3

This alternative was developed to address the purpose and need without the use of commercial timber harvest. This alternative focuses on activities that reduce hazardous fuels and the risk of stand loss due to high fuel loadings, maintain existing desired fuel levels, increase forested stands' resiliency to insects and disease, and increase growth rates in smaller diameter stands. Generally, trees greater than 9 inches dbh would not be cut, except juniper. In isolated cases of damaged or diseased trees, trees up to 12 inches dbh would be cut. Maps 7 and 8 display the activities proposed in this alternative.

Appendix A includes a description of the proposed treatments and a table showing the prescriptions for each unit included in Alternative 3.

One Forest Plan amendment is needed to implement this alternative. The plan amendment would allow precommercial thinning, hand piling, and underburning in the Stewart Springs OGMA. These activities are proposed to improve the longevity of large ponderosa pine on south and west facing slopes. The activities are consistent with the objectives for OGMAs, but are not consistent with the standard and guideline that indicates vegetative management is not allowed.

Table 2. Summary of activities included in Alternative 3.

Fuel Reduction Activities (acres)	
Underburn Activity Fuels	8,323
Underburn Natural Fuels	5,603
Hand Pile	856
Total	**14,782**
Noncommercial Vegetative Activities (acres)	
Precommercial thinning	9,703
Hardwood thinning	196
Total	**9,899**
Total Activity Acres (Many activities overlap the same acres, e.g. activity fuel treatments overlap with precommercial thinning activities.)	**15,501**
Total Project Area Acres	**39,200**
Road Management (miles)	0

Alternative 4

Alternative 4 was developed based on the road issue discussed in Chapter 1. Alternative 4 included the objective of minimizing the amount of new road construction. This alternative focuses on using existing roads whether open or closed and includes reconstruction. Even though this alternative emphasizes use of existing roads, it does include some new road construction.

Maps 9, 10, and 11 display the commercial harvest and road work, precommercial thinning and hardwood treatments, and fuels treatments for Alternative 2.

Appendix A includes a description of the proposed treatments and a table showing the prescriptions for each unit included in Alternative 4.

The Roads Analysis Report for the Bandit II Project Area was updated for the Spears project and is contained in the project record. The following is a list of roads that will be constructed; these roads will be closed after harvest activities are complete.

2600350-738	2620014-517	3300502-126	3300529-120	3350102-189
2610026-851	2630013-887	3300504-112	3300529-125	3350102-845
2610300-535	2700000-748	3300504-118	3300529-806	3350200-191
2620000-878	3300500-127b	3300516-138	3350000-160	

The following is a list of roads that will be constructed; these roads will be decommissioned after harvest activities are complete.

2610120-863a	2610155-565	2700555-752b
2610120-863b	2700555-752	

The following is a list of roads that will be reconstructed for use during harvest activities.

2600013	2610153	2620035	3300504	3350102
2610024	2610159	2630013	3300529	3350200
2610056	2620011	3300550-108b	3300550	3350209
2610058	2620013	3300503	3350018	

The following is a list of roads that will be closed after harvest activities are complete.

2600012	2600350	2610024	2610159	3300550
2600013	2600400	2610025	2700655	3350214
2600017	2610013	2610153	3300516	
2600310	2610022	2610155	3300527	

The following is a list of roads that will be decommissioned after harvest activities are complete.

2600254	2620030	2700559	3300551	3350308
2610012	2620032	3300504	3350023	
2610013	2620039	3300517	3350100	
2610025	2700554	3300550	3350214	

Three Forest Plan amendments are needed to implement this alternative. The first amendment would allow timber harvest activities in multi-strata LOS in the Douglas-fir PAG. Timber harvest would occur in multi-strata LOS within the Douglas-fir PAG to reduce competition and maintain large trees in this area; these stands would be converted to single-strata LOS. Following treatment, multi-strata LOS would be below HRV. The second amendment would allow commercial timber harvest within connective corridors. This activity is designed to maintain existing large trees and promote development of additional large trees within corridors;

however, commercial harvest would reduce the canopy closure to less than two-thirds of site potential. The third amendment would allow precommercial thinning, hand piling, and underburning in the Stewart Springs OGMA. These activities are proposed to improve the longevity of large ponderosa pine on south and west facing slopes. The activities are consistent with the objectives for OGMAs, but are not consistent with the standard and guideline that indicates vegetative management is not allowed.

Table 3. Summary of activities included in Alternative 4.

Fuel Reduction Activities (acres)	
Underburn Activity Fuels	9,824
Underburn Natural Fuels	5,338
Grapple Pile	2,490
Hand Pile	793
Total	**18,445**
Commercial Harvest (acres)	**4,935**
Logging Systems (acres)	
Tractor	4,177
Helicopter	758
Total	**4,935**
Noncommercial Vegetative Activities (acres)	
Precommercial thinning	10,935
Hardwood thinning	196
Total	**11,131**
Total Treatment Acres (Many activities overlap the same acres, e.g. activity fuel treatments overlap with commercial harvest and precommercial thinning activities.)	**16,740**
Total Project Area Acres	**39,200**
Road Management (miles)	
Construction	4.4
Reconstruction	11.0
Decommissioning	5.9
Estimated Volume from Commercial Harvest (million board feet)	12.3

Alternative 5

Alternative 5 was developed based on the wildlife issue discussed in Chapter 1. This alternative includes variable density thinning within some wildlife habitats, and leaving higher densities in moister areas such as draw bottoms and RHCAs. Timber harvest and precommercial thinning is designed to maintain clumpiness and old tree cohorts within some wildlife habitats.

This alternative focused on habitats for pileated woodpecker, goshawk, white-headed woodpecker, and elk. To address wildlife issues, prescriptions were adjusted to retain habitat features for the identified species. Examples of adjusting prescriptions include things such as retaining some clumps and defective trees.

Appendix A includes a description of the proposed treatments and a table showing the prescriptions for each unit included in Alternative 5.

The Roads Analysis Report for the Bandit II Project Area was updated for the Spears project and is contained in the project record. The following is a list of roads that will be constructed; these roads will be closed after harvest activities are complete.

2600350-738	3300500-108	3300516-138	3350102-189
2610026-851	3300500-127b	3300529-120	3350102-845
2620014-517	3300504-112	3300529-125	3350200-191
2700000-748	3300504-118	3350102-185	

The following is a list of roads that will be constructed; these roads will be decommissioned after harvest activities are complete.

2610155-565	2700555-752a	2700555-752b

The following is a list of roads that will be reconstructed for use during harvest activities.

2600013	2610153	2620013	3300503	3350018
2610056	2610159	2630013	3300504	3350102
2610058	2620011	2630020	3300529	3350200

The following is a list of roads that will be closed after harvest activities are complete.

2600013	2600400	2610153	2610159	3300516
2600350	2610013	2610155	2700655	3350214

The following is a list of roads that will be decommissioned after harvest activities are complete.

2610012	2620039	2700559	3300550	3350214
2610013	2630021	3300504	3300551	3350308
2620032	2700554	3300517	3350100	

Maps 12, 13, and 14 display the commercial harvest and road work, precommercial thinning and hardwood treatments, and fuels treatments for Alternative 5.

Two Forest Plan amendments are needed to implement this alternative. The first amendment would allow timber harvest activities in multi-strata LOS in the Douglas-fir PAG. Timber harvest would occur in multi-strata LOS within the Douglas-fir PAG to reduce competition and maintain large trees in this area; these stands would be converted to single-strata LOS. Following treatment, multi-strata LOS would be below HRV. The second amendment would allow precommercial thinning, hand piling, and underburning in the Stewart Springs OGMA. These activities are proposed to improve the longevity of large ponderosa pine on south and west facing slopes. The activities are consistent with the objectives for OGMAs, but are not consistent with the standard and guideline that indicates vegetative management is not allowed.

Table 4. Summary of activities included in Alternative 5.

Fuel Reduction Activities (acres)	
Underburn Activity Fuels	9,503
Underburn Natural Fuels	4,702
Grapple Pile	2,150
Hand Pile	881
Total	**17,236**
Commercial Harvest (acres)	**3,942**
Logging Systems (acres)	
Tractor	3,325
Helicopter	617
Total	**3,942**
Noncommercial Vegetative Activities (acres)	
Precommercial thinning	10,952
Hardwood thinning	196
Total	**11,148**
Total Treatment Acres (many activities overlap the same acres, e.g. activity fuel treatments overlap with commercial harvest and precommercial thinning activities.)	**15,850**
Total Acres in the Project Area	**39,200**
Road Management (miles)	
Construction	3.2
Reconstruction	10.1
Decommissioning	4.9
Estimated Volume from Commercial Harvest (million board feet)	8.9

Design Elements Common to All Alternatives

The Forest Service developed the following design elements to be used as part of all of the action alternatives. These design elements were developed to reduce the environmental effects of the proposed activities or to comply with standards and guidelines in the Forest Plan. Many of the design elements for RHCAs and Water Quality/Fisheries are intended to meet the requirements for protection of water quality in the State of Oregon through planning, application, and monitoring of Best Management Practices (BMPs).

Air Quality/Private Land Interface

Use signing and public notice when burning during hunting season or other times when public use of the area is high. To help ensure public safety during burning operations, signs or other traffic control measures would be used in accordance with Oregon Department of Transportation permit requirements.

All prescribed burning operations would be coordinated with the Oregon State Department of Environmental Quality and the Oregon State Department of Forestry through FASTRACS, the State of Oregon smoke management program. Anticipated weather conditions would be favorable for smoke dispersion.

Burn areas adjacent to private land will be patrolled before leaving the site following ignition and daily thereafter until the unit fire management officer determines there is no further threat to private land.

Hazard trees along private land boundaries, created by underburning activities, will be felled and left on site.

Private landowners within the project area will be notified approximately 14 days in advance of any burning activities adjacent to their lands.

Cultural Resources

If a cultural/heritage resource site were discovered or disturbed during implementation, efforts would be made to avoid any further disturbance. Site-specific mitigation would be determined if sites may not be avoided, and consultation with the Oregon State Historic Preservation Office (SHPO) would occur prior to resuming activities.

Summit Historic Trail

Protect the existing historic qualities and features, such as blazed trees, along the Summit Historic Trail and Road 27. These areas will be managed within a general border of 600 feet either side of the edge of the road or trail and provide a natural setting within the foreground area. Unit 751 is within Summit Trail visual partial retention and visual retention designation. Unit 752 is within visual retention designation. Units 748 and 742 are adjacent to the Summit Trail visual retention corridor boundary. The District Archaeologist will assist with layout of Units 738, 740, 751, 752, and 776.

Do not post boundary tags on Road 27 and Road 2630 within the Summit Historic Trail Management Area. This includes boundary tags for commercial harvest and precommercial thinning units. Within retention and partial retention areas (600 feet either side of the Roads 27 and 2630) in Units 502, 508, 510, 514, 544, 552, 745, 751, 752, 893, 904, and 905 remove boundary tags when the contract is completed.

In Units 751 and 752, consider yarding tops attached to landings outside visual corridor and foreground area to reduce fuel loadings. Use slash to cover/disguise stumps within 75 feet of Road 27.

Paint trees for removal in Units 742, 748, 751, and 752. If trees are not harvested, re-paint trees so blue marking paint is not visible.

Do not use or construct landings within 600 feet either side of Road 27 and Road 2630 within the Summit Historic Trail Management Area. Exceptions can be made on a case-by-case basis, if landings would not be visible in the foreground area because of natural topographic features. This applies to Units 742, 748, 751, and 752.

Hand pile slash in foreground retention areas along Road 27. This applies to Units 742, 748, 751, and 752.

Do not skid or land along trail route in Units 751 and 752.

Minimize new road construction off Road 27. Any newly constructed roads would be closed after use. Road closure activities would include activities to conceal locations such as covering with vegetation or woody debris. This applies to Units 742, 748, 751, and 752.

During precommercial thinning activities in Units 751 and 752, transition thinning to blend with adjacent stand conditions. Leave clumps of small trees.

For precommercial thinning activities, stumps would not exceed 8 inches in height. Slash may be lopped and scattered or piled. Where slash is piled, piles would be small (2-3 feet tall by 4-feet wide). Burn slash or piles within 1 year if possible. This applies to precommercial thin Units 508, 510, 514, 544, and 893 and aspen Units 502, 552, and 745. Retain clumps in foreground areas to reduce visual impacts and blend treatments with adjacent areas.

Hazard trees will be felled along Road 27. If hazard trees contain blazes, the tree would be cut above the blaze. This applies to Unit 751 and 752.

Protect historic qualities in and adjacent to Units 738, 740, and 776 which are along the stock driveway segment (alternate route for Summit Trail). Minimize the number of skid trails that cross the stock driveway segment to no more than three per mile. Do not use or create landings within 150 feet of stock driveway segment. Do not post boundary within 25 feet of stock driveway segment.

Retain carved aspen and protect log troughs. Carved aspen is known to occur Units 104, 402, 403, 407, 409, 502, 533, 745, 905, and 908.

Noxious Weeds

Conduct a weed identification workshop for Forest Service personnel who would be preparing, implementing, and/or administering the proposed activities.

Re-use of landings infested with noxious weeds would not occur, shade would be retained, and burning would be avoided within 100 feet of the infestation. Use timber sale contract provision CT5.12 (use of roads by purchaser) and CT6.315 (sale operation schedule). Units associated with infestations include 110, 306, 317, 542, 544, 559, 707, 803, 819, 841, 844, 859, 894, 895, 896, 897, 899, 941, 945, and 961. Exceptions may be made through coordination with the district weed coordinator.

Avoid or minimize disturbance within or adjacent to existing noxious weed infestations or develop a control plan to prevent their expansion. For example, avoid using weed-infested areas for camps, staging areas, landings, or parking areas. Exceptions may be made through coordination with the district weed coordinator.

Avoid grapple or hand piling of slash within 200 feet of U.S. Highway 26 and the first 1/4-mile from the junction of roads connected to U.S. Highway 26. Along Forest Road 2610 this criteria extends for the first 1/2-mile. This applies to Units 107, 108, 110, 211, 306, 502, 520, 567, 568, 700, 707, 708, 722, 734, 740, 741, 814, 815, 818, 819, 828, 832, 833, 838, 840, 841, 842, 844, 850, 874, 886, 900, 921, 922, and 967. This does not apply to the thinning of conifers in Unit 507, an aspen treatment unit. Exceptions proposed to address risk adjacent to private land will be coordinated through the District Botanist.

Water for prescribed fire control, watering roads, or other activities would be obtained from weed-free sites.

To reduce the potential for weed spread through mineral material (i.e. gravel and rock) used on roads and landings, Ochoco NF material sources will be inspected to ensure materials are weed free. Additionally, the sale contract would include provisions requiring any material from other sources is weed free.

To reduce the potential for transport or spread of noxious weeds by road construction or logging equipment, the timber sale contract would include CT6.343 (Opt.2) provision. This provision requires: (1) certification that equipment be clean of all plant or soil material that may result in the establishment or spread of noxious weeds; and (2) Notification of location where equipment was most recently used. The Forest Service Timber Sale Administrator would certify that equipment is clean of plant and soil material before the equipment enters the project area.

Revegetate roads that will be closed or decommissioned, primary skid trails, and log landing areas as part of the final sale contract work. Seeds that are used to revegetate areas would be certified as “All States Noxious Weed Free” by an approved testing laboratory, such as the Oregon State University Seed Lab. If available, use source-identified, locally-collected native grass species including pinegrass (*Calamagrostis rubescens*), squirreltail (*Elymus elymoides*), Sandberg bluegrass (*Poa secunda*), basin wildrye (*Leymus cinereus*), blue wildrye

(*Elymus glaucus*), or native cultivars such as red fescue (*Festuca rubra*) and big bluegrass (*Poa ampla*). Seed mixture would be applied at approximately 10 lbs/acre.

Document all noxious weed infestations identified during implementation by notifying the district noxious weed coordinator.

Include a noxious weed locator map in the project file to assist in avoidance and monitoring.

Conduct pre-project surveys to document existing infestations of noxious weeds.

Road closures would be coordinated with the district noxious weed coordinator to ensure that noxious weed sites are inventoried.

Where feasible, retain desirable vegetation on road shoulders, cuts, fills, ditches, and drainages.

Straw materials that are used in sediment traps will be certified weed-free or be acquired from certified fields that produce weed-free seed for the grain or grass seed industry.

Range/Minerals

Livestock fences, cattle guards, and other structural range improvements would be protected and/or returned to their pre-activity condition if damaged during thinning or burning operations.

Logging, burning, and road closure activities would be coordinated with permittees/mining claimants as needed. Efforts will be made to minimize conflicts between livestock use/mining activities and logging, thinning, and burning activities.

Recreation

Restrict commercial timber haul on holiday weekends (i.e., Memorial Day, 4th of July, Labor Day) and during the weekends of deer and elk rifle hunting season. Restrict use from Thursday noon through Monday noon. Also restrict commercial timber haul on the day before opening of deer rifle season.

Activities adjacent to management allocated dispersed recreation sites will be designed to retain visual screening. Also activity-generated slash within 25 feet of dispersed sites that is useable as firewood will be stacked. This applies to Units 137, 184, 210, 306, 401, 512, 707, 718, 719, 723, 737, 751, 752, 812, 821, 850, 851, 863, 867, 873, 901, 922, 947, 949, and 972.

Avoid utilizing management allocated dispersed recreation sites for log decks, piling slash, storing road rock, or dumping borrow material. This applies to Units 179, 184, 210, 306, 524, 707, 718, 751, 752, 821, 851, and 863.

Avoid allowing industrial (contractor) camps at management allocated dispersed campsites. This applies to Units 137, 179, 184, 210, 306, 307, 501, 512, 538, 550, 552, 700, 707, 718, 719, 723, 812, 821, 851, 860, 862, 863, 867, 873, 876, 893, 901, 922, 947, and 949.

After timber harvest activities are complete, disturbed sections of system trails would be reconstructed to the existing (pre-harvest) condition within 2 months of activity or funds would be collected for reconstruction. This includes replacing any trail markers that are removed as a result of timber harvest activities and roads that are reopened.

Commercial harvest, thinning, and burning activities would be coordinated with special use permit holders or their representatives, as needed. Efforts would be made to minimize conflicts between recreation permittees and commercial harvest, thinning, and burning activities.

Along trails, where the trail is the boundary, avoid "straight line" burning by using methods such as discontinuous ignition. The objective is to have mosaic burns with low scorch height on trees. This restriction applies to Units 172, 199, 200, 201, 214, 738, 739, 740, 741, 743, 744, 772, and 776.

Bandit Springs Nordic Trail System

Commercial timber harvest activities would be restricted between December 1 and March 30. Activity-generated slash would be cleared prior to the ski season for a minimum of 10 feet on each side of trails (for a minimum width of 20 feet). This restriction applies to Units 738, 740, 742, 748, 751, 752, and 776.

Noncommercial activities adjacent to trails would be restricted and trails cleared of activity-generated slash between December 1 and March 30. Slash would be cleared prior to the ski season for a minimum of 10 feet on each side of trails (for a minimum width of 20 feet). Clear slash as soon as activity is finished or at least prior to the ski season. This restriction applies to Units 739, 743, 744, 747, 772, and 885.

Landings would not be located on system trails. This applies to Units 738, 740, 742, 751, 752, and 776.

Avoid locating grapple piles within 100 feet of system trails. This applies to Units 738, 740, 742, 748, 751, 752, and 776.

To reduce the time that management activities in Unit 740 are apparent, grapple piles will be removed or burned by December 1 of the year following the piling activity.

To minimize the intensity of underburning, perform a spring burn on Unit 741.

Prescribed fire would not be ignited within 50 feet of each side of system trails when the trail is inside a burn unit. This applies to Units 738, 739, 740, 741, 742, 747, 751, 752, and 900.

Along system trails, if trees containing blue or orange diamond or other trail markers are marked to be cut, the trail markers would be moved to a nearby tree at the time the tree is marked for removal. System trails occur in Units 736, 739, 740, 742, 743, 751, 752, 772, and 776.

Boundary tags, markers, and flagging would be removed after completion of post-sale activities along all system trails.

Feather edges around ski trails and trail corridors. Avoid geometric shapes and lines not in character with the existing landscape. Activities are designed to appear as a natural occurrence when viewed in the Foreground. This applies to Units 738, 739, 740, 742, 743, 751, 752, 772, and 776.

Informative signs will be posted at Bandit Springs Rest Area, trailheads, and access points prior to activities occurring in this area.

Ochoco Divide Sno-Park, Road 27, and Road 2630 snowmobile routes

Commercial timber harvest activities would be restricted on weekends (Friday noon to Monday noon) between December 1 and March 30. The sale administrator may waive this seasonal restriction only when there is no snow.

Restrict commercial timber haul on the Snow Park Tie Trail and the Marks Creek-Independence Mine Snowmobile Trails (Roads 2630 and 2630-013) on weekends (Friday noon to Monday noon) between December 1 and March 30. The sale administrator may waive this seasonal restriction only when there is no snow.

Landings would not be located on system trails. This applies to Units 509 and 888.

Informative signs will be posted at Ochoco Divide Campground, Ochoco Sno-Park, Marks Creek Sno-Park, and Walton Lake Sno-Park prior to activity.

Corral Flat Dispersed Camping Area

All slash would be removed from the permitted horse trails 2 weeks prior to the annual endurance ride. The annual endurance ride usually occurs during the third weekend in July. This activity applies to Units 303, 304, 514, 524, 530, 531, 532, 550, 560, and 893.

Commercial harvest operations would be restricted for 3 weeks (end of June-July) each year during the annual endurance ride. There would be a commercial harvest restriction within 1/4-mile of the endurance ride trail that begins the Wednesday before each endurance ride and continues until the Tuesday following the event. This seasonal restriction applies to Units 303, 304, 524, 530, 531, 532, 550, and 560.

Walton Lake Nordic Ski Trail System

Activities adjacent to trails would be restricted between December 1 and March 30. Slash would be cleared prior to the ski season for a minimum of 10 feet on each side of trails (for a minimum of 20 feet). Clear slash as soon as activity is finished or at least prior to the ski season. This restriction applies to Units 544 and 546.

Landings would not be located on system trails. This applies to Unit 546.

Wildcat Trail # 833

After timber harvest activities are complete, disturbed sections of system trails would be reconstructed to the existing (pre-harvest) condition within 2 months of activity or funds would be collected for reconstruction. This includes replacing any trail markers that are removed as a result of management activities. Slash would be cleared from the trail for a minimum of 10 feet on each side. Prohibit grapple piling within 100 feet of trails. This applies to Units 172, 199, 200, 201, and 214.

Landings would not be located on system trails. This applies to Units 166, 172, 199, 200, and 201.

RHCAs

No machine (i.e. bulldozer) fire lines would be constructed within RHCAs.

Hand fire lines would not be constructed within 10 feet of a Class IV stream or within 20 feet of Class I, II, or III streams. Hand fire line would not be constructed through seeps, bogs, springs, meadows, and any other wet area.

Fire prescriptions for RHCAs would provide for a mosaic of burned and unburned material to retain vegetation for infiltration.

To meet mosaic and intensity objectives, fire may be purposely ignited within RHCAs. Prescribed fires would not be ignited within 50 feet of a stream.

Avoid locating industrial camps in RHCAs.

Precommercial thinning would not cause a reduction in shade on perennial streams (Class I, II, and III) with the exception of thinning to promote deciduous trees and shrubs. Thinning around hardwoods would be coordinated with the fisheries biologist or hydrologist.

Thinning and burning activities would not remove vegetation that is contributing to bank stability, especially in those areas adjacent to dormant or active landslide terrain.

Within RHCAs, effective ground cover would be established on landings and skid trails used for logging operations and on decommissioned and temporary roads. When consistent with other management actions, slash would be used on skid trails, temporary roads, and roads proposed to be closed. This would be done in conjunction with post-haul treatments when timber harvest is completed.

Hazard trees within RHCAs, which are required to be felled, would be left on site or managed for the attainment of RMOs for in-stream large wood recruitment.

There will be no new landings within RHCAs and ephemeral draws. Existing landings may be reused. Reuse of existing landings within RHCAs will be coordinated with the fisheries biologist or hydrologist.

To reduce ground-disturbance within RHCAs, ground-based machinery for logging or slash piling operations would not be used within RHCAs, including areas around springs, except on existing roads. Other exceptions would be evaluated on a case-by-case basis with the hydrologist or fisheries biologist. Exceptions include:

1. Pulling cable (winch lining) from an existing road in an RHCA.
2. Using existing roads as landings in RHCAs, such as in Units 104, 117 and 559.
3. Constructing spur roads to access landings within units, such as Units 112 and 118. Landings will be located outside RHCA.

Within Class IV RHCAs, no commercial harvest would occur within 25 feet of the stream bank to reduce potential sediment delivery

To maintain shade and stream bank stability, commercial harvest within Class I, II, and III RHCAs would only occur in the outer 100 feet of the RHCAs.

To reduce ground-disturbance within RHCAs during precommercial thinning and burning operations, off-highway or all-terrain vehicles would not be operated within RHCAs or on closed roads within RHCAs.

Sensitive Plants

Areas would be designated to protect habitat for yellow lady's slipper orchid (*Cypripedium parviflorum*). Slash piling and underburning would be avoided in these areas. Units that contain potential yellow lady's slipper (moist grand fir) habitat would be reviewed prior to implementation. Potential yellow lady's slipper habitat occurs in Units 163, 199, 515, 526, 542, 546, 707, 738, 748, 751, 823, 824, 845, 846, 869, 870, 872, 889, 932, 942, 959, and 982.

To protect sensitive species associated with riparian areas, no ground-based equipment, including grapple pilers, would be used within 100 feet of areas identified as containing Peck's lily (*Calochortus longebarbatus* var. *peckii*) populations or habitat. Exceptions can occur on existing roads and crossings, or other areas that have been reviewed by the botanist. Potential habitat for Peck's lily occurs in or near Units 120, 148, 302, 303, 407, 408, 409, 501, 502, 503, 512, 513, 514, 521, 524, 532, 538, 552, 560, 562, 565, 567, 568, 569, 704, 741, 744, 734, 742, 747, 748, 867, 888, 907, 913, 914, 921, 922, 923, 925, 980, and 981.

Vehicles, including off-highway or all-terrain vehicles, will not be operated within areas identified as Peck's lily habitat, except on existing roads.

To reduce impacts to scabland habitat (lithosol soils), and associated sensitive ricegrass (*Achnatherum hendersonii* and *A. wallowaensis*) habitat, construction of temporary roads or landings on scabland habitats would not occur. Scabland habitats occur within Units 111, 112, 117, and 806.

Avoid ground-disturbing activities, including piling of slash, on scablands. Vehicles, including off-highway or all-terrain vehicles, will not be operated on scablands. Exceptions can occur on existing roads, or other areas that have been reviewed by the botanist.

Soils

For tractor logging units, the leading end of logs would be suspended where practical during skidding to limit soil displacement. Ground-based equipment would not be operated on slopes greater than 35 percent in tractor units. Winch lining will be required on slopes greater than 35 percent to minimize detrimental impacts.

Skid trails would be designated and approved prior to logging and would be located on already disturbed areas where possible. Where practical, skid trails would avoid ephemeral draws and scablands. Where not practical, skidding would be perpendicular to ephemeral draws. Skid trails, landings, and roads would be designed to limit the cumulative extent of activities.

After harvest and grapple piling activities are completed, soil monitoring will evaluate the need for soil rehabilitation, such as tilling. Soil rehabilitation is expected to occur in Units 107, 111, 114, 120, 125, 127, 139, 143, 160, 162, 163, 166, 173, 176, 181, 198, 300, 301, 302, 310, 311, 317, 509, 515, 524, 531, 532, 550, 559, 560, 563, 565, 569, 570, 572, 700, 705, 707, 711, 718, 729, 734, 738, 740, 742, 751, 752, 811, 815, 821, 824, 825, 831, 836, 846, 848, 858, 859, 863, 865, 869, 878, 888, 891, 986, and 988.

Grapple pilers would be limited to operating on existing compacted/displaced areas to limit the amount of detrimental soil conditions. In undisturbed areas, grapple pile equipment would be allowed to make 1-2 passes to move between skid trails and other detrimentally disturbed areas. Grapple pilers would be limited to slopes less than 35 percent.

In units where detrimental soil conditions occur on less than 20 percent of the area, design activities so that detrimental soil conditions do not exceed 20 percent. This includes designating skid trails, landings, and roads.

In units where detrimental soil conditions exceed 20 percent of the area, if tillable, allow no more than 5 percent increase over existing conditions and then till so that there is no net increase in the percentage of detrimental soil conditions. If tillage is not feasible, stay on existing disturbed areas and allow no increase in detrimental soil conditions.

Visual/Scenic Resources

Boundary tags, flagging, and markers would be removed from harvest units in foreground retention areas after completion of activities to minimize visibility. Foreground retention areas include the U.S. Highway 26 corridor, corridors along Roads 27 and 2630, and portions of Road 2210, and the Bandit Springs Recreation Area. This applies to Units 108, 110, 148, 509, 542, 550, 559, 564, 700, 707, 734, 740, 742, 748, 751, 752, 814, 815, 817, 841, 851, 887, and 888.

In Foreground retention areas, trees within 75 feet of the primary travel corridor would be cut to minimize stump heights. For commercial timber harvest, stumps would not exceed 6 inches in height. For precommercial thinning activities, stumps would not exceed 8 inches in height. Primary travel corridors include U.S. Highway 26, Road 27, Road 2630, and portions of Road 2210, and designated trails (including trails in the Bandit Springs Recreation Area). This applies to Units 108, 110, 148, 211, 509, 510, 514, 542, 550, 555, 559, 564, 567, 568, 700, 707, 708, 722, 734, 740, 742, 748, 751, 752, 814, 815, 817, 818, 819, 828, 840, 841, 844, 851, 874, 887, 888, 893, 896, and 981. Along Road 27 which is the Summit Historic Trail, minimize stump heights within 300 feet of road; this applies to Units 751 and 752.

In Foreground retention areas, where practical, design and locate new skid trails and landings at least 300 feet from primary travel corridors. Landings would be revegetated within 1 year of use. Primary travel corridors include U.S. Highway 26, Roads 27 and 2630, and portions of Road 2210. This applies to Units 108, 110, 148, 509, 542, 550, 559, 564, 700, 707, 734, 740, 742, 748, 751, 752, 814, 815, 817, 841, 851, 887, and 888.

To reduce long-term visual effects in Visual Corridors, tree marking paint would be used to designate trees to be harvested, rather than trees to be retained. This applies to Units 108, 110, 148, 509, 542, 550, 559, 564, 700, 707, 734, 740, 742, 748, 751, 752, 814, 815, 817, 841, 851, 887, and 888.

Underburning activities in the Foreground retention areas would be designed to avoid scorching more than 1/3 of the live crown of dominant and codominant trees. Activities such as pruning of lower branches may be used to guard against high crown fire if necessary. Foreground retention areas include primary travel corridors along U.S. Highway 26, Roads 27 and 2630, and portions of Road 2210. This applies to Units 501, 512, 520, 538, 741, 747, 833, 838, 842, 886, 900, 901, 921, 922, and 923.

Water Quality/Fisheries

New roads will be closed or decommissioned in accordance with District written guidelines for “Road Closure and Decommissioning” when harvest operations are completed, except when otherwise designated. The purpose of closing and/or decommissioning roads is to eliminate motorized travel, provide long-term drainage, and reduce erosion potential to speed recovery.

Newly constructed roads within RHCAs would not parallel streams.

Seeps, springs, and landslide areas would be managed using Class III and IV RHCAs as specified in INFISH.

Skid trails and temporary roads within 50 feet of the scab-conifer interface, that are used during harvest operations, would be designed to reduce the concentration of flows and to encourage the flow of water off of them. This applies to Unit 111.

Streams requiring classification or reclassification would be coordinated through the hydrologist or fisheries biologist prior to marking.

To maintain ground cover and reduce potential sediment delivery, natural fuels (underburning) activities in the Wildcat and Salmon Creek subdrainages would occur at least 1 year before or 3 years after commercial timber harvest. This applies to Units 137, 804, 805, 823, 928, and 961.

Landings used in harvest operations would be scarified and seeded to increase infiltration and prevent surface erosion. Landings that are located on a gravel road or at turnouts that will remain open to traffic use would be exempt from the scarification and seeding requirements.

Dust abatement on haul roads would occur to reduce sediment (i.e. dust) entering streams. Generally, this means haul roads within RHCAs. Water used for dust abatement would be obtained from sources identified in the May 1996 Ochoco National Forest Water Conservation Plan.

Newly constructed and reconstructed roads with stream crossings would have adequate relief drainage installed prior to runoff reaching the stream channel. Filter strips below drainage structures would be of sufficient size to catch sediment before runoff enters streams. If adequate filter strips are not available, slash, straw material, rock aprons, or other filtering structures would be installed. Stream crossings structures (culverts and fords) on Class IV streams would be installed when the channel is dry.

In channel work on Class I-III streams would be accomplished in accordance with "Oregon Guidelines for Timing of in-Water Work to protect Fish and Wildlife Resources, June 2000." For the Spears project area, the timing for in-water work is July 1 to October 31.

Relief drainage/erosion control devices, such as straw material or sediment traps, would be placed at designated road/stream crossings to reduce sediment delivery to streams. The fisheries biologist or hydrologist will coordinate specifications and locations.

During wet periods, commercial road use will not contribute to siltation outside the roadway. For example, suspension of use may occur when road use is contributing to sediment detachment and transport, i.e. rutting 1 - 2 inches deep, muddy ditch water.

Wildlife

Goshawk

A 400-acre post fledging area (PFA) has been established around each known nest site. Commercial harvest operations, precommercial thinning, and underburning within PFAs would occur during the period September 1 through February 28. No management activities, including underburning activities, would occur inside the 30-acre nest stand.

There would be a seasonal restriction (March 1 to August 31) on commercial harvest, precommercial thinning, and underburning within approximately 1/2-mile of an active nest. This may also be applied to hauling operations if nests are within the immediate proximity of the haul route. This seasonal restriction may be waived on an annual basis if a nest inventory determines that breeding is not active. This restriction applies to Units 302, 303, 401, 722, 723, 727, 729, 734, 815, 816, 818, 819, 858, 860, 861, 867, 903, 919, 934, 949, and 984.

Other Raptors

Nest Sites - For the primary zone within 330 feet of nest site, maintain existing habitat characteristics. For the secondary zone (between 330 and 660 feet) around a nest site, modified treatments are permitted. Modified treatments are intermediate treatments between that required in the primary zone and that normally prescribed outside the whole protection zone. Operations would be restricted for both primary and secondary zones between March 1 and August 1. Underburning would not be allowed within 330 feet of the nest site. This seasonal restriction may be waived on an annual basis if a nest inventory determines that breeding is not active. This seasonal restriction applies to Units 148, 177, 211, 212, 303, 304, 401, 402, 559, 560, 719, 722, 723, 729, 874, 875, 934, 952, 955, and 962.

Osprey: There would be a seasonal restriction (March 1 to August 1) on commercial harvest, precommercial thinning, and underburning within 1/4-mile of osprey nests. This seasonal restriction may be waived on an annual basis if a nest inventory determines that breeding is not active. This restriction applies to Units 401, 559, 719, 722, 723, 729, 874, 875, and 955.

Deer and Elk

Activities involving heavy/power equipment would not be allowed within big game winter range areas from December 1 through May 1, unless coordinated through the wildlife biologist. This seasonal restriction applies to Units 100, 101, 104, 105, 106, 111, 112, 115, 117, 139, 142, 143, 148, 155, 202, 207, 212, 311, 315, 806, 809, 814, 820, 825, 826, 831, 834, 836, and 839.

Activities within elk calving areas will be seasonally restricted from May 15 to June 30. This seasonal restriction applies to Units 101, 104, 105, 112, 115, 117, 118, 119, 120, 124, 125, 126, 137, 138, 139, 151, 155, 163, 171, 172, 173, 174, 189, 190, 191, 192, 193, 196, 198, 199, 200, 201, 202, 203, 206, 207, 212, 214, 400, 404, 405, 521, 522, 524, 530, 531, 532, 534, 535, 801, 804, 805, 806, 815, 816, 817, 818, 819, 823, 910, 915, 920, 926, 928, 930, 935, 940, 941, 943, 957, 958, 959, 961, 964, and 968.

Snags/Down Logs

Snags that pose a safety hazard would be felled. Within RHCAs, they would be left on site or managed for in-stream large wood.

Harvest activities would not remove existing down logs. Fuel reduction activities would be designed to minimize loss of large down wood. This includes no direct ignition of large down wood, briefing of burn crews to emphasize burn objectives, and burning under conditions which make large fuels unavailable for consumption. Down logs are defined as logs that are 12 inches or greater at the small end and greater than 6 feet in length.

Burning within goshawk post-fledging areas, pileated feeding habitat, and connective corridors would be coordinated with the wildlife biologist.

Monitoring

Conduct post-project surveys and monitoring of noxious weed infestations, including mineral material sources, to evaluate the effects of the project on noxious weeds. Post-project surveys would identify new noxious weed infestations while they are small.

Temperature monitoring will continue on selected stream reaches such as Marks, Salmon, and Little Hay Creeks.

Pre and post-activity shade monitoring will be accomplished on at least one aspen stand where thinning is scheduled.

Two water quality monitoring stations have been established in the Marks Creek Watershed: Marks Creek above Little Hay Creek and Wildcat Creek above U.S. Highway 26. Discharge, TSS (total suspended solids), and turbidity will be measured.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in Table 5 is focused on the purpose and need and significant issues where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 5. Comparison of the effects of implementing each alternative.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Late and Old Structure (LOS) projections at Year 0, 20, and 50	There are 5,575 acres of LOS in the project area. After 20 and 50 years, the amount is expected to increase to 8,283 and 11,368 acres.	At Year 0, there is 5,575 acres of LOS. After 20 and 50 years, the amount is expected to increase to 8,626 and 12,065 acres.	At Year 0, there is 5,575 acres of LOS. After 20 and 50 years, the amount is expected to increase to 8,416 and 11,644 acres.	At Year 0, there is 5,575 acres of LOS. After 20 and 50 years, the amount is expected to increase to 8,600 and 12,011 acres.	At Year 0, there is 5,575 acres of LOS. After 20 and 50 years, the amount is expected to increase to 8,565 and 11,938 acres.
Early-seral Species Composition	There are 22,794 acres dominated by early-seral species. After 20 and 50 years, the amount of the area dominated by early-seral species would be 21,581 and 20,465, respectively.	After treatments, there would be 23,433 acres dominated by early-seral species. After 20 and 50 years, the amount would be 24,136 and 23,098, respectively.	After treatments, there would be 21,929 acres dominated by early-seral species. After 20 and 50 years, the amount would be 22,542 and 21,436, respectively.	After treatments, there would be 23,197 acres dominated by early-seral species. After 20 and 50 years, the amount would be 23,889 and 22,843, respectively.	After treatments, there would be 23,220 acres dominated by early-seral species. After 20 and 50 years, the amount would be 23,630 and 22,576, respectively.
High Risk to Insects and Disease	There are 11,865 acres at high risk to insects and disease. By year 50, there would be 21,551 acres at high risk.	After treatments, there would be 8,800 acres at high risk to insects and disease. By year 50, there would be 19,425 acres at high risk.	After treatments, there would be 11,095 acres at high risk to insects and disease. By year 50, there would be 20,921 acres at high risk.	After treatments, there would be 9,191 acres at high risk to insects and disease. By year 50, there would be 19,653 acres at high risk.	After treatments, there would be 9,486 acres at high risk to insects and disease. By year 50, there would be 19,859 acres at high risk.

Table 5. Comparison of the effects of implementing each alternative.

	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Fuels Treatments	No activities would occur and existing hazard levels would not be reduced. The amount of departure from reference conditions would not be reduced and would increase over time. Within Fire Regimes (FR) I and II, there is a moderate departure, 43 and 57% respectively. Within FR III, the percent departure is low at 16%.	Fuel reduction activities would occur and would reduce the departure from reference conditions in FRs I and III. The percent departure in FR 1 would be low at 29%. The percent departure in FR III would be low at 13%. The percent departure in FR II would remain moderate at 58%.	Fuel reduction activities would occur and would reduce the departure from reference conditions in FRs I and III. The percent departure in FR 1 would be moderate at 37%. The percent departure in FR III would be low at 15%. The percent departure in FR II would be moderate at 58%.	Fuel reduction activities would occur and would reduce the departure from reference conditions in FRs I and III. The percent departure in FR 1 would be low at 31%. The percent departure in FR III would be low at 14%. The percent departure in FR II would remain moderate at 58%.	Fuel reduction activities would occur and would reduce the departure from reference conditions in FRs I and III. The percent departure in FR 1 would be low at 31%. The percent departure in FR III would be low at 14%. The percent departure in FR II would remain moderate at 58%.

Table 5. Comparison of the effects of implementing each alternative.

	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Hardwood Thinning	Cottonwood and aspen would continue to lose vigor because of competition with conifers and in the long term, clones may shrink or die out.	Cottonwood and aspen would become more vigorous, increasing sprouting and the longevity of mature trees. Cottonwood and aspen would be maintained and may increase in extent and vigor.	Same as Alternative 2.	Same as Alternative 2	Same as Alternative 2.
RHCAs	The existing amounts of broadleaf species would continue to compete with conifers and may decrease in number and extent.	Activities on 1,853 acres would reduce conifers and competition. Alder, willow, aspen, and other broadleaf species would become more vigorous and may expand. The growth of residual conifers would increase and would become a source for future large wood to streams.	Activities on 1,726 acres would reduce conifers and competition. Alder, willow, aspen, and other broadleaf species would become more vigorous and may expand. The growth of residual conifers would increase and would become a source for future large wood to streams.	Activities on 1,834 acres would reduce conifers and competition. Alder, willow, aspen, and other broadleaf species would become more vigorous and may expand. The growth of residual conifers would increase and would become a source for future large wood to streams.	Activities on 1,692 acres would reduce conifers and competition. Alder, willow, aspen, and other broadleaf species would become more vigorous and may expand. The growth of residual conifers would increase and would become a source for future large wood to streams.

Table 5. Comparison of the effects of implementing each alternative.

	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Goshawk Post-fledging areas	No activities within PFAs. Retain habitat suitability in the short term.	Activities on 678 acres within 6 PFAs. Alters habitat suitability; all PFAs would remain suitable for occupancy.	Activities on 499 acres within 6 PFAs. Alters habitat suitability; all PFAs would remain suitable for occupancy.	Activities on 607 acres within 6 PFAs. Alters habitat suitability; all PFAs would remain suitable for occupancy.	Activities on 652 acres within 6 PFAs. Alters habitat suitability; all PFAs would remain suitable for occupancy.
Goshawk Habitat	Retains existing amount (22,896 acres) of primary nesting habitat. The amount of primary nesting habitat is within the HRV.	Results in 23,272 acres of primary nesting habitat across the project area. The amount of primary nesting habitat is within the HRV.	Results in 23,243 acres of primary nesting habitat across the project area. The amount of primary nesting habitat is within the HRV.	Results in 23,243 acres of primary nesting habitat across the project area. The amount of primary nesting habitat is within the HRV.	Results in 23,350 acres of primary nesting habitat across the project area. The amount of primary nesting habitat is within the HRV.
Pileated Woodpecker Habitat	The existing amount of habitat would be maintained and would increase in the short term. Overtime, high stand densities may lead to mortality which would reduce the amount of suitable nesting habitat.	This alternative reduces habitat quality on 414 acres of feeding habitat and would reduce the amount of primary nesting habitat by 1,182 acres in the short term. Primary nesting habitat would be within HRV.	This alternative maintains habitat quality on 250 acres of feeding habitat and would reduce the amount of primary nesting habitat by 190 acres in the short term. Primary nesting habitat would be within HRV.	This alternative reduces habitat quality on 360 acres of feeding habitat and would reduce the amount of primary nesting habitat by 996 acres in the short term. Primary nesting habitat would be within HRV.	This alternative maintains habitat quality on 320 acres of feeding habitat and would reduce the amount of primary nesting habitat by 1,048 acres in the short term. Primary nesting habitat would be within HRV.

Table 5. Comparison of the effects of implementing each alternative.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Elk	No satisfactory or marginal cover would be treated. The HEI for winter range would be 53.8. The HEI for general forest winter range would be 45.1.	Satisfactory cover would be reduced by 895 acres. The HEI for winter range would be 10.2. The HEI for general forest winter range would be 15.0. The HEI is within standards.	Satisfactory cover would be reduced by 801 acres. The HEI for winter range would be 14. The HEI for general forest winter range would be 37.6. The HEI is within standards.	Satisfactory cover would be reduced by 870 acres. The HEI for winter range would be 13.8. The HEI for general forest winter range would be 37.6. The HEI is within standards.	Satisfactory cover would be reduced by 788 acres. The HEI for winter range would be 13.7. The HEI for general forest winter range would be 37.6. The HEI is within standards.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in the alternatives chapter.

The information in this chapter summarizes the affected environment, direct, indirect, and cumulative effects of the alternatives along with conclusions and supporting rationale. Further information on the specifics of the affected resources such as historical conditions, assumptions, methodologies, analyses, specific localized information, references, and technical documentation can be found in the individual specialists' reports in the project record.

Late and Old Structure (LOS)

Affected Environment

The upland forest areas within the Spears project area have been characterized using the plant association concept. Plant associations are a method of land classification which is based on the probable, or projected, plant community which will occupy a site given enough time and an absence of disturbance influences. The plant associations for the entire Ochoco National Forest have been mapped using the classifications described in "Plant Associations of the Blue and Ochoco Mountains" (Johnson and Clausnitzer 1992). The mapping was based on 1:12000 aerial photography and intensive fieldwork. In 1998, the adjacent private lands within the Marks Creek watershed were mapped using 1:16000 aerial photos.

The Ochoco National Forest has defined eight plant association groups (PAGs) for upland forest and woodland sites. These groups contain plant associations of similar biophysical environments, productivity, and disturbance regimes. Six PAGs occur within the Spears project area. There are approximately 4,600 acres of nonforest area within the project area.

Table 6. Acres by Plant Association Group (PAG).

Plant Association Group	Total Acres
Moist Grand fir	1,300
Dry Grand fir	19,844
Douglas-fir	8,047
Mesic Ponderosa Pine	2,659
Xeric Ponderosa Pine	1,318
Western Juniper Woodland	1,431
	34,599

*PAG acres have been updated and vary from those listed in the Watershed Analysis.

The Ochoco National Forest's Viable Ecosystem Management Guide (Simpson et al. 1994) describes a seral/structural matrix for characterizing forest vegetation within each of the PAGs. The Ochoco NF matrix has three seral stages based on species composition (early, mid, late), and each of these is subdivided into five size/structural conditions (grass/forb/shrub, seedling/sapling, pole, small trees, large trees). Thus, the matrix can accommodate up to fifteen cells. The grass/forb/shrub condition is only reflected in the early seral condition. Matrix cells are further subdivided to reflect relative differences in tree density, subscripts "a" and "b" are used to denote high and low density, respectively. For example, L4a describes a late-seral species composition, small-sized trees, at a high-density level. An example matrix is shown below:

Table 7. Viable Ecosystem seral/structural matrix.

Structure Class	**Species Composition**		
	Early	Mid	Late
Grass, forb, shrub (trees may be present but not dominant)	E1	--	--
Seedling, sapling (less than 4.9 inches dbh)	E2	M2	L2
Pole (between 5 and 8.9 inches dbh), high density	E3a	M3a	L3a
Pole, low density	E3b	M3b	L3b
Small (between 9 and 20.9 inches dbh), high density	E4a	M4a	L4a
Small, low density	E4b	M4b	L4b
Medium/large (21 inches dbh and larger), high density	E5a	M5a	L5a
Medium/large, low density	E5b	M5b	L5b

Satellite imagery from 1999, updated to 2004 through change detection analysis, has been used to determine the current distribution of seral structural stages. The resolution of the satellite imagery is approximately 1/6th of an acre. Each 1/6 acre is assigned to one of the VEMG matrix classifications depending upon species composition, structure, and density. Stand growth and disturbance since 2004 that changed vegetative stages has not been included. These changes would include slightly increased canopy closure due to ingrowth and expanded conifer dominance on sites identified as grass, shrub, and forb (E1). They would also include mortality due to insects and disease, resulting in an increase in the E1 condition. The amount of change since 2004 is so small that it would not meaningfully alter the analysis. The effects of past harvest, fire, and mortality were incorporated into the 2004 satellite analysis.

The Viable Ecosystem model has been used to characterize the existing landscape and to provide a means of comparison to historical conditions. Five of the six PAGs have been fully analyzed for the project area. A range of acres for each stage is given to compare the current conditions to conditions found in the area historically. The existing condition of the western juniper PAG is displayed but effects on the alternatives on this PAG were not analyzed because the number of acres treated is small, and mostly consists of underburning which would have little if any effect on the vegetative stages. Tables 8 through 13 display the existing condition and the historic range of variability (HRV) for all six PAGs in the project area.

Table 8. Moist grand fir PAG.

S/S Stage	Existing (acres)	Low (acres)	High (acres)
E1	128	65	156
E2	51	65	156
E3a	18	13	39
E3b	10	52	156
E4a	173	5	26
E4b	205	21	104
E5a	149	5	13
E5b	71	21	52
M2	49	39	130
M3	35	65	210
M4a	62	156	416
M4b	61	39	104
M5a	179	104	208
M5b	21	26	52
L2	0	0	26
L3	3	13	65
L4a	26	52	104
L4b	13	0	0
L5a	43	52	104
L5b	3	0	0

Table 9. Dry grand fir PAG.

S/S Stage	Existing (acres)	Low (acres)	High (acres)
E1	1793	397	1389
E2	917	595	1588
E3a	127	198	595
E3b	336	794	2381
E4a	2664	476	794
E4b	6372	1905	3175
E5a	1000	476	794
E5b	696	1905	3175
M2	815	595	1786
M3	500	595	1986
M4a	352	595	1111
M4b	1661	2381	4445
M5a	1026	397	992
M5b	489	1588	3969
L2	5	0	397
L3	18	0	397
L4a	297	318	794
L4b	353	79	198
L5a	397	635	1270
L5b	26	159	318

Table 10. Douglas-fir PAG.

S/S Stage	Existing (acres)	Low (acres)	High (acres)
E1	160	402	1609
E2	684	0	805
E3a	119	0	161
E3b	106	0	644
E4a	1587	322	644
E4b	1797	1288	2575
E5a	343	563	805
E5b	184	2253	3219
M2	47	0	805
M3	89	0	402
M4a	140	80	322
M4b	139	322	1288
M5a	95	80	241
M5b	1	322	966
L2	229	0	402

Table 11. Mesic ponderosa pine PAG.

S/S Stage	Existing (acres)	Low (acres)	High (acres)
E1	109	133	665
E2	17	0	133
E3a	0	0	27
E3b	0	0	106
E4a	2	0	53
E4b	17	0	213
E5a	0	0	53
E5b	0	0	213
M2	14	0	133
M3	16	0	133
M4a	65	0	53
M4b	54	0	213
M5a	18	0	80
M5b	0	0	319
L2	485	0	266

S/S Stage	Existing (acres)	Low (acres)	High (acres)
L3	140	0	402
L4a	968	258	515
L4b	638	64	129
L5a	550	258	515
L5b	31	64	129

S/S Stage	Existing (acres)	Low (acres)	High (acres)
L3	93	133	319
L4a	553	0	106
L4b	1025	532	957
L5a	97	0	106
L5b	94	1330	1755

Table 12. Xeric ponderosa pine PAG.

S/S Stage	Existing (acres)	Low (acres)	High (acres)
E1	43	66	330
E2	19	0	66
E3a	0	0	7
E3b	0	0	59
E4a	9	0	13
E4b	49	66	119
E5a	0	0	13
E5b	0	66	119
M2	4	0	66
M3	4	0	66
M4a	72	0	26
M4b	71	66	237
M5a	2	0	20
M5b	0	66	178
L2	58	66	132
L3	44	66	263
L4a	779	0	46
L4b	104	198	428
L5a	58	0	53
L5b	2	198	474

Table 13. Western juniper PAG.

S/S Stage	Existing (acres)	Low (acres)	High (acres)
E1	123	716	1002
M2	92	72	143
M3	70	72	143
L4a	596	0	0
L4b	525	215	429
L5	25	72	172

LOS is an important vegetative condition specifically identified in the Regional Forester's Forest Plan Amendment No. 2 (June 1995). This Forest Plan amendment is commonly referred to as the Eastside Screens. The Eastside Screens define LOS as vegetative structures in which large trees are a common feature. It goes on to identify two different structural conditions, multi and single strata.

Satellite imagery is used as the landscape analysis tool to estimate the existing amount of LOS. The Viable Ecosystem size/structure class 5 (21 inch or greater dbh) is used to identify existing LOS. Differentiation between multi- and single-strata LOS is based on the "a" and "b" density classifications. The amount of each LOS type by PAG was compared to its corresponding HRV.

Currently, the project area contains an estimated 5,575 acres of LOS. Most of the LOS, about 3,960 acres, is in a multi-strata condition. Historically, the overall amount of LOS would have ranged between 10,569 and 20,205 acres. Historically, most of the LOS would have been single strata due to the frequent low-intensity fires which were the dominate disturbance regime in the area. Examination of each PAG reveals that all PAGs are within or above the historic range for the multi-strata condition. All PAGs except moist grand fir are below the historic range for the single-strata condition. The moist grand fir PAG is within the range for the single-strata condition. The moist grand fir PAG was historically influenced by more infrequent, higher-severity fires which are reflected in the historic ranges. Across all PAGs, the total amount of multi-strata LOS is within the combined historic ranges, while single-strata LOS is below.

Table 14. Existing LOS and historic ranges by PAG.

Plant Association Group	LOS Type	Existing (acres)	Historic Low (acres)	Historic High (acres)	Status
Moist grand fir	multi	371	161	325	above range
	single	95	47	104	within range
	Total	466	208	429	
Dry grand fir	multi	2,423	1,508	3,056	within range
	single	1,211	3,652	7,462	below range
	Total	3,634	5,160	10,518	
Douglas-fir	multi	988	901	1,561	within range
	single	216	2,639	4,314	below range
	Total	1,204	3,540	5,875	
Mesic ponderosa pine	multi	115	0	239	within range
	single	94	1,330	2,287	below range
	Total	209	1,330	2,526	
Xeric ponderosa pine	multi	60	0	86	within range
	single	2	330	771	below range
	Total	62	330	857	
Total (all PAGs)	multi	3,957	2,570	5,267	within range
	single	1,618	7,998	14,938	below range
	Total	5,575	10,568	20,205	

The information displayed in Table 14 includes all LOS stages within the project area, regardless of patch size. The Ochoco NF has identified a minimum patch size of 5 acres that must be met in order to qualify as an LOS “stand” as described in the Eastside Screens. (The April 6, 2007, Silvicultural Input for this project includes additional information.)

Environmental Consequences

Successional and structural changes as a result of the alternatives and projections through time were estimated using the Viable Ecosystem model. This model accounts for multi-directional change (multiple pathway succession) through time, but does not include future disturbances. The model does include density-dependent growth effects. The fuels reduction activities have not been incorporated into the projections because the effects of these activities are not anticipated to create changes in species composition, structure, or density of a magnitude large enough to be measured.

There are two primary processes that affect the movement of one seral structural stage to another. Species composition changes due to succession tend to favor shade-tolerant species and move stages from early seral to late seral. Growth moves stages from smaller to larger structural stages. Although some insects and disease disturbances are species specific and can move early seral to mid or late seral, natural disturbance processes (including fire, insects and diseases, and flooding) tend to move stages backward from mid or late seral to early seral. The magnitude of movement depends on the intensity of the disturbance. Some disturbances, such as low-intensity fire, may not affect the dominant stand character, but serve to maintain the existing stage.

Differing growth rates were applied to the two density categories ("a" and "b") within the grand fir, Douglas-fir, and ponderosa pine PAGs. These growth rates directly correspond to rates of change in structure in the Viable Ecosystem seral/structural stages. Less dense "b" stages received an average 20 percent growth rate increase over stands which have high "a" densities. This estimate corresponds with density and spacing studies (Oliver 1979, Barrett 1982, Cochran and Barrett 1993, and Cochran and Barrett 1999b) where growth rate increases from thinning varied between 15-25 percent depending on stand density and little gains were realized when canopy closure was not reduced below 50-60 percent.

The projected future abundance of each stage is based on stand development assumptions for the various seral structural stages. The 20, 30, and 50-year time intervals were chosen to demonstrate development over time. These projections indicate that all action alternatives move toward the HRV for the first 20 years. Between 20 and 50 years, the results indicate the action alternatives move closer to the HRV than the no action alternative. These projections include changes from natural growth and succession, as well as endemic levels of disturbance (insects and disease). The projections do not include future disturbance events such as widespread insect and disease occurrences, fire, or management activities other than continued fire suppression.

The action alternatives are designed to reduce tree density and improve growth and vigor of the residual trees and reduce susceptibility to insects and disease. Thinning will more quickly restore historic seral/structural stage conditions and improve growing conditions for larger trees than either no action or prescribed fire alone. Thinning also decreases the probability of crown fires, reducing the potential area burned by unwanted fires, and decreases potential fire severity (Peterson et al. 2005).

Live trees 21 inches dbh or larger would not be cut in any prescription except when necessary to provide safe working conditions. Hazardous trees that are cut down in Riparian Habitat Conservation Areas would be left on site.

Numerous studies have shown increased growth and vigor of remaining trees following thinning (Oliver 1979, Barrett 1981, Barrett 1982, Barrett 1989, Larson et al. 1983, Cochran and Barrett 1999a, and Cochran and Barrett 1999b). Growth response to thinning has been shown to occur in all size classes of trees, including large old ponderosa pine (McDowell et al. 2003). Other studies have shown reduced susceptibility to many insect and diseases that are density related (Roth and Barrett 1985 and Filip and Schmidt 1990). Further studies show moderated fire hazard and lower crown fire potential as a result of thinning and fuel reduction activities (Omi and Martinson 2002 and Pollet and Omi 2002).

Alternative 1

LOS development within the project area would be determined by existing stocking and species composition. Much of the future LOS that develops through natural growth and succession would tend towards mid or late-seral species composition and multi-strata characteristics. These conditions are already within or above the historic range for all PAGs. Within 20 years, the total amount of multi-strata LOS is projected to exceed the overall historic range for the project area. The rate at which stands would develop large tree character would be hampered by over stocked conditions. On drier sites, such as the ponderosa pine and Douglas-fir PAGs, stand stagnation may preclude the attainment of additional large trees. Existing LOS (i.e. large trees) would continue to be susceptible to mortality from competition with understory trees and the accompanying increase in risk to loss due to insects, disease, and wildfire.

Tables 15 through 18 and Figures 1, 2, and 3 below display the predicted amounts of LOS that would occur under each alternative.

Alternative 2

Activities would generally move stands in a multi-strata condition to or towards a single-strata condition. Many stands would continue to be in an uneven-aged condition. Reducing stand density would reduce competitive stress on the remaining trees (Powell 1999). This would result in more large trees being maintained over time, as well as to encourage the development of additional large trees (Cochran et al. 1994). The abundance of early-seral species would be maintained and enhanced in the long-term; however, late-seral species would continue to be present in stands where they exist prior to treatment. Grand fir and Douglas-fir would be retained both in the overstory (all trees >21” dbh) as well as in the understory but in lesser amounts.

Activities are also proposed in single-strata conditions but where stocking density is currently considered to be too high. Thinning activities would target the smaller diameter and less vigorous trees for removal, while maintaining the generally single-strata characteristics. This would encourage the development of large structure at an accelerated rate. In addition, reducing stocking density would increase tree vigor and reduce insect and disease hazard.

Activities would remove understory trees to reduce stand density, to maintain existing large trees, and to enhance the development of additional large trees. No live trees 21 inches dbh or larger, except those trees considered hazardous to the logging/hauling operation, would be cut. Primarily fire-intolerant, late-seral species would be targeted for removal although these species would not be eliminated.

Reducing stand densities would reduce competitive stress. This would result in more large trees being maintained over time, as well as encourage the development of additional large trees. Activities would also reduce the risk of large tree mortality due to disturbance agents. Single-strata conditions are more likely to be sustained over time than multi-strata conditions since the trees are more vigorous and less susceptible to insects, disease, and wildfire. The abundance of early-seral species would be maintained and enhanced in the long term.

The overall amount of LOS would not change immediately due to treatment, although 929 acres of multi-strata LOS would be converted to single-strata LOS. The overall amount of multi-strata LOS would not be reduced below historic levels; however, the amount of multi-strata LOS within the Douglas-fir PAG would drop below the historic range by 222 acres. By year 20, the amount of multi-strata LOS in the Douglas-fir PAG would increase to be within the historic range. After year 20, the amount of multi-strata LOS remains within or above the historic range for all PAGs. This alternative results in the greatest amount of single-strata LOS in both the long and short term, although the overall amount of single strata does not reach the historic range within the 50-year projection period. Tables 15 through 18 and Figures 1, 2, and 3 below display the predicted amounts of LOS that would occur under each alternative.

Alternative 3

Precommercial thinning in this alternative would remove smaller diameter trees and reduce some competitive stress on the remaining trees. Early-seral species or disease-resistant trees would be selected for retention where possible. Because only small trees would be removed, the amount of competition among the remaining trees would vary depending on the existing stand density and number of trees greater than 9 inches dbh. In some units, it may not be possible to reach recommended stocking levels. Disease in trees larger than 12 inches dbh, such as dwarf mistletoe, would not be reduced. The ability to change species dominance from late seral to early seral would be limited where there is an abundance of late-seral trees 9 inches dbh and larger. In addition, the ability to move from multi-strata conditions to single-strata conditions would be reduced where trees in the 9 to 20 inch dbh range make up a separate canopy strata.

Reducing stand densities would reduce competitive stress although not to the extent possible with commercial harvest. Density reduction would result in more large trees being maintained over time, as well as encourage the development of additional large trees. Activities would also reduce the risk of large tree mortality due to disturbance agents. Single-strata conditions are more likely to be sustained over time than multi-strata conditions since the trees are more vigorous and less susceptible to wildfire. The abundance of early-seral species would be maintained and enhanced in the long term. This alternative would not directly move any acres of multi-strata LOS to single-strata LOS.

The overall amount or distribution of LOS would not change immediately due to thinning. Precommercial thinning would tend to maintain LOS in its current condition for a longer period of time when compared to Alternative 1. In stands that are currently not LOS, thinning trees less than 9 inches dbh would accelerate their growth and allow the development of large trees at a faster rate than if they were left unthinned. By year 20, there would be an increase in the amount of LOS, but the increase is the least of all the action alternatives. This trend continues through the 50-year projection period. Tables 15 through 18 and Figures 1, 2, and 3 below display the predicted amounts of LOS that would occur under each alternative.

Alternative 4

Activities would generally move stands in a multi-strata condition to or towards a single-strata condition similar to Alternative 2; however, fewer acres would be treated. Many stands would continue to be in an uneven-aged condition. Reducing stand density would reduce competitive stress on the remaining trees (Powell 1999). This would result in more large trees being maintained over time, as well as to encourage the development of additional large trees (Cochran et al. 1994). The abundance of early-seral species would be maintained and enhanced in the long-term; however, late-seral species would continue to be present in stands where they exist prior to treatment. Grand fir and Douglas-fir would be retained both in the overstory (all trees >21” dbh) as well as in the understory but at lesser amounts.

Activities are also proposed in single-strata conditions but where stocking density is currently considered to be too high. Thinning activities would target the smaller diameter and less vigorous trees for removal, while maintaining the generally single-strata characteristics. This would encourage the development of large structure at an accelerated rate. In addition, reducing stocking density would increase tree vigor and reduce insect and disease hazard.

The overall amount of LOS would not change immediately due to treatment, although 763 acres of multi-strata LOS would be converted to single-strata LOS. The overall amount of multi-strata LOS would not be reduced below historic levels; however, the amount of multi-strata LOS within the Douglas-fir PAG would drop below the historic range by 129 acres. By year 20, the amount of multi-strata LOS in the Douglas-fir PAG would increase to be within the historic range. After year 20, the amount of multi-strata LOS remains within or above the historic range for all PAGs. This alternative results in more single-strata LOS than Alternative 3, but less than Alternative 2. Tables 15 through 18 and Figures 1, 2, and 3 below display the predicted amounts of LOS that would occur under each alternative.

Alternative 5

Activities would generally move stands in a multi-strata condition to or towards a single-strata condition similar to Alternative 2; however, fewer acres would be treated and in several stands higher-density levels would be retained. Activities would generally move stands in a multi-strata condition to or towards a single-strata condition. Many stands would continue to be in an uneven-aged condition. Reducing stand density would reduce competitive stress on the remaining trees (Powell 1999). This would result in more large trees being maintained over time, as well as to encourage the development of additional large trees (Cochran et al. 1994). The abundance of early-seral species would be maintained and enhanced in the long-term; however, late-seral species would continue to be present in stands where they exist prior to treatment. Grand fir and Douglas-fir would be retained both in the overstory (all trees >21” dbh) as well as in the understory but at lesser amounts.

Activities are also proposed in single-strata conditions but where stocking density is currently considered to be too high. Thinning activities would target the smaller diameter and less vigorous trees for removal, while maintaining the generally single-strata characteristics. This would encourage the development of large structure at an accelerated rate. In addition, reducing stocking density would increase tree vigor and reduce insect and disease hazard.

The overall amount of LOS would not change immediately due to the proposed activities. The overall amount of multi-strata LOS would not be reduced below historic levels; however, the amount of multi-strata LOS within the Douglas-fir PAG would drop below the historic range by 108 acres. By year 20, the amount of multi-strata LOS in the Douglas-fir PAG would increase to be within the historic range. After year 20, the amount of multi-strata LOS remains within or above the historic range for all PAGs. This alternative results in more single-strata LOS than Alternative 3, but less than Alternatives 2 and 4. Treatments in this alternative are similar to those in Alternatives 2 and 4, except for the modified prescriptions proposed for certain units with wildlife habitat emphasis. Those modifications include leaving portions of units untreated and/or retaining higher residual densities than Alternative 2 or 4. Modeling these modifications is outside the capabilities of the Viable Ecosystem model. Given the nature of these modifications, and the acres involved, it is reasonable to predict that the output of the model will overstate changes in vegetative stages by approximately 15 percent. Given that caveat, this alternative would move an estimated 685 acres of multi-strata LOS to single-strata LOS. Tables 15 through 18 and Figures 1, 2, and 3 below display the predicted amounts of LOS that would occur under each alternative.

Table 15. Existing and post-treatment LOS by PAG (acres).

PAG	LOS Type	Alternative 1 (existing)	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Moist grand fir	multi	371	305	371	320	330
	single	95	151	95	138	136
Dry grand fir	multi	2,423	1,886	2,423	1,942	1,992
	single	1,211	1,742	1,211	1,688	1,642
Douglas-fir	multi	988	679	988	772	793
	single	216	523	216	431	411
Mesic ponderosa pine	multi	115	98	115	100	101
	single	94	112	94	109	108
Xeric ponderosa pine	multi	60	60	60	60	60
	single	2	2	2	2	2
Total (all PAGs)	multi	3,957	3,028	3,957	3,194	3,276
	single	1,618	2,547	1,618	2,381	2,229
Total (both multi and single)		5,575	5,575	5,575	5,575	5,575

Table 16. Projected acres of LOS by PAG (Year 20).

PAG	LOS Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Moist grand fir	multi	462	409	464	422	423
	single	101	150	102	139	138
Dry grand fir	multi	3,500	3,047	3,509	3,098	3,140
	single	1,803	2,441	1,865	2,387	2,324
Douglas-fir	multi	1,352	1,124	1,345	1,189	1,208
	single	382	758	436	667	634
Mesic ponderosa pine	multi	346	332	347	334	335
	single	115	139	121	136	135
Xeric ponderosa pine	multi	211	215	216	217	215
	single	12	12	12	12	12
Total (all PAGs)	multi	5,870	5,126	5,881	5,259	5,322
	single	2,413	3,499	2,535	3,341	3,243
Total (both multi and single)		8,283	8,626	8,416	8,600	8,565

Table 17. Projected acres of LOS by PAG (Year 30).

PAG	LOS Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Moist grand fir	multi	502	456	506	468	469
	single	103	149	105	139	139
Dry grand fir	multi	4,016	3,607	4,030	3,655	3,693
	single	1,988	2,656	2,073	2,604	2,537
Douglas-fir	multi	1,525	1,335	1,519	1,389	1,405
	single	435	831	509	742	705
Mesic ponderosa pine	multi	445	433	448	435	436
	single	121	146	129	143	142
X Pine	multi	270	275	276	277	276
	single	15	15	15	15	15
Total (all PAGs)	multi	6,759	6,106	6,779	6,224	6,279
	single	2,662	3,798	2,831	3,643	3,538
Total (both multi and single)		9,420	9,904	9,610	9,867	9,817

Table 18. Projected acres of LOS by PAG (Year 50).

PAG	LOS Type	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Moist grand fir	multi	576	541	582	551	552
	single	106	147	109	138	137
Dry grand fir	multi	5,007	4,685	5,033	4,727	4,757
	single	2,194	2,890	2,314	2,840	2,769
Douglas-fir	multi	1,861	1,741	1,861	1,777	1,787
	single	497	913	599	829	789
Mesic ponderosa pine	multi	618	607	620	609	609
	single	126	153	137	150	149
Xeric ponderosa pine	multi	364	369	370	371	370
	single	18	19	19	19	19
Total (all PAGs)	multi	8,426	7,944	8,466	8,035	8,075
	single	2,942	4,122	3,178	3,976	3,863
Total (both multi and single)		11,368	12,065	11,644	12,011	11,938

Figure 1. Projected acres of multi-strata LOS by alternative.

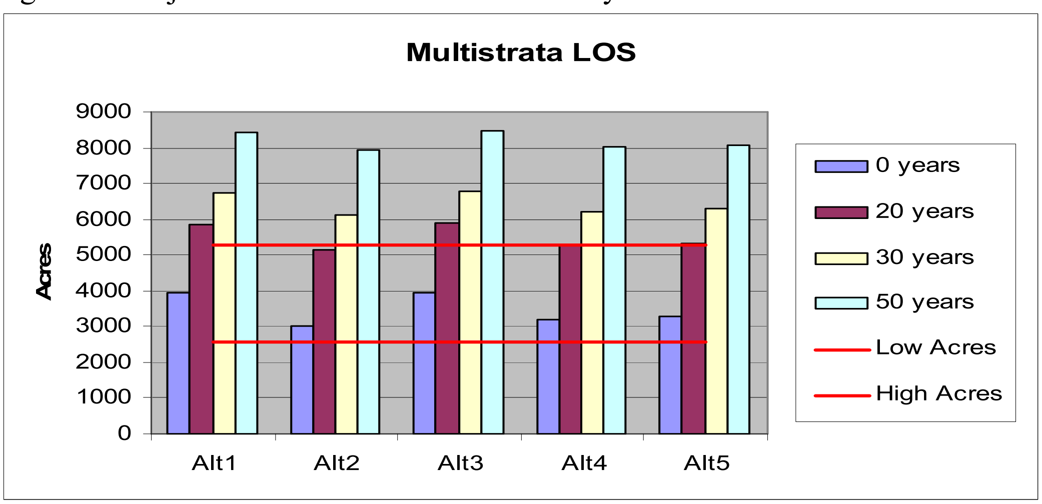


Figure 2. Projected acres of single-strata LOS by alternative.

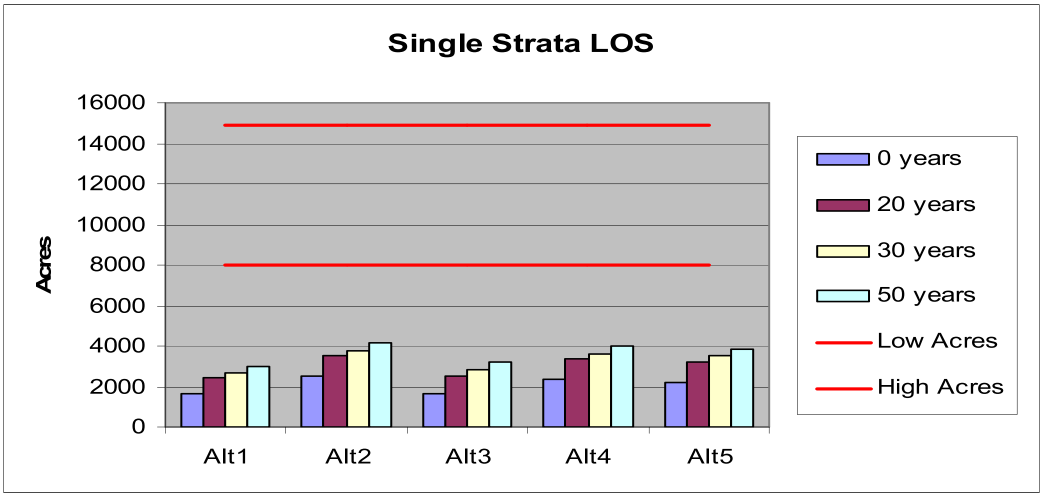
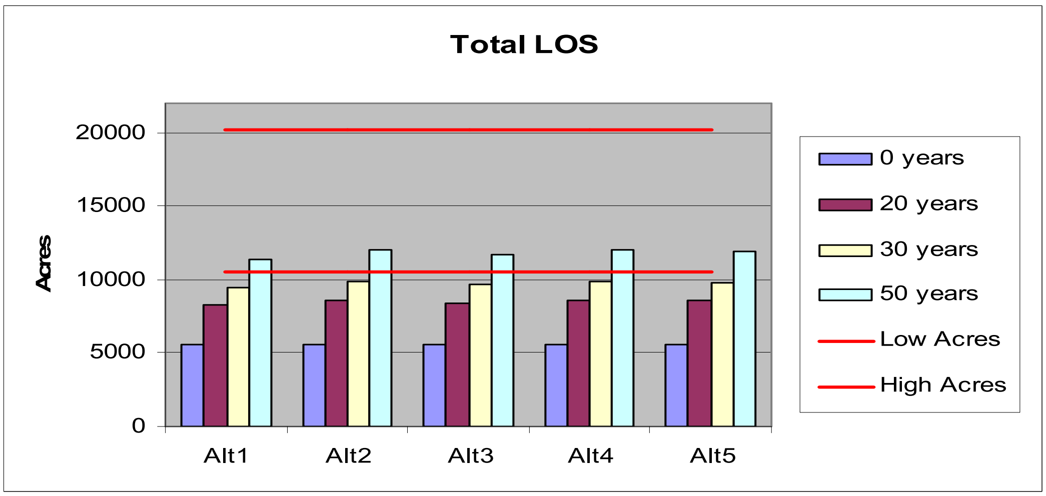


Figure 3. Projected total acres of LOS by alternative.



The projections for Alternatives 2, 3, 4, and 5 include only the proposed activities associated with each alternative. They do not include any future management such as continued underburning, thinning, or other stand-tending activities that may occur in the future. Thus, the predicted amounts of multi-strata LOS tend to increase with time as succession and stand growth continue without further management activities other than continued fire suppression.

Cumulative Effects

There are no active or planned timber sales within the Spears project area that would alter the amount of LOS or change species composition. The effects of past harvest and other activities have been included in the description of the existing condition. There are no other vegetation projects (i.e. precommercial thinning or fuels reduction activities) currently ongoing or planned within the area. Approximately 1,500 acres of precommercial thinning from the 2002 Bandit II project have been completed within the area. This work was done in 2003 and 2004; fuels reduction in these units (underburning and pile burning) has not been completed and is included in the action alternatives.

Increased mortality from bark beetles was occurring in the project area following the Hash Rock Fire of 2000. It appears that the amount of mortality has decreased to endemic levels in the past 2 years. No further increase in insect mortality is anticipated related to the Hash Rock Fire.

Most of the private ownership within the project area is xeric ponderosa pine or juniper. Some nonforest land is also associated with homes and meadows. The privately owned forestland contains little, if any, LOS. It is foreseeable that land management practices on these lands would neither favor the development of additional LOS nor remove existing LOS.

Early-seral Species Composition

Affected Environment

There are two primary processes that affect the movement of one seral structural stage to another. Species composition changes due to succession tend to favor shade-tolerant species and move stages from early seral to late seral. Growth moves stages from smaller structure to larger structural stages. Although some insects and disease disturbances are species specific and can move early seral to mid or late seral, natural disturbance processes (including fire, insects and diseases, and flooding) tend to move stages backward from mid or late seral to early seral. The magnitude of movement depends on the intensity of the disturbance. Some disturbances, such as low-intensity fire, may not affect the dominant stand character, but serve to maintain the existing stage.

The projected future abundance of each stage is based on stand development assumptions for the various seral structural stages. The 20, 30, and 50-year time intervals were chosen to demonstrate development over time. These projections indicate that all alternatives move toward the HRV for the first 20 years. Between 20 and 50 years, the treatments proposed in the action alternatives provide a landscape which is closer to the HRV than the no action alternative.

Environmental Consequences

Alternative 1

Vegetation would continue to develop within the project area in a manner determined by existing stocking and species composition. Many of the future stages, which develop through natural growth and succession, would tend towards mid or late-seral species composition and multi-strata characteristics. Many of these conditions are already within or above HRV. The rate at which many stands develop large tree character would be hampered by overstocked conditions. On drier sites, such as ponderosa pine PAGs, stand stagnation would become more common. Existing trees would continue to be weakened by competition in overly dense stands.

Dense structural stages, already above the historic abundance, would continue to increase, reaching the highest levels of all alternatives. Acres dominated by grand and Douglas-fir (late-seral species) would steadily increase, while acres dominated by ponderosa pine and western larch (early-seral species) would steadily decrease. Tables 19 and 20 and Figures 4 and 5 display the effects of the five alternatives on species composition and dense conditions.

Table 19. Acres dominated by grand and Douglas-fir.

	0 years	20 years	30 years	50 years
Alternative 1	3,711	4,266	4,472	4,947
Alternative 2	2,719	3,208	3,370	3,748
Alternative 3	3,412	3,954	4,149	4,595
Alternative 4	2,878	3,191	3,543	3,932
Alternative 5	2,974	3,477	3,649	4,048

Table 20. Acres dominated by ponderosa pine and western larch.

	0 years	20 years	30 years	50 years
Alternative 1	22,794	21,581	21,283	20,465
Alternative 2	23,433	24,136	23,103	23,098
Alternative 3	21,929	22,542	19,546	21,436
Alternative 4	23,197	23,889	23,626	22,843
Alternative 5	23,220	23,630	23,363	22,576

Figure 4. Grand and Douglas-fir dominated stages.

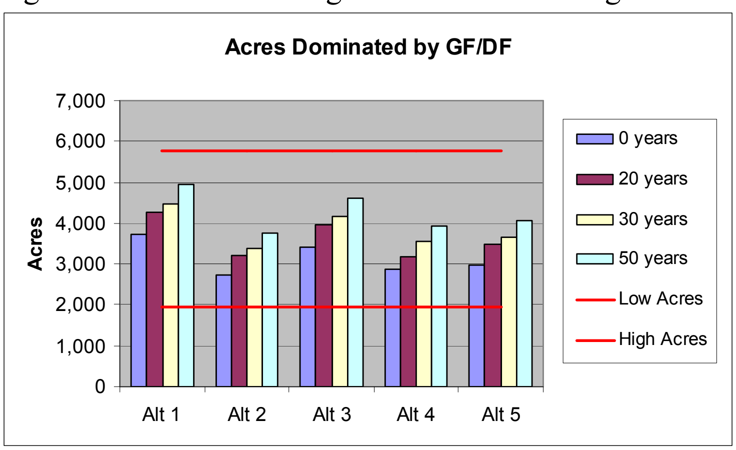
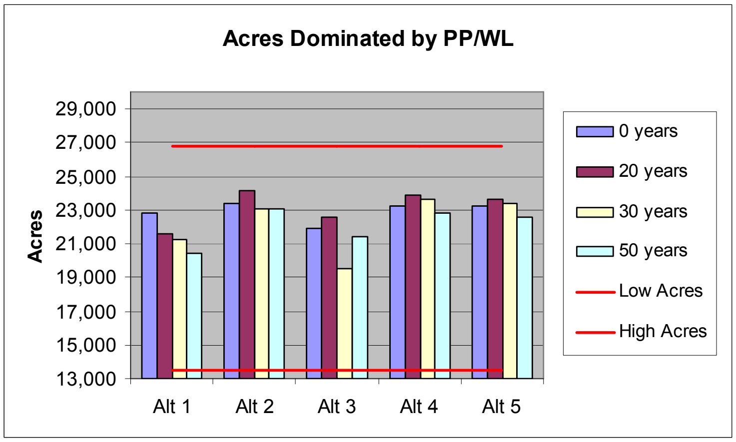


Figure 5. Ponderosa pine and western larch dominated stages.



Effects Common to all Action Alternatives

Proposed treatments (commercial harvest and precommercial thinning) are designed to reduce tree density and improve growth and vigor of the residual trees and reduce susceptibility to insects and disease. These treatments would more quickly restore historic seral/structural stage conditions and improve growing conditions for larger trees than either no action or prescribed fire alone. Commercial harvest and precommercial thinning would decrease the probability of crown fires, reducing the potential area burned by unwanted fires, and would decrease potential fire severity (Peterson et al. 2005).

Alternative 2

The abundance of early-seral species would be maintained and enhanced in the long-term; however, late-seral species would continue to be present in stands where they exist prior to treatment. Grand fir and Douglas-fir would be retained both in the overstory (all trees >21" dbh) as well as in the understory but at lesser amounts.

Acres dominated by grand and Douglas-fir would be reduced the most of any alternative, yet remain with the historic range. Acres dominated by ponderosa pine and western larch would be increased by about 650 acres due to treatment, and increase by an additional 700 acres over the next 20 years.

Alternative 3

Early-seral or disease-resistant species would be selected for retention where possible. Because only small trees would be removed, the amount of competition among the remaining trees would vary depending on the larger density and it may not be possible to reach recommended stocking levels in some units. The ability to change species dominance from late seral to early seral will be limited in stands where there is an abundance of late-seral trees 9 inches dbh and larger.

Acres dominated by grand and Douglas-fir would be reduced by about 300 acres, the least of any action alternative. Acres dominated by ponderosa pine and western larch would be increased by about 865 acres due to treatment, then increase by 600 acres over the next 20 years, surpassing the amount in Alternative 1 at that time.

Alternative 4

The abundance of early-seral species would be maintained and enhanced in the long-term; however, late-seral species would continue to be present in stands where they exist prior to treatment. Grand fir and Douglas-fir would be retained both in the overstory (all trees >21" dbh) as well as in the understory but at lesser amounts.

Acres dominated by grand and Douglas-fir would be reduced by more than 800 acres, but stay within the historic range. Acres dominated by ponderosa pine and western larch would be increased by about 400 acres due to treatment, and increase by an additional 700 acres over the next 20 years.

Alternative 5

The abundance of early-seral species would be maintained and enhanced in the long-term; however, late-seral species would continue to be present in stands where they exist prior to treatment. Grand fir and Douglas-fir would be retained both in the overstory (all trees >21" dbh) as well as in the understory but at lesser amounts.

Acres dominated by grand and Douglas-fir would be reduced by about 250 acres, but stay within the historic range. Acres dominated by ponderosa pine and western larch would be increased by about 425 acres due to treatment, and increase by about 400 additional acres over the next 20 years.

Cumulative Effects

There are no active or planned timber sales within the Spears project area that would alter the amount of area dominated by ponderosa pine and western larch. The effects of past harvest and other activities have been included in the description of the existing condition as described previously. There are no other vegetation projects currently ongoing or planned that would alter the amount of area dominated by early-seral species.

Infestations by Insects and Disease

Affected Environment

Past management practices, including fire exclusion and selection harvest, have favored the development of stands, which are now considered to be out of balance when compared to their historic conditions. Historically (100+ years ago) stands in the project area would have commonly had more ponderosa pine and western larch and less grand fir and Douglas-fir. They would have been more open and single storied rather than the multi-storied stands of today. These stand conditions were maintained by frequent, low-intensity fires, which prevented them from becoming overcrowded. The natural disturbance agents found in the project area, have always been present; however, the degree to which they now affect the area can be considered to be a reflection of the ecosystem's health and resiliency.

Bark Beetles: Aerial insect and disease surveys for years 1996 through 2006 show numerous active mortality centers due to bark beetle feeding. Stand exams and field reconnaissance also identified bark beetle activity and susceptible stand conditions. Elevated levels of western pine beetle occurred in the area following the Hash Rock Fire. At this time, it appears that elevated mortality from that event has declined.

Mountain pine beetle (*Dendroctonus ponderosae*) and western pine beetle (*Dendroctonus brevicomis*) occur in the project area. Ponderosa pine is a susceptible host in overstocked stands. Bark beetle mortality is symptomatic of over-stocked stand conditions that create competition stress and reduce tree vigor (Schmid et al.1994 and Graham and Knight 1965). Thinning (density reduction) has been shown to be effective in reducing bark beetle susceptibility in stands (Fettig et al. 2007).

Douglas-fir beetle (*Dentroctonus pseudotsugae*) and the fir engraver (*Scolytus ventralis*) also occur in the project area. Both of these insects are regarded as secondary pests because they attack trees that are weakened and stressed. Factors such as drought, defoliation, overstocking, and disease can result in outbreaks of these insects that can cause increased mortality within a stand.

Defoliating Insects: From approximately 1987 to 1992, this project area, along with the rest of the Ochoco Mountains, experienced an outbreak of western spruce budworm which caused large amounts of trees damage and/or mortality in nearly all stands in which grand fir and Douglas-fir are major components. Beginning in 1992, the Marks and Harpo timber sales included harvest in stands with high levels of mortality and damage from the western spruce budworm. Attributes, which contribute to high susceptibility to defoliating insects, are: (1) increased amount of later seral host species, (2) increased stand densities, and (3) the development of multi-storied stand structures (Carlson and Wulf 1989). The trend without vegetative treatments would be for these characteristics to increase until insect population dynamics and climatic conditions combine to generate another outbreak of epidemic proportions.

Dwarf mistletoe: Dwarf mistletoes are present in the project area. Ponderosa pine dwarf mistletoe (*Arceuthobium campylopodum*) decreases tree vigor, reduces growth, and increases susceptibility to other pathogens (Hawksworth and Shaw 1987). Infections in trees of the upper canopies spread readily to trees in the lower canopies. Douglas-fir dwarf mistletoe (*Arceuthobium douglasii*) causes growth loss, reduced wood quality, topkill, and mortality. Dwarf mistletoes are largely specific to one or two host tree species. In other words, Douglas-fir dwarf mistletoe would not be expected to infect ponderosa pine (Knutson and Tinnin 1980).

Dwarf mistletoes accelerate the movement to mid and late-seral species compositions by reducing the vigor of infected early-seral species and increasing the competitive edge of later-seral species. Dwarf mistletoes cause branch structure to broom creating nest and hiding sites for many animals. Some animals forage on dwarf mistletoe plants.

Dwarf mistletoes are probably more common at present than historically due to the reduction of normal fire events. Dwarf mistletoe spreads from infected trees to adjacent trees that are close enough to catch mistletoe seeds as they are released from the plant. Historically more stands in the project area were open with fewer understory trees. Frequent, low-intensity fire would have scorched lower branches and killed infected branches which would have reduced or prevented the spread of mistletoe. As stands have become more dense and multi-strata, dwarf mistletoes have been able to spread faster. As height growth slows due to infected branches, dwarf mistletoe moves more quickly into the higher tree crown. Brooming branches contribute to ladder fuels that allow wildfires to reach tree crowns increasing the risk of crown fire initiation.

Dwarf mistletoe management can be directed at either prevention or reduction. The most effective treatment for dwarf mistletoe control is to remove infected overstory trees; this project does not include the removal of large trees over 21 inches dbh. Harvest or precommercial thinning in the lower canopies can and does reduce stocking and can effectively reduce some growth loss, improve vigor, and reduce re-infection (Roth and Barrett 1985). Favoring an immune tree species when performing thinning is also an effective method of dwarf mistletoe management (Knutson and Tinnin 1980).

Root disease: Armillaria root disease and laminated root rot are present in the project area. They are most evident within stands of high density and those with a major component of later-seral species. Vigorously growing trees can be infected but can often confine the fungi and limit the extent of the infection (Hadfield et al. 1986). Most of the root disease activity in the project area can be found in the grand fir PAG, especially in areas where stand conditions combine to reduce stand vigor. These diseases can kill trees directly, and often work in conjunction with insects and disease to create pockets or patches of mortality (Hagle and Shaw 1991). Historically, these disease centers were usually small and contributed to stand diversity. With the changes over time in species composition, the incidence of and susceptibility to root disease infection is increasing. The tendency, without disturbance, is for infection centers to be repopulated with host tree species and for infections to perpetuate and intensify.

Table 21 displays the seral/structural stages by PAG that are considered to be at high risk of damage by insects and diseases.

Table 21. High risk stages by PAG.

PAG	High Risk Stages
Moist GF	E4a, E5a, M5a, L3, L4a, L5a
Dry GF	E3a, E4a, E5a, M4a, M5a, L3, L4, L5
Doug-fir	E3a, E4a, E5a, M4a, M5a, L3, L4a, L5a
Mesic PP	M4a, M5a, L4a, L5a
Xeric PP	M3, M4a, M5a, L4a, L5a

Currently, there are about 11,900 acres within the project area that are in stages rated as high risk. This exceeds the historic range of high risk stages by about 600 acres.

Environmental Consequences

Alternative 1

No actions would be taken to reduce susceptibility to insects and diseases. Vegetative development would continue dependent on the conditions and successional trends which currently exist. More of the project area would develop conditions such as high density and an abundance of later-seral species. High risk stages would become more abundant in the future. In 20 years the amount of high risk area is projected to increase by an additional 4,600 acres.

Table 22 and Figure 6 below display the amount of high risk area associated with each alternative.

Effects Common to Alternatives 2, 3, 4, and 5

The proposed activities would reduce susceptibility to insects and disease by decreasing tree density, favoring early-seral species, and moving towards single-strata conditions which were more abundant historically. Decreasing tree density would result in increased growing space and less competition for the remaining trees. This would increase their vigor and lessen the risk of tree mortality caused by bark beetles and root diseases. The susceptibility to western spruce budworm would be reduced by (1) favoring early-seral species (ponderosa pine and western larch) which are not preferred primary hosts, (2) reducing multilayered canopy conditions which support larval survival during dispersal, and (3) improving tree vigor and the ability to withstand attack. Susceptibility to dwarf mistletoe would be reduced by (1) favoring non-host tree species, (2) reducing dense multilayered canopy conditions favorable to seed dispersal, and (3) improving tree vigor which would allow for increased tree height growth.

Alternative 2

This alternative reduces the high-risk stages by more than 3,000 acres. This alternative brings the amount of area into the range at which it historically occurred. The proposed activities would reduce stand densities, increase the relative abundance of early-seral species, and increase resistance to disturbance agents. This alternative reduces the acres of high risk condition the most of all alternatives. This trend continues through the 50-year projection period.

Alternative 3

This alternative reduces the high-risk stages by almost 800 acres, and brings the amount of area just into the range at which it historically occurred. This alternative is predicted to have the least amount of risk reduction of all the action alternatives.

Alternative 4

This alternative reduces the high-risk stages by almost 2,700 acres, and brings the amount of area into the range at which it historically occurred. The proposed activities would reduce stand densities, increase the relative abundance of early-seral species, and increase resistance to disturbance agents.

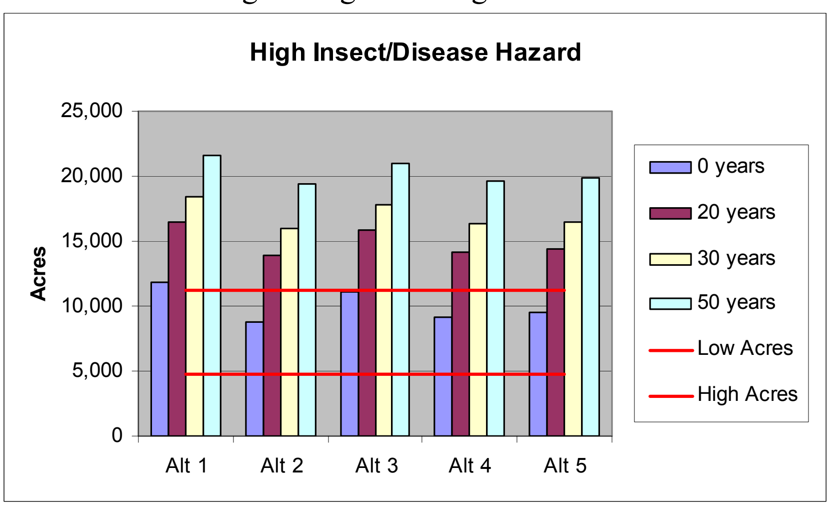
Alternative 5

As discussed previously, the predictions made by the Viable Ecosystem model are not able to fully account for the modified prescriptions incorporated into this alternative. It can be anticipated that the untreated patches within units, and the areas retaining more than the recommended stocking level would continue to be in a high risk stage. The model prediction of amount of high risk area reduced is potentially overstated by about 15 percent. The actions proposed in this alternative, however, are estimated to reduce the high-risk stages by almost 2,400 acres, and bring the amount of area into the range at which it historically occurred.

Table 22. Acres in a condition of high risk to insects and disease.

	0 years	20 years	30 years	50 years
Alternative 1	11,865	16,491	18,439	21,551
Alternative 2	8,800	13,877	16,004	19,425
Alternative 3	11,095	15,802	17,770	20,921
Alternative 4	9,191	14,188	16,283	19,653
Alternative 5	9,486	14,440	16,518	19,859

Figure 6. Acres in high risk stages susceptible to insects and disease and the historic range of high risk stages.



The 20, 30, and 50-year projections include only the actions associated with each alternative. They do not include any future management such as continued underburning, thinning, or other stand-tending activities, which may occur. Thus, the acres of high risk increase with time as succession and stand growth continue uninterrupted.

Cumulative Effects

There are no ongoing or planned activities, other than those described in the action alternatives, that would reduce the amount of area in the high risk stages. Therefore, there are no cumulative effects that relate to insect and disease susceptibility.

Fuels

Affected Environment

The most common natural disturbance that has had an effect on vegetation in the project area is lightning-caused fire. Fire exclusion over the last 90-100 years has reduced the acres burned from naturally occurring, low-intensity fires. Frequent, low-intensity fires removed both surface and ladder fuels resulting in more open forest stands than what occur today. When fire is kept out of forest stands, both surface and ladder fuels increase and stands become denser, which increases the likelihood of high-intensity wildfire. As a result of fire exclusion, the amount of fuel loadings and the density of forest stands have increased.

Fire regimes describe the role of fire as a disturbance process for a given landscape. A fire regime is defined as the fire frequency or interval as “the average number of years between fires” and severity as the “effect of the fire on the dominant over story vegetation” (Hardy et al. 2001 and Schmidt et al. 2002). The majority of the Spears project area is classified as Fire Regimes I and III which correlates with the ponderosa pine PAG at the lower elevations and mixed conifer at upper elevations.

Fire regimes are divided into five levels of historical natural fire occurrences; only three of the five regimes occur within the Spears project area. Fire regime is a reflection of the biophysical environment that occurs across a landscape, hence none of the alternatives would have any effect on fire regime.

Fire Regime Condition Class (FRCC) is used to describe general landscape fire regime and vegetation/fuel characteristics. Estimates of these characteristics are calculated for comparison with estimates of natural fire regime reference values and reference condition vegetation/fuel characteristics to index FRCC (a classification of the amount current conditions have departed from those of historical reference conditions).

Condition classes are generally equivalent to low, moderate, and high departure from the natural or historical range of variability (HRV).

Table 23 displays the effects of the alternatives on condition class within each fire regime for the Spears project area.

Table 23. Fire regime and condition class (percent departure from reference conditions).

Fire Regime	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
I	2 (43)	1 (29)	2 (37)	1 (31)	1 (31)
II	2 (57)	2 (58)	2 (58)	2 (58)	2 (58)
III	1 (16)	1 (13)	1 (15)	1 (14)	1 (14)

Fire Regime I includes the ponderosa pine and Douglas-fir PAGs. Fire Regime I comprises about 35 percent of the project area. Currently, areas within this fire regime exhibit a moderate amount of departure (43%) from reference conditions, primarily a deficiency of late-seral, open vegetation/fuels conditions. Alternatives 2 through 5 reduce the amount of departure. Alternatives 2, 4, and 5 move this fire regime into condition class 1.

Fire Regime II is a minor component in the project area. The juniper woodland PAG is Fire Regime II. Within Fire Regime II, there is a lack of open, early-seral condition compared to reference conditions. This results in a moderate amount of departure and is classified as condition class 2. There is little if any treatment proposed for Fire Regime II under any of the alternatives and the condition class remains the same for all alternatives.

Fire Regime III comprises 61 percent of the project area. Current vegetation and fuels conditions are similar to reference conditions, with departure at 16 percent and in condition class 1. Alternatives 2 through 5 reduce the amount of departure as shown in the table above. This occurs primarily by increasing the amount of late-seral, open vegetation/fuels conditions.

Environmental Consequences

Alternative 1

This is the no action alternative and no fuel reduction activities, including prescribed fire, would occur. No fuel reduction activities would occur within the WUI. In the absence of frequent, low-intensity fires, forest stands in the project area have developed multi-canopy conditions, stocking levels have increased, ladder fuels have increased, surface fuels have increased, and the abundance of late-seral, fire-intolerant species (such as grand fir) has increased. These changes from historic conditions have left forested stands susceptible to high-intensity wildfire, with an increased potential for the unwanted loss of trees, water quality, soil productivity, wildlife habitat, and other forest resources. These trends would continue. The amount of the project area that is in condition class 1 would decrease over time as both surface and ladder fuels increase. The amount of the project area in condition classes 2 and 3 would increase as fuels accumulate and departures from reference conditions increase. Over time, the amount of area with the potential for high-intensity wildfire would increase while the amount of area that would support low-intensity fire would decrease.

There are no ongoing or reasonably foreseeable activities in the project area that would reduce the amount of fuel accumulations and reduce the potential for high-intensity wildfire.

Alternative 2, 4, and 5

Direct and Indirect Effects

These alternatives include several types of fuel reduction activities including activity-fuels underburning, natural fuels underburning, piling, and jackpot burning. Precommercial thinning and commercial timber harvest are also considered because they would reduce ladder fuels. The amount of each fuel reduction activity varies by alternative as displayed in Table 24. Fuel reduction activities would occur both within and outside the WUI. In Alternative 2, an estimated 8,493 acres would be treated in the WUI. In Alternative 4, the amount of treatment in the WUI is an estimated 8,474 acres. In Alternative 5, an estimated 8,112 acres would be treated within the WUI.

Fuel reduction activities may be used alone or in combination. For example, most areas where precommercial thinning is prescribed also include activity-fuels underburning to reduce the amount of surface fuel created by the thinning activity. In all areas where commercial harvest is prescribed, there would be a follow-up activity such as grapple piling, hand piling, and/or underburning to reduce the activity fuels.

Table 24. Acres of fuel reduction activities.

	Alternative 2	**Alternative 4**	**Alternative 5**
Commercial harvest	6,172	4,935	3,942
Precommercial and hardwood thinning	11,356	11,131	11,148
Underburning	15,464	15,162	14,205
Hand piling	718	793	952
Grapple piling	3,015	2490	2150
Jackpot burning	219	265	910

Prescribed fire operations that are conducted after harvest and thinning operations would reduce activity fuels (i.e. slash). These fuels are surface fuels and consist of limbs, branches, tree tops, and small trees. Based on prescribed fires in the Trout, Mill, Yobear, and Sheep Rock areas, 40 to 70 percent of the surface area of prescribed fire units is burned, thereby removing surface fuels. These fire operations would reduce the density of seedlings and saplings (generally less than 3 inches dbh) in these stands and may result in small changes in species composition. Because ponderosa pine and western larch are fire-tolerant species, small trees of these species are more likely to survive while fire would kill many of the small fir trees. In addition to removing activity fuels, prescribed fire operations would also reduce some of the natural fuel accumulations. Prescribed fire in these stands would also prune the lower branches of larger trees, increasing the distance from the forest floor to the crowns of those trees, making them less susceptible to high-intensity wildfire.

Activity fuels created by commercial harvest and precommercial thinning cause a short-term increase (up to 6 years) in the potential for high-intensity wildfire because they increase the amount of surface fuels. For the first year after thinning, the fuel moisture in green slash makes it unavailable to burn, unless a wildfire occurs under extreme conditions (Rothermel et al. 1986).

After approximately 1 year, the slash has dried out, needles have turned red, and slash is available to burn. Should a wildfire occur during this time, the additional heat generated by the increased fuel load has the potential to cause undesired effects to the surrounding stand, soils, and other resources. This hazard is mitigated by either lopping (cutting) the slash to reduce the height of the fuel bed so that it is under 12 inches, or by piling the slash. Lopping and piling both reduce fire intensity by rearranging fuels. In units that have been lopped, after 2 or 3 years the slash gets further compacted by winter snows and can be burned with a low-intensity underburn. This delay also allows for the redistribution of nutrients from the slash back into the soil (Graham et al. 1999).

In three units (110, 210, and 810), underburning would occur prior to commercial harvest and precommercial thinning to reduce the existing amount of fuels in these stands. These prescribed fire operations would kill many small trees (generally less than 3 inches dbh). Some medium and large trees may also be killed by fire; the trees most likely to be killed by fire operations are fire-intolerant species such as fir. Based on past experience, between 1 and 10 percent of the medium and large trees may be killed. Fire operations in these three stands would reduce the density of the stand by removing trees and would change the species composition by removing fire-intolerant trees. However, in these three units underburning alone would not remove enough trees.

Maintenance or natural fuels underburning would occur in many stands. Maintenance underburning would remove mostly surface fuels. Some small trees less than 3 inches dbh would be killed, but these activities are not expected to change the density of the forested stand or the species composition because these stands tend to be more open with relatively low fuel levels. Prescribed fire in these stands would also remove some ladder fuels by pruning the lower branches of larger trees, increasing the distance from the forest floor to the crowns of those trees, making them less susceptible to high-intensity wildfire.

The number of units that would include jackpot burning varies by alternative. Jackpot burning would be completed after commercial harvest and/or precommercial thinning operations to remove concentrations of activity fuels prior to underburning. In combination, the prescribed fire operations would reduce both surface and ladder fuels.

In some areas, activity fuels would be piled, either by hand or grapple machines. Where fuels are piled, an estimated 60-70 percent of the surface fuels would be piled and burned. Where piles are located, there would be small amounts of soil scorching. Hand piles tend to be small (5-6 feet high by 3-4 feet wide) and burning these piles would not alter the species composition or density of surrounding stands. Grapple piles are generally 5-10 feet high and 10-15 feet wide. Radiant heat from grapple piles may occasionally kill nearby trees, but not enough to measurably change species composition or stand density. Piling allows the fuels to be treated sooner, generally within 1-2 years.

All of the activities described above that reduce ladder and surface fuels also reduce the potential for crown fire, crown scorch (which kills trees by scorching their needles with convective heat), radiant heat damage to cambium (the inner bark of trees, where diameter growth occurs), and radiant heat damage to soils and tree roots (Saveland and Nuenschwander 1989).

Linking Spears units with previous activity areas would increase the likelihood that suppression actions would be successful if an unplanned ignition does occur. Activities along ingress/egress routes such as U.S. Highway 26 and Roads 27, 2630, 2620, 2610, 2610-150, and 3350 would reduce fuels within these road corridors and contribute to safe evacuation routes for both homeowners and visitors in the project area. Reducing fuels would increase the likelihood that wildfires would be suppressed while they are small and would reduce the risk of wildfires spreading between NFS lands and private lands. Finally, unplanned ignitions in or near OGMA, the Mill Creek Wilderness, and the Ochoco Divide RNA may be more successfully suppressed.

All of these fuel reduction activities would reduce the amount of departure from reference conditions and would move fire regime I into condition class 1. Table 23 displays the changes in percent departure from reference conditions.

Alternative 3

Direct and Indirect Effects

This alternative includes activity fuels underburning, natural fuels underburning, hand piling, and jackpot burning. Precommercial thinning is considered a fuel reduction activity because it reduces ladder fuels. The amount of each fuel reduction activity is displayed in Table 25. Fuel reduction activities would occur both within and outside the WUI. This alternative includes an estimated 7,722 acres of fuel reduction activities within the WUI. These activities may be used alone or in combination. For example, most areas where precommercial thinning is prescribed also include activity-fuels underburning to reduce the amount of surface fuel created by the thinning activity.

Prescribed fire operations would be conducted after thinning operations to reduce activity fuels. These fuels are surface fuels and consist of limbs, branches, tree tops, and small trees. Based on prescribed fires in the Trout, Mill, Yobear, and Sheep Rock areas, 40 to 70 percent of the surface area of prescribed fire units is burned, thereby removing surface fuels. These fire operations would reduce the density of seedlings and saplings (generally less than 3 inches dbh) in these stands and may result in small changes in species composition. Because ponderosa pine and western larch are fire-tolerant species, small trees of these species are more likely to survive while fire would kill most of the small fir trees. In addition to removing activity fuels, prescribed fire operations would also reduce some of the natural fuel accumulations. Prescribed fire in these stands would also prune the lower branches of larger trees, increasing the distance from the forest floor to the crowns of those trees, making them less susceptible to high-intensity wildfire.

Table 25. Acres of fuel reduction treatments in Alternative 3.

	Alternative 3
Precommercial and hardwood thinning	9,899
Underburning	13,926
Hand piling	856
Jackpot Burning	1,716

Precommercial thinning would cause a short-term increase (up to 5 years) in the potential for high-intensity fire because they increase the amount of surface fuels. For the first year after thinning, the fuel moisture in green slash makes it unavailable to burn, unless a wildfire occurs under extreme conditions (Rothermel et al. 1986). After approximately 1 year, the slash has dried out, needles have turned red, and the slash is available to burn. Should a wildfire occur during this time, the additional heat generated by the increased fuel load has the potential to cause undesired effects to the surrounding stand, soils, and other resources. This hazard is mitigated by either lopping (cutting) the slash to reduce the height of the fuel bed so that it is under 12 inches, or by piling the slash. Lopping and piling both reduce fire intensity by rearranging fuels. In units that have been lopped, after 2 or 3 years the slash gets further compacted by winter snows and can be burned with a low-intensity underburn. This delay also allows for the redistribution of nutrients from the slash back into the soil (Graham et al. 1999).

Maintenance or natural fuels underburning would occur in many stands. Maintenance underburning would remove mostly surface fuels. Some small trees would be killed, but these activities are not expect to change the density of the forested stand or the species composition because these stands tend to be more open with relatively low fuel levels. Prescribed fire in these stands would also remove some ladder fuels by pruning the lower branches of larger trees, increasing the distance from the forest floor to the crowns of those trees, making them less susceptible to high-intensity wildfire.

In some areas, activity fuels would be hand piled. Where fuels are piled, an estimated 60-70 percent of the surface fuels would be piled and burned. Where piles are located, there would be a small amount of soil scorching. Hand piles tend to be small (5-6 feet high by 3-4 feet wide) and burning these piles would not alter the species composition or density of surrounding stands. Piling allows the fuels to be treated sooner, generally within 1-2 years.

Linking Spears units with previous activity areas would increase the likelihood that suppression actions would be successful if an unplanned ignition does occur. Activities along ingress/egress routes such as U.S. Highway 26 and Roads 27, 2630, 2620, 2610, 2610-150, and 3350 would reduce fuels within these road corridors and contribute to safe evacuation routes for both homeowners and visitors in the project area. Reducing fuels would also increase the likelihood that wildfires would be suppressed while they are small and would reduce the risk of wildfires transitioning between NFS lands and private lands. Finally, unplanned ignitions in or near OGMA, the Mill Creek Wilderness, and the Ochoco Divide RNA boundaries may be more successfully suppressed.

All of the activities described above that reduce ladder and surface fuels also reduce the potential for crown fire, crown scorch, radiant heat damage to cambium, and radiant heat damage to soils and tree roots (Saveland and Nuenschwander 1989). Even though these activities would reduce the amount of departure from references conditions, they do not change condition class. Table 23 displays the changes in percent departure from reference conditions.

Cumulative Effects

Past activities such as the Hash Rock Fire and the Marks Creek Burn reduced fuel loading in the project area. Prescribed fire activities that were completed before the Bandit II decision was withdrawn reduced the fuel loading on 1,726 acres. In some areas, the amount of surface fuels increased as a result of precommercial thinning activities authorized under the Bandit II decision. In many cases, such as in Unit 535, no activity fuel treatment was completed because the decision was withdrawn. The action alternatives in the Spears project include follow-up fuels treatments in these areas. The effects of these and other past activities such as timber harvest were taken into account when describing the affected environment and the number of acres in each condition class.

There are no other activities in the project area that would reduce fuels and result in changes in condition class.

Potential Fire Behavior and Probability

Affected Environment

Potential fire behavior and probability for the Spears project area was analyzed utilizing FlamMap, Version 3 (Finney et al. n.d.) and ArcFuels (Ager 2005). Modeling was used to predict various fire behavior characteristics and probabilities of occurrence for Alternative 1 (no action) to assess the affected environment as well as the four action alternatives to assess changes as a result of proposed treatments. All assessments used the same weather and fuel condition scenario so that the effects of different alternatives could be consistently compared. Scenarios were modeled under hot dry conditions with a 10 mile per hour northwesterly wind across the project area. Fire behavior attributes assessed include flame length, rate of spread, and potential crown fire activity.

Flame length is the distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface); flame length is an indicator of fire intensity. Flame lengths less than 4 feet are generally of low enough intensity that suppression crews can directly attack the fire, while flame lengths more than 4 feet require that control lines be built using heavy equipment. Flame lengths more than 8 feet generally require indirect suppression tactics and in many cases indicate intensities high enough to result in stand replacement events.

Table 26. Percent potential flame length (feet) by alternative.

Alternative	0-4	4-8	8-11	> 11
1	26%	21%	17%	36%
2	57%	13%	8%	21%
3	55%	13%	9%	23%
4	57%	13%	8%	22%
5	55%	13%	9%	22%

Rate of spread is measured in chains (66 feet) per hour and is used to determine the type and number of resources that would be needed to suppress a fire. Faster rates of spread generally result in larger fires which are more difficult to control.

Table 27. Rate of spread by alternative.

Alternative	0-10 ch/hr	10-40 ch/hr	40-80 ch/hr	> 80 ch/hr
1	10%	30%	28%	32%
2	49%	15%	15%	21%
3	46%	16%	16%	22%
4	49%	15%	15%	21%
5	47%	16%	16%	22%

Crown Fire Activity - Two types of potential fires were predicted; surface fire (no crown fire) and crown fire (both passive and active). Crown fire activity can be used as an indicator of potential stand effects with surface fire generally having the least effect on stand structure, density, and composition while crown fire generally indicates a fire behavior resulting in at least partial stand replacement.

Table 28. Crown fire activity (percent of project area) by alternative.

Alternative	Surface fire	Crown Fire
1	20%	80%
2	53%	47%
3	49%	51%
4	53%	47%
5	51%	49%

Burn Probability - To asses the overall susceptibility of the landscape to burning, 1,000 random ignitions were used to assess changes for each alternative. High burn probabilities are directly correlated to fire sizes that occur on a landscape under similar conditions. Large fires produce higher probabilities than small fires since each fire burns a larger fraction of the landscape. Since fire size is a function of the gross spread rate and duration of the fire, activities or conditions that reduce the spread rate also lower burn probabilities.

Table 29. Burn probabilities (percent of project area) by alternative.

Alternative	Low	Moderate	High)
1	41%	45%	14%
2	90%	10%	0%
3	90%	10%	0%
4	93%	7%	0%
5	93%	7%	0%

Environmental Consequences

Alternative 1

There would be no activities that would result in modifying fire behavior or burn probabilities across the project area other than continued fire suppression efforts for unplanned wildfires. Fuel conditions within the area currently support potentially high fire intensities, high rates of spread, and a large amount of potential crown fire behavior (80%). See Tables 26 to 29. Forty-one percent of the project area has a low-burn probability, while 59 percent has a moderate or high probability. Continued stand growth, successional changes, and continued fire exclusion would result in these indicators increasing over time.

Alternatives 2, 3, 4, and 5

All action alternatives include activities that would modify fire behavior by reducing ground fuels, reducing ladder fuels (small understory trees), and removing activity-generated fuels following commercial harvest and precommercial thinning. All action alternatives would result in reducing areas that support higher flame lengths and faster rates of spread. All action alternatives reduce the amount of area which could potentially support crown fire by approximately 30 percent. Under all action alternatives, there is approximately a 50 percent increase in the amount of low-burn probability over that predicted for Alternative 1.

Although the FlamMap predictions for fire behavior and burn probability show slight differences between Alternatives 2, 3, 4, and 5, these differences are not meaningful because they fall within the uncertainty and randomness associated with the model. All action alternatives produce essentially the same result because there are only small differences between the total amount of treatment and the arrangement of treatments within the project area. All activities in all action alternatives are designed to reduce surface and ladder fuels, which are the primary factors associated with fire behavior.

Cumulative Effects

There are no other actions proposed on NFS lands within the project area which would modify potential fire behavior. It is foreseeable that activities on private lands would be undertaken to reduce potential fire behavior and fire effects. Oregon Department of Forestry has recently acquired a grant from the National Fire Plan to perform fuel reduction activities adjacent to private homes inside the Spears project area. These activities would lessen potential fire effects on private lands and would probably be geared towards providing defensible space around structures. There are approximately 2,300 acres of private land within the area. It is unknown how much of this area might be treated to lessen potential fire behavior but given that the total amount of private land is a relatively small amount of the project area (less than 6%), it is unlikely that these activities would have a measurable effect on the potential fire behavior and probability across the landscape.

Hardwood Plant Communities

Affected Environment

Quaking aspen and cottonwood provide unique and special habitats. The project area contains numerous small aspen stands usually associated with riparian areas. Aspen develop as clones where individual trees are short-lived and are replaced by sprouts from the root system. Aspen is sensitive to conifer encroachment and accompanying shading, browsing by livestock and big game, and reduced water tables.

Both cottonwood and aspen grow in self-perpetuating clones in areas of locally high moisture such as meadows, seeps, and adjacent to streams. Conifer trees are encroaching into aspen and cottonwood stands in the project area. These conifers compete with the hardwood trees for light, moisture, and growing space. Since the hardwood trees are not shade tolerant, they can be shaded out by the encroaching conifers, which results in loss of vigor for the hardwoods in the short term, and can lead to loss of the clone(s) in the long term.

Environmental Consequences

Alternative 1

No thinning activities would occur. Conifer trees would continue to encroach into aspen and cottonwood stands in the project area. These conifers compete with the hardwood trees for light, moisture, and growing space. Since the hardwood trees are not shade tolerant, they would continue to be shaded out by the encroaching conifers. Aspen and cottonwood trees would continue to lose vigor and, in the long-term, clones may shrink or die out.

Alternatives 2, 3, 4, and 5

Thinning would occur in 196 acres of hardwood stands. These thinning activities would result in cutting or girdling conifer trees. Removing conifer trees within and adjacent to aspen and cottonwood stands would reduce competition for light, moisture, and other nutrients and maintain hardwood plant communities. Cottonwood and aspen would become more vigorous, increasing sprouting and the longevity of mature trees.

Thinning would occur in 196 acres of hardwood stands under each of the action alternatives. These thinning activities would involve cutting or girdling conifer trees up to 12 inches dbh. Removing conifer trees within and adjacent to aspen and cottonwood stands would reduce competition for light, moisture, and other nutrients. Slash arrangement, individual cages, and fencing would protect developing sprouts from being browsed. An exclosure fence is proposed to be constructed within one of the two cottonwood stands on Peterson Creek, unit 145. In unit 145 half of the stand would be fenced with a big game exclosure, while the other half would have a livestock exclosure with individual cages within it. Slash would be lopped and scattered. In the other cottonwood stand on Peterson Creek, unit 916, no fence would be constructed. Most slash would be lopped and scattered; however, some individual trees would be felled to provide protection to streambanks and to protect individual sprouts. In aspen stands, most slash would be lopped and scattered while some individual trees would be arranged to provide protection to sprouts. Aspen exclosure fences would be constructed, as follows: Sears Creek unit 915, two big game exclosures; Marks Creek units 507 and 908, two big game exclosures; Coyle Butte units 525 and 910, two big game exclosures; Rush Creek unit 533, one livestock exclosure with individual cages; Crystal Creek units 407, 408, 552, 577 and 909, three big game exclosures and two livestock exclosures with individual cages within them; McGinnis Creek unit 737, one big game exclosure. Small cages would be constructed to protect aspen sprouts in other stands, as follows: Crystal Creek units 409, 410, and 411; Coyle Butte units 403, 404, and 405; Cornez Creek unit 401; Deadman Creek unit 914; Little Hay Creek unit 402; Grant Meadows units 406, 911, 912, and 913. This would allow small sprouts to develop into sapling and pole sized stems, that would provide future replacements for larger overstory trees. Sprout protection would be limited to strategic arrangement of slash in units 502, 745, 904, and 905 in order to meet visual objectives at the sno-park and along Road 27. Cottonwood and aspen would become more vigorous, increasing sprouting and the longevity of mature trees. Aspen and cottonwood clones would be expected to be maintained or increased in extent and vigor as a result.

Cumulative Effects

Past, present, and reasonably foreseeable actions with effects that could combine with effects of the proposed action, and which would result in effects to hardwood communities include riparian planting, construction of exclosure fences and individual cages, the repair of headcuts, road construction, ongoing road maintenance, and livestock grazing.

In the last several years, riparian planting has occurred along Marks, Reilly, McGinnis, Rush, Deadman, Little Hay, E. Fork Hamilton, and W. Fork Hamilton Creeks. Riparian planting and the protection of riparian vegetation with exclosures and cages have contributed to increased extent and development of riparian hardwood habitat. Livestock grazing in riparian areas generally has reduced the stature and abundance of hardwood sprouts because livestock consume leaves and small branches and trample sprouts. However, the development of upland watering sites and salt stations, and the use of riders associated with livestock management would have helped distribute cattle out of the riparian areas, thus partially compensating for past browsing and trampling damage. Livestock are expected to continue grazing in the four allotments that overlap the project area. Livestock browsing and trampling are expected to continue; however, constructing big game and livestock exclosures and individual cages around sprouts would reduce the amount of damage to hardwoods.

Repair of headcuts with step-pool structures improved channel stability and maintained water tables above the structures which maintains potential to support riparian vegetation. In 2002 and 2003, headcuts were repaired on Little Hay and McGinnis Creek. Though road construction has in some areas intercepted natural drainage and concentrated flow along ditches, road maintenance would generally promote cross draining of water to ensure continued down slope hydrology which is vital to maintenance of riparian vegetation. Since 2000, nine culverts have been replaced, one culvert was removed, and road decommissioning occurred on Roads 2600-021, 2600-022, 2600-253, 2600-301, 2610-012, and 3300-550. These activities have all increased stream drainage to ensure continued down slope hydrology.

The effects of restorative activities (planting, protection, headcut repair, road work, off-site salt/water) when combined with the effects of this project on hardwood stands complement each other in promoting riparian hardwood habitat. The effects of browsing, trampling, and hydrologic interception are at least partially compensated for by the beneficial effects of the proposed activities on riparian hardwoods. Considering past, present, and reasonably foreseeable activities, aspen and cottonwood clones would be expected to be maintained or increased in extent and vigor.

Riparian Habitat Conservation Areas

Affected Environment

Riparian Habitat Conservation Areas (RHCAs) are portions of watersheds where riparian dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines contained in INFISH.

For streams, the width of RHCAs are determined by whether it is fish-bearing and whether it is perennial or intermittent. There are an estimated 4,546 acres of RHCAs in the project area. In addition to streams, RHCAs also occur around ponds, lakes, reservoirs, wetlands, landslides, and landslide-prone areas. RHCAs for these areas have not been mapped and are not included in the estimated acres of RHCAs within the project area. As noted in the design criteria in Chapter 2, seeps, springs, and landslides would have RHCAs around them. There are no ponds, lakes, reservoirs, or wetlands greater than 1 acre in size on NFS lands within the project area.

Class I and II streams are fish-bearing and RHCAs extend 300 feet slope distance from the stream channel. Class I and II RHCAs are 600 feet wide, including both sides of the stream channel. There are approximately 45 miles of Class I and II streams in the Spears project area. The RHCAs for these streams encompass 3,273 acres.

Class III streams are perennial, non-fish-bearing streams and RHCAs extend 150 feet slope distance from the stream channel. Class III RHCAs are 300 feet wide including both sides of the stream channel. There are approximately 14 miles of Class III streams in the Spears project area. The RHCAs for these streams encompass 509 acres.

Class IV streams are seasonally flowing, or intermittent and RHCAs extend 50 feet slope distance. There are approximately 63 miles of Class IV streams and Class IV RHCAs encompass approximately 764 acres in the project area.

The amount and type of vegetation in riparian areas plays an important role in the maintaining and improving both water quality and fish habitat. The increasing amount of conifers in RHCAs prevents woody vegetation such as alder, willow, aspen, and shrubs from expanding. Conifers within RHCAs compete with these species for nutrients. Many of these broadleaf species are shade-intolerant; throughout the project area conifers are competing with and shading these brushy, shrubby species, and they are losing vigor. The roots of woody vegetation help to stabilize streambanks and the stems act as a roughness element that reduces the velocity and erosive energy of over bank flow during high water events. Conifers do not provide the same bank stabilizing function as these brushy, shrubby species.

INFISH established landscape-scale interim Riparian Management Objectives (RMOs) that would be applied to watersheds with inland native fish. INFISH states that the interim RMOs would not be met instantaneously, but would be achieved over time. INFISH also recognized that all RMOs may not occur on a specific segment of stream within a watershed, but all should generally occur at the watershed scale for stream systems of moderate to large size (3rd to 6th order streams). There are no RMOs that specifically address riparian vegetation; however, riparian vegetation does affect pool frequency, water temperature, large woody debris, width-to-depth ratios, and bank stability. All of the habitat features described in the interim RMOs are inter-related.

The interim RMOs that apply to the Spears project area include pool frequency, water temperature, large woody debris, and width-to-depth ratios. The interim RMOs for bank stability and lower bank angle only apply to non-forested systems; the Spears project area is a forested system and these RMOs do not apply. Additional discussion is contained in the January 2007 Spears Resource Report and Biological Evaluation for Aquatic Species.

Pool Frequency

The frequency and area of pools is dependent on stream gradient and drainage area, generally as stream size (order) increases, pools become larger but more infrequent. In smaller order channels, large wood in the stream channel increases pool frequency (Montgomery and Buffington 1993). Pool depth and complexity is also a function of the abundance of woody debris and sediment routing. Large pulses of sediment moving through a stream system can restrict pool depth and ultimately limit habitat capability. The bankfull width-to-depth ratio, a primary indicator of channel dimension, is also directly related to both pool quantity and quality. An inverse relationship between stream width and pool spacing has been well documented by Rosgen (1996). The number of pools per mile increases as the stream channel narrows as shown in Table 30.

Table 30. Interim objectives for pool frequency in INFISH.

Wetted width (feet)	10	20	25	50	75	100	125	150	200
Pools per mile	96	56	47	26	23	18	14	12	9

Marks Creek is lacking pool structure. Level II steam surveys completed in 1999 in Marks Creek indicated that pools averaged 20.01 per mile. Average number of pools for 25 feet wetted width from INFISH is 47 pools per mile. On Nature Creek, there were 42.24 pools per mile. Nature Creek is moving towards meeting the objective of 47 as described in INFISH. Because similar conditions have been observed on other streams within the project area, the findings from these stream surveys are assumed to apply throughout the project area. Therefore, the streams in the project area are assumed to have fewer pools than indicated by the INFISH interim RMOs.

Water Temperature

The interim objective for water temperature is to not increase the maximum water temperature based on a 7-day average and to have maximum water temperatures below 59 degrees Fahrenheit in adult holding habitat and 48 degrees Fahrenheit within spawning and rearing habitats. Currently, water temperature monitoring in the project area indicates that the 7-day average temperatures exceeds the RMO for water temperature. Water temperatures are discussed later in this chapter in the section on water quality.

Large Woody Debris

Large woody material in streams and the adjacent flood plain provides streambank stability, decreases flow velocities, increases storage time (decreases downstream flood risk), cools water temperature, and stores sediment. Large woody debris (i.e. down trees) also appears to reduce grazing and browsing impacts on bank stability by reducing accessibility to the riparian vegetation. Large wood helps to form pools in the stream channel.

Based on stream surveys, the project area is deficient in the amount of large woody material in streams. Large woody material provides aquatic habitats and shade for streams. Redband trout, like many other salmonids, have evolved in stream systems in which large woody material helps retain organic and inorganic particulate matter that is important for channel stability, biological diversity, and productivity (Nakamura and Swanson 1993). Large wood influences habitat for fish and other aquatic organisms by serving as energy dissipaters, flow deflectors, and dams. Large trees are needed in RHCAs because they become large woody material when they fall. In the Spears project area, there is less large woody debris than the amount indicated by the RMO. Table 31 displays the desired amounts of large woody debris, by size, and the existing amounts based on the 1997 Level II stream survey. Desired amounts were determined from INFISH and a study of unmanaged, mixed conifer, Blue Mountain streams (Cordova 1995).

Table 31. Existing amount of large woody debris compared to objective.

Large Woody Debris Size	Objective (# of pieces per 100 feet)	Existing Amount (# of pieces per 100 feet)
>21 inches dbh, >35 feet long	0.4 - 0.8	0.33
>12 inches dbh, >35 feet long	1.3 - 1.7	1.49
>6 inches dbh, >35 feet long	3.4 - 4.5	2.32

Width-to-depth Ratio

The width-to-depth ratio is often used as an index of cross-sectional shape, where both width and depth are usually measured at the bankfull level. Both depth and width can respond rapidly to changes in sediment load and/or discharge. Whether a stream erodes downward or outward is influenced by both local shear stresses and whether the bed or banks are the most easily eroded. Bank vegetation increases the resistance to erosion through its binding effects on banks, with erosion decreasing as the percentage of roots in the soil increases, and this leads to narrower channels than would otherwise be expected. The effect of vegetation on channel shape is more pronounced in smaller streams (Gordon et al. 1992).

Changes in width-to-depth ratios are a result of wood recruitment within RHCAs, sediment delivery, and bank stability. Wood embedded in the stream channel and streambanks narrows the channel, slows velocity, catches sediment, and creates pools. Showing an improvement in large wood recruitment will result in improvement in width-to-depth ratios. Narrower deeper stream channels result in cooler water temperatures improving habitat for fish.

The interim RMOs for width-to-depth ratios are less than 10. Bottom Line Stream surveys indicate that the width-to-depth ratio for Marks Creek is 13.63.

Environmental Consequences

Alternative 1

No activities would occur in RHCAs. In many places, high densities of conifers within the RHCAs would continue to inhibit the growth of deciduous, broadleaf species such as alder, willow, aspen, and cottonwood. The existing conifers in RHCAs would continue to compete for nutrients with broadleaf species and other conifers. Because of competition, conifers would grow at slower rates and trees (future large woody debris) would be smaller in diameter than would be expected in less dense stands.

Since the Forest Plan was signed in 1989 and again when INFISH was signed in 1995, the Ochoco National Forest has been managing riparian areas to maintain or improve riparian conditions. Because of protection of streams, meadows, seeps, springs, and riparian areas over the last 15+ years, pools have been improving. Large woody material increased as a result of budworm mortality in the late 1980's and early 1990's. Wood recruitment inside the Hash Rock Fire (2000) perimeter will improve the pool structure as some of the dead trees fall into the creeks from weather events such as wind. Recruitment of large wood outside the fire area as a result of beetle-killed trees is also expected to improve pool numbers when dead trees inside RHCAs begin to fall in the next 5 to 10 years. Over time, pool numbers are expected to increase and width-to-depth ratios are expected to decrease, providing cooler water and cover. Large wood from logs would also catch sediment. Riparian vegetation that has been planted along streams in the fire perimeter would help stabilize pools, increase cover, decrease width-to-depth ratios, and reduce water temperatures.

Alternatives 2, 3, 4, and 5

Several activities have been proposed within RHCAs to increase the vigor of riparian vegetation and contribute to recruitment of future large woody material. Table 32 summarizes the proposed activities within RHCAs. Tables 33 through 38 provide a breakdown of activities within RHCAs by stream, stream class, and alternative. Streams identified as "trib" are unnamed tributaries to the named stream.

Table 32. Comparison of activities within RHCAs by alternative.

	Commercial Harvest	Precommercial Thinning	Hardwood Thinning	Prescribed Fire	Hand Piling	Total*
Alt. 1	0	0	0	0		0
Alt. 2	226.31	891.40	123.80	1,636.52	104.39	1,853.17
Alt. 3	0	835.99	123.80	1,506.77	103.02	1,725.86
Alt. 4	192.62	884.21	123.80	1,617.54	108.36	1,834.19
Alt. 5	140.15	899.13	123.80	1,492.82	108.36	1,691.51

*Totals do not add because more than one activity would occur on the same acre. For example, commercial harvest, precommercial thinning, and hand piling may all occur on a single acre.

Table 33. Acres of commercial harvest within RHCAs by alternative and stream class.

	Alternative 2				Alternative 4				Alternative 5			
	Class				Class				Class			
Stream Name	I	II	III	IV	I	II	III	IV	I	II	III	IV
Buck		2.96				1.48				1.48		
Buck trib			1.27									
Cornez trib			0.16				0.16					
Crystal trib			1.42	0.38			0.38				1.42	
Deadman		12.51				12.51				12.51		
Deadman trib			3.36				3.36				0.53	
Jim Elliott		0.48	0.12				0.12					
Jim Elliott trib				2.84				2.84				0.15
Little Hay		2.86				1.60				2.86		
Little Hay trib			1.33				1.33				1.33	
Long Hollow		3.82				3.82				3.82		
Marks	30.92				27.18				24.37			
Marks trib		3.07	4.33	26.25		3.07	4.33	25.08		3.07	3.85	22.90
McGinnis trib				4.17				4.17				4.17
Peterson		18.74	0.13	1.09		12.77				0.51	0.13	1.09
Peterson trib			10.26	10.24			8.07	10.24			3.0	
Rush trib			5.18				5.18					
Salmon		18.86				18.86				13.87		
Salmon trib			18.04	17.85			16.97	6.79			16.97	4.07
Sears		2.55				1.60				0.92		
Sears trib			0.76	0.33			0.76					0.33
Wildcat		3.66		1.29		3.66		1.29		2.96		1.29
Wildcat trib		0.30		14.75		0.30		14.69		0.30		12.23
Total	30.92	69.82	46.36	79.20	27.18	59.67	40.66	65.10	24.37	42.30	27.24	46.23

Alternative 3 is not displayed in Table 33 because no commercial harvest would occur in that alternative. The amount of hardwood thinning activities is the same in all four action alternatives. Under all four action alternatives, hardwood thinning activities would occur on 123.8 acres within RHCAs.

Table 34. Acres of hardwood thinning within RHCAs by stream class.

Stream Name	Stream Class				Total
	I	II	III	IV	
Cornez		3.25			3.25
Crystal		14.51			14.51
Crystal Trib		29.94	9.69	3.18	42.81
Deadman		7.81			7.81
Deadman trib			0.34		0.34
Little Hay			5.11		5.11
Marks	4.54	3.55	2.40		10.49
Marks Trib		17.16			17.16
McGinnis		10.98			10.98
Peterson		2.94			2.94
Rush				3.70	3.70
Sears		4.70			4.70
Total	4.54	94.84	17.54	6.88	123.80

Commercial harvest is proposed in the outer portions of RHCAs in Alternatives 2, 4, and 5. In Class I and II RHCAs, no harvest would occur within 200 feet of the stream channel. In Class III RHCAs, no harvest would occur within 50 feet of the stream channel. In Class IV RHCAs, no harvest would occur within 25 feet of the stream channel. Because of the distance to the stream, commercial harvest by itself in Class I and II RHCAs would have negligible effects to the RMOs. However, commercial harvest is combined with precommercial thinning and underburning to promote attainment of RMOs for pool frequency, water temperature, large woody debris, and width-to-depth ratios. Commercial harvest in the outer portions of the RHCAs would reduce tree densities and increase the growth of the residual trees. When combined with precommercial thinning, increased tree growth is also expected in the inner portion of the Class I and II RHCAs. Larger trees that become large wood in the outer portions of Class I and II RHCAs are unlikely to reach the stream channel, but large trees within the inner portions of these RHCAs would increase future recruitment of large woody material. In Class III and IV RHCAs, larger trees in the outer portion of the RHCAs are more likely to reach stream channels because larger trees may be as tall as 100 feet and could fall directly into the stream channel. Within RHCAs, commercial harvest would promote the development of larger trees and future large wood recruitment.

Commercial harvest in Class III and IV RHCAs would benefit riparian-associated trees and shrubs such as cottonwood, aspen, alder, and willow by reducing competition for nutrients and growing space. These treatments would contribute to future large woody debris recruitment, pools, decreased width-to-depth ratios, and reduced water temperature. In the future, when large trees fall into streams they would improve pool numbers which would reduce stream temperatures. Increases in riparian vegetation would contribute to bank stability and capture sediments, contributing to narrower streams and decreased width-to-depth ratios.

Table 35. Acres of precommercial thinning within RHCAs by alternative and stream class.

	Alternative 2				Alternative3				Alternative 4				Alternative 5			
	Class				Class				Class				Class			
Stream Name	**I**	**II**	**III**	**IV**	**I**	**II**	**III**	**IV**	**I**	**II**	**III**	**IV**	**I**	**II**	**III**	**IV**
Buck		22.53				3.13				22.53				22.53		
Buck trib			1.27								1.27				1.27	
Cornez		21.42				21.42				21.42				10.09		
Cornez Trib			1.38				1.22				1.38				0.16	
Crystal		42.20	1.48			42.20	1.48			42.20	1.48			42.20	1.48	
Crystal trib			7.07	3.17			5.65	3.17			5.65	3.17			7.07	2.79
Deadman		17.16				17.16				17.16				17.16		
Deadman trib			5.09	1.98			2.26	1.98			5.09	1.98			5.09	2.17
Jim Elliot		4.90	0.12			4.90				4.90	0.12			4.90		
Jim Elliot trib				5.52				2.68				5.52				2.82
Little Hay		4.64				3.04				3.38				4.64		
Little Hay trib			1.33	0.37			1.33	0.37			1.33	0.37			1.33	0.37
Long Hollow		12.44				12.44				12.44				12.44		
Marks	111.12				103.59				112.9				127.90			
Marks trib		124.16	59.56	78.51		124.18	56.18	78.83		124.16	59.56	78.16		124.16	63.80	77.05
McGinnis trib			8.50	4.62			8.50	4.62			8.50	4.62			8.50	4.62
Nature						0.29										
Peterson		60.89	2.0	1.93		60.89	1.87	0.84		54.92	1.87	0.84		60.89	2.0	1.93
Peterson Trib			14.53	13.98			12.34	13.98			12.34	13.98			14.53	13.98
Polly				0.27				0.27				0.27				0.27
Polly Trib				6.99				6.99				7.03				5.37
Reilly		34.47				34.47				34.47				34.47		
Rush trib			5.18								5.18				5.13	
Salmon		38.92				38.92				38.92				77.29		
Salmon trib			27.81	24.39			27.81	24.39			27.71	24.40			27.71	24.40
Sears		11.95				11.95				11.97				11.95		
Sears trib			0.76	1.73				1.39			0.76	1.39				1.73
Wildcat		28.66	6.47	1.29		26.50	6.47	0.38		28.66	6.47	1.29		21.32	6.47	1.29
Wildcat trib		28.46	16.67	23.47		28.46	16.67	16.13		28.46	16.67	23.41		9.71	5.96	24.28
Total	111.12	452.81	159.24	168.24	103.59	429.94	141.79	156.04	112.9	445.59	155.39	166.46	127.90	453.76	150.51	163.08

Table 36. Acres of prescribed burning within RHCAs by alternative and stream class.

	Alternative 2				**Alternative3**				**Alternative 4**				**Alternative 5**			
	Class				**Class**				**Class**				**Class**			
Stream Name	**I**	**II**	**III**	**IV**	**I**	**II**	**III**	**IV**	**I**	**II**	**III**	**IV**	**I**	**II**	**III**	**IV**
Buck		22.53				3.13				22.53				22.53		
Buck trib			1.27								1.27				1.27	
Cornez		21.42				21.42				21.42				10.09		
Cornez Trib			1.38				1.22				1.38				0.16	
Crystal		96.46	4.70			96.52	4.70			96.46	4.70			96.46	4.70	
Crystal trib			31.09	8.81			29.73	8.50			29.66	8.81			31.09	8.43
Deadman		40.09				34.36				40.09				32.90		
Deadman trib			3.36				0.53				3.36	0.18			3.36	0.18
Jim Elliot		4.90	23.44	3.47		4.90				4.90	0.12			4.90		
Jim Elliot trib				2.84								2.84				0.15
Little Hay		67.36	0.80			67.39	0.88			66.10	0.80			52.99	0.80	
Little Hay trib			5.87	13.40			5.87	13.40			5.87	13.40			5.87	10.10
Long Hollow		3.82				3.82				3.82				3.82		
Marks	200.63	11.85	0.24		197.28	11.85	0.24		200.71	11.85	0.24		200.06	11.85	0.24	
Marks trib		173.43	68.71	85.43		173.51	65.33	86.18		173.43	68.71	85.08		173.43	68.71	83.97
McGinnis		10.14				10.14				18.60				10.14		
McGinnis trib			8.50	4.62			8.50	4.62			16.58	4.62			8.50	4.62
Nature		13.27				13.27				13.27				13.27		
Peterson		74.36	39.80	1.48		74.41	39.80	1.48		68.39	39.67	0.39		74.36	39.80	1.48
Peterson Trib			78.08	57.34			78.08	57.34			75.89	57.34			78.08	57.34
Polly				0.27				0.27				0.27				0.27
Polly Trib				6.99				7.03				7.03				5.37
Reilly		36.49				36.49				36.49				36.49		
Rush		40.11								40.11				22.30		
Rush trib			11.78	2.31				1.76			11.78	2.31			11.73	2.31
Salmon		87.06				87.23				87.06				87.06		
Salmon trib			30.25	34.70			30.25	34.70			30.14	34.71			30.14	29.38
Sears		35.77				35.77				35.78				35.77		
Sears trib			2.37	0.50				0.17			2.37	0.17			1.61	0.50
Wildcat		53.99		1.29		51.85		0.38		53.99		1.29		42.60		1.29
Wildcat trib		44.39	25.36	38.0		44.9	25.44	28.72		44.39	25.36	37.94		19.09	9.74	37.65
Total	200.63	837.43	336.99	261.46	197.28	770.44	290.55	244.55	200.71	838.68	317.89	256.39	200.06	750.05	295.79	243.05

No heavy machinery or off road vehicles would be used in the RHCAs for commercial harvest, except on existing roads. Design elements to reduce ground disturbance within RHCAs such as winch lining, and locating landings outside of RHCAs would minimize sediment. Residual slash and the unharvested areas are expected to filter sediment before it reaches the streams. Alternative 3 would have no effect from commercial harvest activities.

Precommercial thinning is proposed in RHCAs in all action alternatives. Precommercial thinning would occur to within 5 feet of stream channels. No heavy machinery or off road vehicles would be used in the RHCAs to implement this activity. Understory trees (typically less than 9 inches dbh) would be thinned to approximately 16 to 18 foot spacing. The heights of trees at various slopes and distances that provide shade during the period when peak temperatures occur were calculated. Only trees less than the height indicated would be removed so that the existing amount of stream shade is maintained. Removing these conifers would result in more sunlight to deciduous vegetation which, in turn, would result in more vigorous deciduous vegetation. This activity would have similar effects as commercial harvest by reducing understory tree density and reducing competition. The growth rate of residual trees would increase, promoting future large woody debris. Thinning would reduce the competition between riparian-associated species and conifers resulting in more woody, shrubby species. Precommercial thinning would result in increased growth rates for both conifers and riparian vegetation. Precommercial thinning would promote attainment of RMOs in RHCAs (Class I-IV). In the future, when large trees fall into streams they would increase pool numbers and help reduce stream temperatures. Increases in riparian vegetation would contribute to bank stability and capture sediments, contributing to narrower streams and decreased width-to-depth ratios.

Prescribed underburning is proposed within RHCAs in all action alternatives. Ignition would not occur within 50 feet of the streams; however, fire would be allowed to burn within 50 feet of the stream. Prescribed fires are expected to burn in a mosaic pattern in the RHCAs with an objective of burning about 20 percent of the area at a low-intensity level. Project design criteria have been established to retain large woody debris and for the construction of firelines in RHCAs. Burning within the RHCAs would reduce stand density and remove ladder fuels by killing small seedling and sapling sized trees. Burning is also expected to consume surface fuels such as leaves, needles, limbs, and branches that have fallen. Like the other activities, the reduced competition is expected to rejuvenate riparian-associated species, increasing riparian species composition and abundance. Increased riparian species would improve bank stability and shade which would promote attainment of RMOs in the future, particularly the RMOs for width-to-depth ratio and stream temperature. Some large woody debris is expected to be consumed during burning activities; however, burning activities would be designed to minimize consumption of large down wood. While some large wood may be consumed, fire is expect to kill some standing trees that over time would fall and become large woody debris. Reducing competition promotes the growth of residual trees that will be future large woody debris.

Hardwood thinning activities are proposed within RHCAs in all action alternatives. Conifers would be cut and left on the ground or lopped and scattered. These thinning activities would occur in aspen and cottonwood stands and reduce the amount of conifers that are competing with these hardwood species. As a result, aspen and cottonwood clones would be expected to be maintained or increased in extent and vigor. Shade is expected to increase in these stands as the hardwood species increase in size as a result of reduced competition. Increased levels of shade would contribute to lower stream temperatures.

Hand piling of thinning slash with RHCAs is planned in all action alternatives. This treatment would have no effects on RMOs for pool frequency, water temperature, large woody debris, or width-to-depth ratio. The hand piled material is small diameter slash that would not provide large woody debris to the stream and therefore would have no effect on pool formation and reduced water temperatures resulting from pools.

Road work is proposed in RHCAs in Alternatives 2, 4, and 5. Table 37 displays the amount of road construction by alternative. Table 38 displays the amount of road reconstruction, closures, and decommissioning. Alternative 3 does not propose any road work and is not included in Tables 37 and 38. Under Alternative 3, roads within RHCAs are expected to continue to transport sediment to streams, particularly to Crystal, Marks, Peterson, Rush, Salmon, and Wildcat Creeks.

Road work, including constructing, reconstructing, closing, and decommissioning, affects sediment delivery to streams. The construction of new road within RHCAs would increase the potential for sediment delivery to streams. New roads would provide additional soil disturbance and potential for sediment transport. Construction of roads in the Salmon Creek RHCA would not increase sedimentation to Salmon Creek because the new construction would be above an existing road that effectively blocks sediment from entering Salmon Creek.

Closing and decommissioning roads within RHCAs would reduce compaction, increase infiltration, and improve road drainage which would reduce concentrated flows and sediment transport. Reconstruction of roads within RHCAs would improve drainage and reduce sedimentation from the existing condition. Existing roads within RHCAs known to be chronic sources of sediment include road 3300-504 along Salmon Creek and road 2630-013 near Crystal Creek. Both of these roads would be reconstructed which would reduce the amount of sediment entering these streams. Additionally, two culverts would be removed on Rush Creek and portions of Road 2620-030 would be decommissioned. These actions would eliminate the chronic sediment production from the two undersized culverts.

Table 37. Road construction (miles) by alternative.

Stream Name	Alternative 2	Alternative 4	Alternative 5
Deadman	0.05	0.02	0.02
Marks trib	0.07	0	0.03
Salmon	0.06	0.06	0.06
Salmon trib	0.08	0.03	0.03
Total	0.26	0.11	0.14

The net result is that Alternatives 2, 4, and 5 would result in a reduction of open roads in RHCAs and an improvement over current conditions by reducing compaction, improving road drainage, and reducing the amount of sediment produced by roads. During the short term, prior to vegetation becoming established on scarified road surfaces, there may be an increase in sediment production from road closure, decommission, and reconstruction activities. However, with drainage and outsloping, sediment reaching the streams is expected to be minimal. Work would normally occur during the summer months when stream flows are low. However, small pulses of sediment may occur if a rain event immediately followed road work. The rain event would increase flow in the stream and sediment would be dispersed throughout the system.

Table 38. Road closure, decommission, and reconstruction (miles) by alternative.

Stream Name	Alternative 2	Alternative 4	Alternative 5
Crystal	0.5	.05	0.5
Crystal trib	0.2	0	0.2
Deadman	0.7	0.9	0.9
Deadman trib	0.1	0.1	1
Jim Elliott	.05	0	0
Little Hay trib	0.2	0.2	0.2
Marks	1	1	0.6
Marks trib	0.8	0.8	0.7
McGinnis trib	0.5	0.5	0.4
Peterson	0.4	0.4	0.4
Peterson trib	0.1	0.3	0.3
Reilly	0.2	0.2	0
Rush	0.5	0.5	.05
Rush trib	0	0.1	0
Salmon	2.5	2.4	2.4
Salmon trib	0.1	0.3	0.3
Wildcat	0.3	0.3	0.1
Wildcat trib	0.2	0.2	0.1
Total	8.4	8.2	8.2

None of the proposed activities would immediately result in meeting RMOs for pool frequency, water temperature, large woody debris, or width-to-depth ratio. However, these activities would promote attainment of RMOs in the future.

Cumulative Effects

The cumulative effect of past, present, and reasonably foreseeable actions is expected to be improved RHCA function and condition. RHCAs in which the proposed activities overlap with past, present, or reasonably foreseeable actions include Cornez, Jim Elliott, Little Hay, Marks, McGinnis, Reilly, and Rush Creeks.

The Hash Rock Fire burned the upper reaches of Cornez, Hamilton, McGinnis, and Reilly Creeks in the summer of 2000. The fire removed ground cover, riparian vegetation, and large woody debris. Immediately after the fire, there was a high risk of bank erosion and channel widening. Since that time, vegetation has reestablished. Large wood recruitment is now occurring as fire-killed trees fall into streams. Precommercial thinning and prescribed burning activities within the RHCAs of these streams by the action alternatives would contribute towards the development of future large woody debris by increasing the growth rates of residual trees.

As a result, these activities promote future recruitment of large woody debris. Hardwood thinning in the RHCAs of Cornez and McGinnis Creeks would promote increased riparian vegetation and increased shade. Post-fire work in these areas to stabilize stream systems included both riparian planting and replacing undersized culverts on McGinnis Creek, Reilly Creek, and the east and west forks of Hamilton Creek; replacing two undersized culverts on Cornez Creek, and decommissioning approximately 0.4 miles of road on McGinnis Creek. Precommercial thinning and prescribed burning along these streams would complement riparian planting that has already occurred, contributing to increased hardwood species composition and abundance. Road closure and decommission on Cornez Creek, Reilly Creek, and tributaries to McGinnis Creek would complement previous road decommission and culvert replacements along these streams. Sediment production from roads and culverts is expected to decrease along these streams. The cumulative effect of these treatments is to promote attainment of RMOs for pool frequency, water temperature, large woody debris, and width-to-depth ratios.

Activities that have occurred in the RHCAs of Jim Elliott, Little Hay, Marks, and Rush Creeks include road decommissioning along Jim Elliott Creek; headcut stabilization, riparian planting, and fencing on Little Hay Creek; riparian planting, stream channel restoration, and road decommissioning along Marks Creek; and riparian planting along Rush Creek. Commercial harvest, precommercial thinning, prescribed burning, hardwood thinning, and road work along these streams would also contribute toward the attainment of RMOs for pool frequency, water temperature, large woody debris, and width-to-depth ratios.

Livestock grazing would continue. The Marks Creek, Wildcat, Burn, and Crystal Springs allotments overlap the Spears project area. Historic grazing contributed to the removal of deciduous woody vegetation and compaction of alluvial terraces. Livestock grazing levels have been reduced from historic and riparian vegetation has since improved. Activities within RHCAs would likely attract livestock because removing small trees and surface and ladder fuels would remove barriers to livestock movement. Increasing sunlight to the ground by removing conifers would also increase growth of grasses and shrubs. This would increase the amount of forage available which would also attract livestock. Livestock are expected to continue to use riparian areas and are expected to consume some of the increased forage. Livestock use of riparian areas is not expected to increase because activities in the uplands are expected to increase forage and remove barriers to livestock movement similar to the activities in the RHCAs. Also, livestock grazing permits include provisions for distributing livestock or moving livestock from pastures when certain triggers are reached. Triggers include bank trampling and a switch to preference for woody species. Livestock are expected to be moved when triggers are reached. Where hardwood thinning activities occur in RHCAs, livestock are not expected to utilize these areas because some fences and cages would be constructed and slash would be arranged to discourage livestock use.

Aquatic Species

Essential Fish Habitat

The Pacific Fishery Management Council designated Essential Fish Habitat (EFH) for Chinook salmon on September 27, 2000. This designation included current and some historic habitat in the Deschutes Basin. Historical habitat above Pelton Round Butte Dam was included. Historical habitat located above Ochoco Reservoir Dam was not included because the dam does not allow fish passage. The Spears project area is upstream from Ochoco Reservoir Dam and is not considered EFH. Therefore, this project would have no effect on EFH.

Management Indicator Species

The Forest Plan identified Management Indicator Species (MIS) to determine the effects of management activities on fish and wildlife habitat. Management indicator species are species whose presence in a certain location or situation at a given population level indicates a particular environmental condition. Population changes are believed to indicate effects of management activities on a number of other species.

Rainbow trout (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*) were picked as indicators of riparian and aquatic habitat. In the past, these fish were stocked by the Oregon Department of Fish and Wildlife. They are no longer stocked in the streams in the project area, but naturally reproduce in many streams. These trout species can be found in the same streams where redband trout are found. Effects to brook and rainbow trout habitat would be the same as the effects described for redband trout habitat in the section on threatened, endangered, and sensitive species.

Threatened, Endangered, and Sensitive Species

Affected Environment

Two aquatic species federally listed as threatened are known to occur on the Ochoco National Forest. These species are: bull trout (*Salvelinus confluentus*) and Mid-Columbia River steelhead trout (*Oncorhynchus mykiss* ssp.). There are no endangered aquatic species on the Ochoco National Forest. Several species from the R-6 Regional Forester's sensitive species list are known to occur on the Ochoco National Forest and include: redband trout (*Oncorhynchus mykiss* ssp.), Malheur mottled sculpin (*Cottus bairdi*), west slope cutthroat trout (*Oncorhynchus clarki lewisi*), Columbia spotted frog (*Rana luteiventris*), and Mid-Columbia River spring Chinook salmon (*Oncorhynchus tshawytscha*).

This project would have no effect to the Mid-Columbia River steelhead trout or Mid-Columbia spring chinook salmon because dams constructed downstream of the project area on the Crooked and Deschutes Rivers, and Ochoco Dam on Ochoco Creek prevent anadromous fish from accessing streams in the project area. There would be no effect to the bull trout, Malheur mottled sculpin, or west slope cutthroat trout because they are not known to exist in the project area or there is no habitat for the species in the project area. The January 2007 Resource Report and Biological Evaluation for Aquatic Species contains additional information on threatened, endangered, and sensitive aquatic species.

Redband Trout

The redband trout is known to occur throughout the project area. There are 45 miles of fish-bearing streams (Class I or II) in the project area: 36 miles are on National Forest System lands and 9 miles are on private lands. Map 3 displays the streams that are occupied by redband trout.

The redband trout is a stream spawner, normally spawning in the spring (March through June). The eggs usually hatch in 4-7 weeks and alevins (pre-emerging fish) take an additional 3-7 days to absorb the yolk before becoming free-swimming. The average age at first spawning is 2-3 years, but some wild populations do not spawn until they are age 5. Gravel embeddedness of less than 20 percent is essential to maintain healthy salmonid population, especially in those areas identified as potential or existing spawning areas (Bjorn and Reiser 1991).

Redband trout populations are currently depressed. However, existing populations are generally in fair condition, based on age distribution and condition factor (ODFW 1991). The combination of habitat modification, low summer flows, high summer stream temperatures, lack of suitable riparian vegetation (due to roads in RHCAs, stream down cutting, conifers shading hardwood species, and livestock browse), and increase in sediment (due to roads built within RHCAs) has affected redband trout populations in the project area. Sediment has been found to fill spawning gravels resulting in lower numbers of fry emergence, lower oxygen levels, and change in food sources and habitat features.

Redband trout have evolved in stream systems in which large woody debris helps retain organic and inorganic particulate matter that is important for channel stability, biological diversity, and productivity (Nakamura and Swanson 1993). Large woody debris influences habitat for fish and other aquatic organisms by serving as energy dissipaters, flow deflectors, and dams. As large wood accumulates it forms pools in the stream channel. The deep water of the pools lowers water temperature. Fish use pools for hiding cover, to seek refuge in cooler water during the summer months, and as resting areas while feeding.

Temperatures of 60 degrees F are considered ideal for rapid growth of rainbow trout (Leitritz and Lewis 1980). In the Spears project area, temperatures are likely below 56 degrees F for the months of October to March prior to spawning. Females are most productive when they are in water where temperatures do not exceed 56 degrees F for 6 months before spawning (Leitritz and Lewis 1980). Water temperatures in the high 70's, except under otherwise ideal conditions, may cause stress, which predisposes disease or in some cases, death for all age classes. Redband trout are most successful in habitats with temperatures of 70 degrees or slightly lower, but can survive if there is cooler, well-oxygenated water into which they can retreat as the surface waters warm over 70 degrees F. The 7-day maximum average temperatures in Marks Creek average as high as 75.6 degrees F. Naturally occurring temperatures in some tributaries also exceeded State standards. In the summer, stream temperatures often reach levels that retard the growth of and stress redband trout. Streamside vegetation such as willow, alder, and aspen is important for providing shade in the summer and insulation in the winter.

Streams in the project area have a low number of pools. In a channel with a low number of pools, the ratio of surface area to volume of water is high, and water in the channel tends to heat and cool rapidly. This causes variations in daily temperatures as much as 15 to 20 degrees F. Large pulses of sediment moving through a stream system can restrict pool depth and ultimately limit habitat capability. Fine sediments degrade spawning gravels and spawning success by filling the spaces between rocks, reducing the oxygenation and survival of eggs.

Erosion from previous activities in the project area such as timber harvest, road construction, and grazing have caused sediment input into streams and has also reduced the reproductive success of redband populations. The Hash Rock Fire in 2000 removed ground cover and riparian vegetation in the upper reaches of Hamilton, Cornez, Reilly, and McGinnis Creeks. Since then, vegetation has been reestablished in the fire area as a result of sprouting and planting. Increases in vegetation help stabilize streambanks, filter sediment, reduce water temperature, provide hiding cover, and improve width-to-depth ratio.

Habitat features of the redband trout that may be directly affected by the proposed activities include large woody debris (LWD), stream shade, and sediment delivery to streams. Effects to these features, in turn, affect pool frequency and depth, water temperature, and width-to-depth ratios.

Columbia Spotted Frog

Columbia spotted frogs inhabit a variety of vegetation communities, including coniferous or mixed forests, grasslands, and riparian areas of sage-juniper brush lands. Historically, Columbia spotted frogs were found at elevations ranging from near sea level to 7,370 feet. Although no formal surveys have been conducted, Columbia spotted frogs are known to occur in the project area.

Dumas (1966) reported that relative humidity of less than 65 percent is lethal to adult spotted frogs in approximately 2 hours, a factor which would restrict spotted frogs to higher elevations or moist riparian zones in arid western landscapes. Because both breeding and over-wintering occur at aquatic sites, populations are located in the general vicinity of ponds, lakes, springs, and/or streams. A study in arid southwestern Idaho (Munger et al. 1998) found adult spotted frogs were associated with palustrine, shrub-scrub, intermittent riverine, streambed, or seasonally flooded sites. Frogs were also associated with vegetation indicating permanent water sources (i.e., willows and submerged aquatic plants rather than with emergent vegetation such as sedges) and vegetation providing hiding and thermal cover (e.g., willows). Spotted frogs are located in similar habitats in the project area.

Summer foraging may occur at the same water body used for breeding and over wintering, but in many cases frogs move to other areas. Spotted frogs move to other sites in summer for a variety of reasons including predator avoidance and the attractions of more abundant food and less competition (Bull and Hayes 2001). Foraging sites include ephemeral pools in forests and meadows, streams (permanent and intermittent), river edges, riparian zones, temporary and permanent ponds, lake margins, and marshes. Sites used for summer foraging only in the Idaho mountains included all types of wetland habitats and were on average smaller and shallower than wetlands used for breeding and wintering, with less forest or shrub cover along shorelines (Pilliod et al. 2002). Patla (1997) found that "spotted frogs demonstrate considerable plasticity in summer foraging habitat, making use of small wet or damp areas in forest and meadows, including water-filled tire tracks, stream edges, and marshes."

Wintering habitat includes ponds, streams, under stream banks, springs, beaver dams, and underground areas (associated with water bodies), but all such sites must have above freezing temperatures, be moist or wet, and be well oxygenated. Columbia spotted frogs winter in or immediately adjacent to aquatic sites, where they can avoid the threat of freezing or oxygen depletion (Bull and Hayes 2002).

Environmental Consequences

Redband Trout

The definition for adverse effects in INFISH (1995) was utilized in the fisheries analysis. This definition states "adverse effects include short- or long-term, direct or indirect management related impacts of an individual or cumulative nature, such as mortality, reduced growth, or other adverse physiological changes; harassment of fish; physical disturbance of redds; reduced reproductive success; delayed or premature migration; or other adverse behavioral changes."

Management related impacts to large woody debris, stream shade provided by vegetation, and sediment delivery resulting from the proposed activities were evaluated to determine the degree of effects to redband trout. Evaluation of these variables also indicates the effects to the RMOs describing good fish habitat, including pool frequency, large woody debris, and width-to-depth ratios. Bank stability and lower bank angle are not further discussed because these RMOs apply to non-forest systems. The Spears project area is a forested system.

Alternative 1

There are no activities proposed in Alternative 1 that would directly alter redband trout habitat. In many places, high densities of conifers within the RHCAs would continue to inhibit the growth of deciduous, broadleaf species such as alder, willow, aspen, and cottonwood. Conifers in RHCAs would continue to compete for nutrients with broadleaf species, as well as other conifers. Because of competition, conifers would grow at slower rates and trees (future large woody debris) would be smaller diameter than less dense stands. In open canopy areas where woody vegetation is present along streambanks, shade would increase. Increasing shade over streams contributes to reducing water temperature and acts as hiding cover for redband trout.

Large woody material has been increasing as a result of budworm mortality in the late 1980's and early 1990's. Wood recruitment inside the Hash Rock Fire (2000) perimeter will improve the pool structure as some of the dead trees fall into the creeks from weather events such as wind. Recruitment of large wood outside the fire area as a result of beetle-killed trees is also expected to improve pool numbers when dead trees inside RHCAs begin to fall in the next 5 to 10 years. Over time, pool numbers are expected to increase and width-to-depth ratios are expected to decrease, providing cooler water and cover. Large wood is also expected to catch sediment. Riparian vegetation that has been planted along streams in the fire perimeter will help stabilize pools, increase cover, decrease width-to-depth ratios, and reduce water temperatures.

Road 3300-504 along Salmon Creek would continue to be a chronic sediment source. Two culverts on Rush Creek would also continue to be a chronic sediment source. Gravel embeddedness of less than 20 percent is essential to maintain healthy salmonid population, especially in those areas identified as potential or existing spawning areas (Bjorn and Reiser 1991). If sediment exceeds 20 percent, the spaces between the rocks in the substrate are filled and oxygenation of eggs is reduced. Reduced oxygenation results in reduced success of fish and frog eggs surviving. Salmon Creek along Forest Road 3300-504 and the undersized culverts on Rush Creek would continue to contribute sediment into Salmon Creek and Rush Creek, which would reduce the suitability of spawning habitat in these areas.

This alternative would have no impact on redband trout or its habitat.

Alternatives 2, 3, 4, and 5

The analysis for redband trout focused on activities within Class I and II RHCAs because redband trout are found within Class I and II streams. Activities proposed in the action alternatives that occur outside of RHCAs would have negligible effects to the redband trout. The RHCA buffers would protect streams from sediment inputs and provide for other riparian functions including the delivery of organic matter and woody debris, stream shading, and bank stability (INFISH pp. A-4). Sedimentation that may result from activities in the uplands, such as timber harvest, precommercial thinning, fuels treatments, and road work would be filtered by ground vegetation and slash in both the treated areas and RHCA. Activities occurring within the RHCAs of Class III and IV streams would also have negligible effects to the redband trout, because these streams are non-fish bearing or intermittent. While Class III and IV streams provide water to fish-bearing streams and could transport sediment downstream, the no harvest areas within RHCAs would minimize sediment delivery to streams. Precommercial thinning and underburning activities are not expected to result in more than background levels of sediment because slash and ground vegetation would help filter sediment and underburning activities would occur during spring and fall when vegetation is more moist and less likely to burn.

Commercial harvest would occur in the outer 100 feet of Class I and II RHCAs in Alternatives 2, 4, and 5. The amount of commercial harvest ranges from a high of 101 acres in Alternative 2, to 87 acres in Alternative 4, and a low of 67 acres in Alternative 5. Table 33 displays the amount of commercial harvest by stream name and stream class. With a few exceptions, ground-based machinery for harvest would not occur in RHCAs. No grapple piling would occur in RHCAs. Units 104 (Salmon Creek) and 559 (Marks Creek) have existing roads within the RHCAs that would be reused during harvest operations. These roads effectively block sediment from the harvest activity from entering Salmon Creek or Marks Creek. There would be negligible effects to the redband trout from commercial harvest in the outer 100 feet of Class I and II RHCAs, because harvest would not occur within 200 feet of the stream channels. Stream shade and water temperature would be unaffected by commercial harvest because none of the trees removed from the outer portion of the RHCAs provide shade. Sediment from commercial harvest would be filtered by existing ground vegetation in the 200-foot non-treated area. Reshin et al. (2006)

found that a 32.8-foot (10 meter) setback of felling and yarding activities prevented sediment delivery to streams from about 95 percent of harvest-related erosion. Large wood from the outer portions of these RHCAs would not be expected to reach the stream channel. Pool frequency would be unaffected.

Precommercial thinning would occur within 5 feet of the stream channel in Class I and II RHCAs. The amount of precommercial thinning in Class I and II RHCAs ranges between 534 and 582 acres in the action alternatives. Table 35 identifies the amount of precommercial thinning by alternative and by stream class. Understory trees (typically less than 9 inches dbh) would be thinned to approximately 16 to 18-foot spacing which would promote growth of the remaining trees; increasing the diameter and number of trees that may reach sizes for future large wood (>21 inches dbh). Future large wood recruitment would improve fish habitat by creating pools and hiding cover. Water temperatures would decrease from increased numbers of pools. Competition between conifers and riparian-associated species would be decreased, increasing hardwood species composition and abundance. Increased abundance of riparian species would increase bank stability and reduce erosion because of the deeper root systems of these species. They would also provide increased stream shade. Thinning trees within RHCAs would contribute to improved redband trout habitat in the future by increasing riparian shrubs which provide cover, bank stability, and stream shade. No heavy equipment or OHVs would be used during precommercial thinning activities so there would be minimal ground disturbance from this activity. Ground vegetation, as well as the slash resulting from precommercial thinning would filter any sediment from the thinning activity. There would be little or no disturbance to fish or fish habitat during implementation of this activity. Fish would move to another part of the stream and/or seek hiding cover if some activity in the RCHA was a minor disturbance just as they would when deer cross the stream or feeds in the RHCA.

Prescribed underburning would occur within RHCAs. Within Class I and II RHCAs, the amount of burning by alternative varies between 950 and 1,040 acres. Table 36 displays the amount of burning by stream, stream class, and alternative. Burning within the RHCAs would reduce ladder fuels by killing small seedling and sapling sized trees. Like the other activities, the reduced competition is expected to increase growth of residual trees and rejuvenate riparian-associated species, increasing riparian species composition and abundance. Large woody debris may be consumed during burning; however, design criteria have been developed to minimize consumption of large down wood. While some large wood is expected to be consumed, fire is also expected to kill some standing trees that over time would fall and become large woody debris. Reducing competition also promotes the growth of residual trees that will be future large woody debris. Prescribed burning activities are expected to result in minimal amounts of sediment because (1) burning would occur during spring and fall when conditions are moist and burn intensity would be light, (2) consumption of live vegetation and large diameter wood would be minimal, (3) not all units in a single drainage would be burned in the same year, and (4) burning activities would occur over a 10-year period.

Hand piling of some thinning slash would occur within RHCAs. Piling would occur after thinning, usually before the fuels dry out. The piles would be burned in the late fall or early winter usually within 2 to 4 years. This sequence of activities retains ground cover to filter sediment. Slash piles can act as filters for sediment into streams immediately after treatment.

Large woody debris would be unaffected by this activity. The material that is piled is small diameter slash. Pool frequency and formation would be unaffected since large woody debris would not be affected. Water temperature would also be unaffected.

Approximately 100 acres of hardwood thinning would occur within Class I and II RHCAs. In areas where hardwood thinning would occur, conifers are competing with aspen and cottonwood for nutrients, light, and growing space. Thinning conifers in these areas would improve the vigor of aspen and cottonwood. These species are expected to be maintained and increase in extent. Shade would increase with expansion of stream side hardwoods. Increased shade contributes to lower temperatures in streams. The felled conifers would be left for downed wood or would be lopped and scattered leaving slash on the ground. Some slash would be manipulated to protect seedlings from grazing and trampling. There would be no underburning in these areas. Some of the larger conifers would be girdled and would be retained as snags. This activity is expected to result in increasing numbers of aspen and cottonwood trees, which would increase shade within the RHCAs. Retaining slash would add filtering vegetation from upland sediment during rain events.

Road work, including closing, decommissioning, reconstructing, and constructing, affect sediment delivery to streams. Alternatives 2, 4, and 5 would each construct approximately 300 feet (0.06 miles) of new road in the RHCA of Salmon Creek. This is the only new road construction in Class I or II RHCAs. Construction of this road would provide additional soil disturbance and potential for sediment transport; however, the new construction would be above an existing road that effectively blocks sediment from entering Salmon Creek. Construction of this road would not affect habitat and spawning success of the redband trout.

Alternatives 2, 4, and 5 propose to close, decommission, and reconstruct roads within Class I and II RHCAs. Table 39 displays the amount of road work within Class I and II RHCAs by alternative. Closing and decommissioning roads would reduce compaction and improve road drainage, reducing concentrated flows and sediment transport. Reconstruction of roads would improve road drainage and reduce sedimentation from the existing condition. Existing roads within Class I and II RHCAs known to be chronic sources of sediment include road 3300-504 along Salmon Creek and road 2630-013 near Crystal Creek. Both of these roads would be reconstructed which would reduce the amount of sediment entering these streams. Additionally, two culverts would be removed on Rush Creek and portions of Road 2620-030 would be decommissioned. These actions would eliminate the chronic sediment production from the two undersized culverts. Reducing chronic sediment sources along Salmon, Rush, and Crystal Creeks would reduce sediment in these areas and improve spawning habitats for the redband trout.

Prior to vegetation becoming established on scarified road surfaces, there may be an increase in sediment production from road closure and decommissioning activities. However, with proper drainage and outsloping, sediment reaching the streams is expected to be minimal. Work would generally occur during the summer months when stream flows are low and eggs produced during spawning (ranging from May to June) have hatched. During road work, fish can move to other parts of the stream and avoid any sediment. Small pulses of sediment may occur if a rain event immediately followed road work. The rain event would increase flow in the stream and sediment would be dispersed throughout the system and is not expected to adversely affect redband trout.

Alternative 3 does not include any road work and would maintain the current conditions. Under Alternative 3, roads within the RHCAs of Class I and II streams are expected to continue to transport sediment to streams, particularly to Crystal, Marks, Peterson, Rush, Salmon, and Wildcat Creeks. Spawning habitat would continue to be degraded by sediment delivery from roads.

Table 39. Road work (miles) within Class I and II RHCAs by alternative.

Stream Name	Alternative 2		Alternative 4		Alternative 5	
	Reconstruction, decommission, and close	Construction	Reconstruction, decommission, and close	Construction	Reconstruction, decommission, and close	Construction
Crystal	.53		.03		.53	
Jim Elliott	.03					
Marks	1.05		1.05		.6	
Peterson	.35		.36		.36	
Reilly	.18		.18			
Rush	.47		.48		.03	
Salmon	2.47	.06	2.38	.06	2.38	.06
Wildcat	.27		.28		.1	
Total	5.3	.06	4.76	.06	4	.06

The determination for redband trout for Alternatives 2, 3, 4, and 5 is may impact individuals or habitat but would not cause a trend toward federal listing. The proposed activities would result in small amounts of sediment delivery to streams. However, fish would move out of the area of disturbance. Over time, sediment would be reduced as a result of increase in riparian vegetation from thinning and underburning in RHCAs. Fish habitat would be improved and fish populations would increase in the long term as a result of pool formation from large wood recruitment.

Cumulative Effects

Class I and II streams in which the effects of past, present, and reasonably foreseeable actions overlap in time and space include Cornez, Jim Elliott, Little Hay, Marks, McGinnis, Reilly, and Rush Creeks. Past actions including riparian planting, headcut stabilization, stream restoration, road closure and decommission, and culvert replacements have all contributed to improved riparian function and condition, including improvements in stream shade and sediment reduction.

The difference in cumulative effects between the action alternatives is negligible. The cumulative effects of Alternatives 2, 3, 4, and 5 are the same for Jim Elliott, McGinnis, and Reilly Creeks. Cumulative effects are very near the same on Cornez, Little Hay, and Marks Creek (+/- 15 acres between alternatives). In all cases, the cumulative effects are expected to be beneficial to the redband trout. Closing, decommissioning, and reconstructing roads in the RHCAs of Jim Elliott, Marks, Reilly, and Rush Creeks is expected to reduce sediment transport to these streams. Hardwood thinning, precommercial thinning, and prescribed burning within the RHCAs of Marks, McGinnis, Reilly, and Rush Creeks would complement riparian planting that previously occurred along these streams, contributing to increased stream shade. These activities would also promote the growth of residual trees which would be a source of future large wood recruitment that would contribute to the development of pools, further adding to reduced water temperatures and sediment reduction.

The livestock grazing within Class I and II RHCAs is expected to continue at the current levels. Precommercial thinning and underburning activities would remove barriers to livestock movement and are likely to increase forage as a result of increased sunlight and nutrients. Livestock use of riparian areas is not expected to increase because activities in the uplands are expected to increase forage and remove barriers to livestock movement similar to the activities in the RHCAs. Also, livestock grazing permits include provisions for distributing livestock or moving livestock from pastures when certain triggers are reached. Triggers include bank trampling and a switch to preference for woody species. Livestock are expected to be moved when triggers are reached. Where hardwood thinning activities occur in RHCAs, livestock use in these areas would be small because some fences would be constructed and slash would be arranged to discourage livestock use.

Columbia Spotted Frog

Alternative 1

There are no activities proposed in Alternative 1 that would directly alter spotted frog habitat. In open canopy areas where woody vegetation is present along streambanks, shade would increase. Increasing shade over streams contributes to reducing water temperature and acts as hiding cover for Columbia spotted frogs.

This alternative would have no impact on Columbia spotted frog or its habitat.

Alternative 2, 4, and 5

Harvesting trees would not contribute to changes in frog habitat. Ponds, seeps, and wet areas that may be used by frogs are included within RHCAs (INFISH 1995) and harvest would not occur within 25 feet.

Precommercial thinning would occur on up to 900 acres within RHCAs. The amount varies by alternative and is displayed in Table 32. No heavy equipment or OHVs would be used in RHCAs for implementing this activity. There would be little disturbance to spotted frogs during implementation of this activity. Since workers would be walking through the area and using chainsaws to cut trees generally less than 9 inches dbh, frogs could move to other areas during this activity.

Reconstructing roads within RHCAs (up to 3.5 miles) on Salmon, Crystal, and Rush Creeks, reduces sedimentation from the existing condition by improving road surfaces and drainage. Activities would occur when the flows of streams are low and frog eggs have hatched. Precipitation is low during the summer months in the project area. Frogs make use of summer foraging in small wet or damp areas in forest and meadows, including water-filled tracks, stream edges, and marshes. Frogs that use water-filled tracks from vehicles may be affected by reconstruction of existing roads in RHCAs. Current visitor traffic that disturbs frogs using water-filled tracks would no longer affect these frog sites because these sites would be destroyed. Road work would occur after eggs have hatched.

Road closure work includes adding drainage structures. Long term the closed roads would have fewer puddles that would be used by frogs which may affect foraging frog numbers. Using small spur roads within RHCAs prevents building new parallel roads or opening longer segments of roads that would increase sedimentation to the stream and reducing vegetation. Keeping existing vegetation by reusing roads can be used by frogs for cover and foraging instead of building new parallel roads to existing roads in RHCAs.

An estimated 124 acres of hardwood thinning would occur in RHCAs. Vegetation for summer and winter habitat would be improved by implementing hardwood thinning activities. Increased riparian vegetation would increase cover and close areas for increased humidity needed by frogs.

Fuels treatments would occur in the spring and fall. Hand piles would be burned later in the year after the first snow. Egg deposition occurs for frogs soon after snowmelt. Eggs are normally deposited in water at temperatures of approximately 57.2 degrees F. Fire generally does not creep through seeps, bogs, springs, meadows, or other wet areas. Fire line would not be constructed in these areas. Foraging that takes place in the summer would not be affected by fuels treatments that take place in the spring and fall. Therefore, it is unlikely that fuel treatments would affect frogs or their habitat.

These alternatives would result in a may impact individuals or habitat determination for Columbia spotted frog because road work within RHCAs may occur while frogs are present. Frogs would be expected to move to other areas. Road reconstruction would reduce the amount of water-filled tracks that might be used by frogs and other road work and could affect individual frogs. During precommercial and hardwood thinning activities, individual frogs could be disturbed by workers in RHCAs; frogs would be expected to move to other areas during these activities.

Alternative 3

Precommercial thinning would occur on approximately 835 acres within RHCAs. No heavy equipment or OHVs would be used in RHCAs for implementing this activity. There would be little disturbance to spotted frogs during implementation of this activity. Since workers would be walking through the area and using chainsaws to cut trees generally less than 9 inches dbh, frogs could move to other areas during this activity.

An estimated 124 acres of hardwood thinning would occur in RHCAs. Vegetation for summer and winter habitat would be improved by implementing hardwood thinning activities. Increased riparian vegetation would increase cover and close areas for increased humidity needed by frogs.

Fuels treatments would occur in the spring and fall. Hand piles would be burned later in the year after the first snow. Egg deposition occurs for frogs soon after snowmelt. Eggs are normally deposited in water at temperatures of approximately 57.2 degrees F. Fire generally does not creep through seeps, bogs, springs, meadows, or other wet areas. Fire line would not be constructed in these areas. Foraging that takes place in the summer would not be affected by fuels treatments that take place in the spring and fall. Therefore, it is unlikely that fuel treatments would affect frogs or their habitat.

This alternative would result in a may impact individuals or habitat determination for Columbia spotted frog because workers could disturb individual frogs during precommercial and hardwood thinning activities. Frogs are expected to move away from these areas while thinning activities are occurring.

Cumulative Effects

The cumulative effects for spotted frogs are similar to those described for RHCAs. Where the Hash Rock Fire burned the upper reaches of Cornez, Hamilton, McGinnis, and Reilly Creeks in the summer of 2000 it reduced spotted frog habitat by removing vegetation. Planting in these areas and natural regrowth of vegetation has increased spotted frog habitat since the Hash Rock fire. Large wood recruitment is now occurring as fire-killed trees fall into and near streams. This large wood helps to provide hiding cover for frogs. Post-fire work in the fire area has increased streambank stability as a result of both riparian planting and replacing undersized culverts on McGinnis Creek, Reilly Creek, and the east and west forks of Hamilton Creek; replacing two undersized culverts on Cornez Creek, and decommissioning approximately 0.4 miles of road on McGinnis Creek. Precommercial thinning and prescribed burning along these streams would complement riparian planting that has already occurred, contributing to increased hardwood species composition and abundance. Road closure and decommission on Cornez Creek, Reilly Creek, and tributaries to McGinnis Creek would complement previous road decommission and culvert replacements along these streams.

Activities that have occurred in the RHCAs of Jim Elliott, Little Hay, Marks, and Rush Creeks include road decommissioning along Jim Elliott Creek; headcut stabilization, riparian planting, and fencing on Little Hay Creek; riparian planting, stream channel restoration, and road decommissioning along Marks Creek; and riparian planting along Rush Creek. Commercial harvest, precommercial thinning, prescribed burning, hardwood thinning, and road work along these streams would also contribute toward the attainment of RMOs for pool frequency, water temperature, large woody debris, and width-to-depth ratios.

Air Quality

Affected Environment

Air quality can be affected by both wildfire and activity fuels burning. National Ambient Air Quality Standards have been developed and include standards for total suspended particulates (solid material contained in smoke). The Oregon Department of Environmental Quality (DEQ) is responsible for assuring compliance with the Clean Air Act. In 1994, the Forest Service, in cooperation with the Oregon DEQ, the Oregon Department of Forestry, and the Bureau of Land Management (BLM), signed a Memorandum of Understanding (MOU) to establish a framework for implementing an air quality program in northeast Oregon. The MOU includes a prescribed fire emission limit of 15,000 tons of PM 10 per year for the national forests of the Blue Mountains (Malheur, Ochoco, Umatilla, and Wallowa-Whitman). PM 10 are particulate matter that measure 10 microns in diameter or less, and are small enough to enter the human respiratory system. All prescribed burning on these forests is coordinated with the Oregon DEQ and Department of Forestry through the State of Oregon smoke management program.

Winds in the Spears project area are typically from the southwest-to-northwest during the spring and fall prescribed fire seasons. Inversions are common at night in the fall in the Marks Creek valley, but tend to dissipate by mid-morning. Populated areas that may be affected by smoke from underburning are primarily the private lands along Marks Creek.

The nearest Class I airshed is the Strawberry Mountain Wilderness, 75 miles to the east. The nearest special protection sone is Bend, 50 miles to the west, into the prevailing winds.

Environmental Consequences

Alternative 1

Activity fuels and natural fuels underburning activities would not occur. There would be no emissions produced as a result of implementing this alternative. Because Alternative 1 would not result in any emissions, there are no cumulative effects associated with this alternative. However, because the amount of fuels in the project area would not be reduced and fuels would continue to accumulate, the intensity of any wildfire within the project area and the amount of emissions it would produce would be higher than if fuels were reduced.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

Due to the location of the project area and local weather patterns, smoke from prescribed fire would not affect Class I airsheds or urban special protection zones.

Burning activities would be conducted under the State of Oregon Smoke Management System to track smoke produced and would be coordinated with adjacent National Forests to meet smoke management objectives for total emissions.

Prescribed fire operations would be conducted under favorable smoke dispersal conditions and would be suspended during persistent inversion conditions. Burning during inversion conditions increases the potential for smoke pooling in the Marks Creek valley. Residents and visitors to the area would encounter smoke as long as the inversion conditions persist, which can be anywhere from a few days to a few weeks. Residents in the area are also likely to encounter dust, noise, and increased traffic from prescribed burning operations.

Underburning activities would be implemented over a period of about 10 years. The amount of natural fuels and activity fuels underburning would vary by alternative and the amount of emissions produced would vary by alternative. Table 40 displays the estimated total annual emissions over the 10-year implementation period for underburning activities included in each of the alternatives.

Table 40. Emissions from prescribed fire (tons).

Project Year	**Yr 1**	**Yr 2**	**Yr 3**	**Yr 4**	**Yr 5**	**Yr 6**	**Yr 7**	**Yr 8**	**Yr 9**	**Yr 10**
% of Project	10%	10%	10%	15%	15%	10%	10%	10%	5%	5%
Alternative 2										
Underburn	173	173	173	260	260	173	173	173	87	87
Pile Burn	70	70	70	106	106	70	70	70	35	35
Total PM10	244	244	244	366	366	244	244	244	122	122
Alternative 3										
Underburn	179	179	179	268	268	179	179	179	89	89
Pile Burn	16	16	16	24	24	16	16	16	8	8
Total PM10	195	195	195	292	292	195	195	195	97	97
Alternative 4										
Underburn	173	173	173	259	259	173	173	173	86	86
Pile Burn	62	62	62	93	93	62	62	62	31	31
Total PM10	234	234	234	352	352	234	234	234	117	117
Alternative 5										
Underburn	165	165	165	248	248	165	165	165	83	83
Pile Burn	59	59	59	88	88	59	59	59	29	29
Total PM10	224	224	224	336	336	224	224	224	112	112

Alternative 2 includes the highest level of prescribed fire operations and would produce the most emissions. Alternative 2 would produce an estimated 2,440 tons of PM 10 particulates over the 10-year implementation period. Alternative 4 would produce the second highest level of emissions and would produce an estimated 2,342 tons of PM 10 particulates. Alternatives 5 and 3 would produce 2,240 and 1,950 tons, respectively. The highest estimated annual emission of PM 10 is 366 tons, which is less than 3 percent of the annual emission limit for the Blue Mountains.

Prescribed fire operations would reduce the amount of fuel in the project area. With a reduction in fuel levels, the intensity of wildfires and the amount of emissions they produce would be reduced.

Cumulative Effects

During the summer months, there are occasional smoke intrusions into the Prineville area from agricultural burning in Crook and Jefferson Counties. Prescribed burning in the Spears project area would occur during the spring and fall, and would not coincide with those intrusions.

In June 2006, the Ochoco Valley Fuels Reduction project was authorized. This project includes the use of prescribed fire on approximately 2,700 acres in the Upper Ochoco Creek Watershed which lies due east of the project area. This project is expected to be implemented over 2-3 years beginning in 2007. This project is expected to produce a total of 293 tons of PM 10 emissions over the 2-3 year implementation period.

The Lookout Mountain Ranger District is in the process of developing the Snowshoe Fuels Reduction project. The purpose of the Snowshoe project is to develop a fuel break along U.S. Highway 26. This project is in the Bridge Creek Watershed which is adjacent to the project area on the north. This project is expected to include up to 200 acres of prescribed fire. The earliest implementation of this project would begin is fall 2007. This project is expected to produce a total of 22 tons of PM 10.

Both of these fuel reduction projects will result in some smoke emissions that may overlap with emissions from the Spears Project. The amount of emissions from these two fuel reduction project would be small (less than 2% of the annual emission limit) and combined with the emissions from the Spears project would be less than 5% of the annual emission limit. All of these projects will be coordinated with the Oregon DEQ and the other National Forests in the Blue Mountains to ensure that the annual emission limit is not exceeded.

Botanical Species

Affected Environment

There are no known proposed, endangered, or threatened plant species known or expected to occur on the Ochoco National Forest. Therefore, there would be no effect to threatened or endangered botanical species as a result of any of the alternatives.

There are 28 plant species on the 2004 Regional Forester's Sensitive Species List documented or suspected to occur on the Ochoco National Forest; 13 of these species do not have potential habitat within the Spears project area. These species are: Estes wormwood, South Fork John Day milkvetch, Peck’s milkvetch, Deschutes milkvetch, long-bearded mariposa lily, dwarf suncup, narrow-leaved sedge, Ochoco lomatium, disappearing monkeyflower, Peck’s penstemon, Columbia cress, arrow-leaf thelypody, and Howell’s thelypody. There would be no impact to any of these species from any of the alternatives. (More information is contained in the January 12, 2007, botany report.)

The 15 sensitive species that have potential habitat, or are known to occur in the project area, have been grouped where they occupy similar habitats, and anticipated effects of the alternatives are similar. The habitat groups are riparian, moist forest, and non-forest scabland. The following species are those that have either been documented in or near the project area, or have a higher potential for occurrence in the area. The groupings are as follows:

1. riparian species: ascending moonwort, crenulate moonwort, Mingan’s moonwort, mountain moonwort, twin-spike moonwort, pinnate moonwort, Peck’s mariposa lily, porcupine sedge, interior sedge, silverskin lichen, and margined streamside moss.
2. moist forest species: yellow-lady’s slipper orchid and Back’s sedge.
3. scabland species: Henderson’s needlegrass and Wallowa needlegrass.

Surveys were conducted for sensitive plants in the project area in 1990-1993, 2000, 2001, and 2006. Records of these surveys can be found in the Lookout Mountain Ranger District office. Most of these surveys were completed as intuitive control and in areas with the highest potential for Peck's lily and needlegrass species. Peck's mariposa lily and interior sedge have been documented to occur in the project area.

Riparian Species

Moonworts (*Botrychium* spp.)

The six species of sensitive moonworts known to occur on the Ochoco NF occupy similar riparian habitats and are discussed here as one group. This group includes ascending moonwort (*Botrychium ascendens*), crenulate moonwort (*B. crenulatum*), Mingan's moonwort (*B. minganense*), mountain moonwort (*B. montanum*), twin-spike moonwort (*B. paradoxum*), and pinnate moonwort (*B. pinnatum*). Because Mingan's moonwort has been determined to be more common than originally believed, it may be removed from the Regional Forester's sensitive species list. The six moonwort species are considered rare and local species, meaning there are only a few known populations and the populations are usually small.

These are small, primitive plants closely related to ferns. They reproduce by spores, and are associated with mycorrhizal fungi. Habitat for the six moonwort species is primarily moist ground sedge/forb communities associated with seeps, drainages, and the edges of wet meadows at relatively high elevations, generally over 5,000 feet. Moonwort sites are found within or adjacent to coniferous forest, especially grand fir (*Abies grandis*) communities. Though several surveys have been completed, none of these species have been documented in the Spears project area. Where these species have been found on other portions of the Ochoco National Forest, they occupy sites that are partially shaded to fully open at the edges of clearcuts. When found, more individual plants have been located at intact sites versus altered sites. At least one population is in a natural wet meadow. Habitat and populations appear to be stable (Ianni et al. 1996, pers. comm. and Lesko, personal observation). Moonworts may be dependent on some level of natural disturbance, such as flooding or other natural processes that occasionally create small openings for spores to become established.

Peck's Mariposa Lily (*Calochortus longebarbatus* var. *peckii*)

Peck's mariposa lily is a local endemic, known only from the Ochoco Mountains of eastern and central Oregon. Most populations occur along drainages associated with Big Summit Prairie and Little Summit Prairie. Other populations have been recorded on McKay Creek, Marks Creek, in the Maury Mountains, and on the former Snow Mountain Ranger District.

Peck's mariposa lily occurs in vernally moist areas, along intermittent drainages and meadow margins. This species is a sterile triploid, reproducing asexually through the production of bulblets in the axil of its single leaf or flower bracts (Kagan 1996). With no genetic transfer and limited ability to expand into suitable habitat, maintaining existing populations is essential for continued species viability.

In the Spears project area, populations are primarily along meadows and low-gradient drainages in the lower elevations. Compared with other portions of the Ochoco National Forest, the Spears project area contains a moderate amount of potential habitat. The majority of plants are in the Grant Meadows area. Monitoring indicates populations of this species are stable (Halvorson 2000 and 2003, pers. comm.). Proposed units with potential to affect habitat include 120, 148, 302, 303, 407, 408, 409, 501, 502, 503, 512, 513, 514, 521, 524, 532, 538, 552, 560, 565, 734, 742, 747, 748, 867, 888, 896, and 980.

Non-native plants have likely contributed to a decline in Peck's mariposa lily. Sensitive plant site records indicate non-native grasses such as timothy and Kentucky bluegrass are ubiquitous in Peck's mariposa lily sites. These non-native grasses have been present for several decades, and do not appear to threaten the viability of Peck's mariposa lily. Teasel and Canada thistle have begun to dominate some areas of suitable habitat for this sensitive species. Within the project area, it appears teasel invasion into Peck's mariposa lily habitat has resulted in extirpation of one sub-population.

Past management activities are also likely to have contributed to a decline in Peck's mariposa lily. Road construction and timber harvest with heavy machinery resulted in soil disturbance that impacted individual plants because of their shallow root system. Soil compaction and erosion changed hydrological patterns and reduced potential future recruitment in some areas. Other activities, such as slash piling and burning, resulted in scorched soils which damaged plants and their habitat. Piling and burning activities also increased the risk for introduction and spread of non-native invasive plants that may displace Peck's mariposa lily.

Earlier interpretations of survey data suggest that occurrences of this species are so small in number, with the exception of Grant Meadows, that this species may be at risk of extirpation from the majority of the Marks Creek watershed. However, this species is often inconsistent in its flowering patterns. This can affect survey data interpretations. The 1990-1992 surveys may have been completed during years of relatively low flowering. Informal monitoring and field review since these surveys indicate populations are larger and more widespread within the project area (Lesko, personal observation).

Porcupine Sedge (*Carex hystericina*) and Interior Sedge (*Carex interior*)

These species are associated with very wet riparian habitats, usually in association with perennial water. On the Ochoco National Forest, porcupine sedge has been found along Black Canyon Creek and other creeks on the Paulina Ranger District. It also occurs in the Bridge Creek watershed on public lands administered by the BLM. Though surveys of potential habitat have been completed, this species has not been documented in the project area. It appears to be more often associated with non-forested lower elevations, and may not occur in the Spears project area. Interior sedge has been documented within the Spears project area, and in other places on the Ochoco National Forest. Because interior sedge is more common than had been earlier believed, it may be removed from the Regional Forester's sensitive species list. Both species appear to be tolerant of moderate grazing disturbance (Lesko, personal observation). In Oregon, habitat for these species appears stable (Halvorson 2001, pers. comm., Helliwell 2001, and Yates

2001, pers. comm.). Few areas of potential habitat in the project area presently appear to be threatened by non-native invasive plants.

Silverskin Lichen (*Dermatocarpon luridum*) and Margined Streamside Moss (*Scouleria marginata*)

Silverskin lichen has been documented in a variety of aquatic habitats in Washington, Oregon, and California. It has been found on rocks or bedrock in streams, rivers, or seeps that are usually submerged or inundated for most of the year. Surveys have occurred on other portions of the Ochoco National Forest, and this species was documented. Because perennial streams occur in the project areas, habitat is assumed to be present. Habitat does not appear to be threatened by invasive species. Livestock use that results in physical damage by hooves may impact this species, but maintaining habitat for this species appears to be more related to maintaining water quality.

Margined streamside moss species is endemic to the Pacific Northwest, found in southern British Columbia, Washington, Idaho, western Oregon, and northern California. It often forms dark mats on exposed to shaded rocks in streams; seasonally submerged or emergent. Surveys have occurred on portions of the Ochoco National Forest and this species was not found. However, because perennial streams occur in the project area, habitat is assumed to be present. Habitat does not appear to be threatened by invasive species. Livestock use may result in physical damage to plants by hooves. However, closely-related species appear to occupy rocky, steep stream habitats that are not usually associated with high livestock use. Maintaining habitat for this species appears to be more related to maintaining water quality.

Moist Forest Species

Yellow Lady's-Slipper Orchid (*Cypripedium parviflorum*)

This species typically occupies very moist upland sites and riparian zones. This habitat is moist grand fir (*Abies grandis*)/twinflower (*Linnaea borealis*) and grand fir/beadlily (*Clintonia uniflora*) plant associations. This orchid is also known as *Cypripedium calceolus* var. *parviflorum*. A population of *Cypripedium* orchids with yellow flowers, tentatively identified as *Cypripedium parviflorum*, occurs in an old harvest unit in the Trout Creek watershed in the western portion of the Ochoco National Forest. This site was partially cut in the early to mid 1970’s using an overstory removal prescription. The unit did not have any slash disposal following the 1970’s harvest. The population appears to be stable. It appears to be associated with the decomposing large woody debris left on site after the harvest and areas with partial shade.

In the Spears project area, the highest-probability habitat for this species would occur on northerly aspects in higher-elevation western and northern portions of the area. Proposed units with potential to affect habitat include 163, 199, 515, 526, 542, 546, 707, 738, 748, 751, 823, 824, 845, 846, 869, 870, 872, 889, 932, 942, 959, and 982. No populations or plants of yellow lady’s-slipper orchid have been documented in the project area, despite surveys for this and other projects, including limited-focus surveys for this species in 2000 and 2001. Other surveys in and near the Spears project area have documented a similar species, mountain lady's-slipper orchid (*Cypripedium montanum*).

While this species appears to be somewhat tolerant of moderate disturbance, heavy ground disturbance such as road construction or log skidding may destroy plants or habitat. Burning may remove large woody debris on which this species may depend. Design elements have been incorporated into all the action alternatives to maintain habitat for yellow lady's-slipper orchid. These elements include maintaining partial shade and no slash piling or underburning on areas identified as yellow lady's-slipper orchid habitat, unless reviewed by the district botanist.

Back's Sedge (*Carex backii*)

Back's sedge occurs across much of the western United States and Canada, though it is less common in the Pacific Northwest (Wood 2002). Recent information suggests occurrences of this species in Oregon have been misidentified, and are actually *Carex cordillerana*, a "new" species yet to be described (formally published). In central Oregon, this species was last documented in 1916 on private land along Ochoco Creek at Cabin Station Pasture which is adjacent to the Ochoco National Forest.

Back's sedge occupies riparian areas and moist meadows, but also has been documented in moist woods and thickets in eastern Oregon (Wood 2003, pers. comm.). This species also occurs in rocky, often steep areas. These sites are less susceptible to livestock grazing, indicating this species may be more likely to occur in areas with little or no grazing (Lytjen 2003, pers. comm.). Back's sedge is not rhizomatous and reproduces only by seed. It is not considered a fire-adapted species, but because it is most often found on moist sites, only high-intensity wildfire is likely to affect it (Wood 2002).

Though surveys have been completed on a variety of sites throughout the Ochoco National Forest, including within the Spears project area, this species has not been documented on the Ochoco National Forest or in central Oregon. These and earlier surveys indicate this species is likely not present in the Spears project area. It appears likely that this species has been extirpated from central Oregon. The closest known populations are approximately 100 miles east of the project area. Populations of this species on the Umatilla, Malheur, and Wallowa-Whitman National Forests appear to be stable (Wood 2003, pers. comm.). It is also known to occur on lands managed by the Burns District of the BLM (Lytjen 2003, pers. comm.).

Scabland Species

Needlegrass Species (*Achnatherum hendersonii* and *A. wallowaensis*)

These perennial grasses are regional endemic species. They are associated with residual, clay soils known as lithosols. This habitat is commonly referred to as non-forest balds or scablands. These species are uncommon but widely scattered on the Ochoco National Forest. These species occur sporadically in central and northeastern Oregon on rocky, scabland ridges, often in association with rigid sagebrush, Sandberg bluegrass, onespike oatgrass, and buckwheat species. Dry, heavy clay to gravelly, droughty, shallow soil is common, with aspect mostly south to southwest, with gentle to moderate slopes. Stone circles, stripes, and nets are common signs of frost heaving in these sites (Virlakas 1990 and Maze and Robson 1996). Known sites are at elevations of 3,400 to 5,400 feet. The closest documented populations are on land managed by the BLM within the North Fork Crooked River watershed. No populations of these species have been documented within the project area, though few areas of suitable habitat have been surveyed. There are two units (704 and 806) with potential to affect habitat; this includes the roads used to access these units.

Studies indicate that where scabland soils occur on slopes exceeding 15 percent, measurable erosion has occurred over the last 100 years. As a result of these changes, productivity and plant community composition has also likely changed due to the loss of surface soil, grazing, and invasion by exotic species. Monitoring indicates the majority of this change occurred several decades ago. Though this species occurs on these altered sites, it is difficult to estimate effects of these changes on sensitive needlegrass populations. Where scablands occur on flatter slopes, less erosion has occurred, indicating little change in productivity and plant communities (David 2001, pers. comm.). On the Ochoco National Forest, the majority of this habitat appears to be stable and is expected to remain suitable for these species.

Monitoring of this species has not been extensive. However, scabland habitat associated with this species presently appears to be stable, and, except for road construction and some damage by OHV traffic, has changed little over the last few decades. Because scabland habitat does not recover from disturbance, protection is emphasized under the Ochoco National Forest Plan.

Environmental Consequences

Riparian Species

Alternative 1

This alternative includes no disturbance, such as road construction, timber harvest, burning or other activities that may affect viability of these species. Habitat would be maintained. Therefore, there would be no impact to Peck's mariposa lily, the six moonworts, porcupine sedge, interior sedge, silverskin lichen, or margined streamside moss. Monitoring indicates populations or habitats for these species are currently stable; therefore short-term (less than 10 years) effects are unlikely. Because Peck's mariposa lily appears to decline if competition is not set back due to fire or other disturbance, the continued policy of wildfire suppression and lack of management practices, such as tree thinning and prescribed burning, may lead to a long-term decline of Peck's mariposa lily (Kagan 1996 and Halvorson 2003, pers. comm.).

Alternative 3

This alternative includes no disturbance from road construction, timber harvest, or grapple piling. However, other activities, including thinning and hand piling and burning of slash, may potentially affect these species. Heavy thinning slash and piling can bury plants, and burning these higher fuel loads can scorch soils, damaging plants and their habitat, and increasing risk for introduction and spread of non-native invasive plants that may displace sensitive plants.

However, the majority of habitat would be maintained. Therefore, anticipated short-term effects would be that some individuals or habitat may be affected, but would not be likely to contribute to a trend towards federal listing or a loss of viability Peck's mariposa lily, the six moonworts, porcupine sedge, interior sedge, silverskin lichen, or margined streamside moss.

Where precommercial thinning and prescribed burning would occur along forest/meadow interface that contains habitat for Peck's mariposa lily, the expected long-term effects (>10 years) would be enhanced habitat resulting from the reduction of shade and the expansion of meadow habitat. This may result in expansion of populations.

Alternatives 2, 4, and 5

Soil disturbance from heavy machinery can directly impact individual plants. Soil compaction or erosion can impact future recruitment by changing hydrological patterns in riparian habitat. Heavy thinning slash and piling can bury plants, and burning these higher fuel loads can scorch soils, damaging plants and their habitat, and increasing risk for introduction and spread of non-native invasive plants that may displace sensitive plants.

In the long term (more than 10 years), management activities such as thinning and burning may improve habitat for Peck's mariposa lily by reducing competition from conifers and other competing vegetation (Ianni et al. 1996, pers. comm.).

All of the action alternatives avoid mechanical disturbance of known populations and high probability habitat for Peck's mariposa lily, the six moonworts, porcupine sedge, interior sedge, silverskin lichen, or margined streamside moss. Ground-based equipment would be restricted in most Riparian Habitat Conservation Areas (RHCAs) and in areas identified as habitat for these species.

Seeding of native or native cultivar grasses and forbs would take place during rehabilitation of log landings and portions of closed and decommissioned roads, including those in riparian areas, to reduce potential for erosion and introduction and spread of noxious weeds. Additional seeded grasses and forbs may move into Peck's mariposa lily habitat. Observations indicate Peck's mariposa lily populations and habitat are stable. Populations of native and non-native grasses and non-noxious forbs appear to have shared habitat with Peck's mariposa lily for decades. Therefore, seeding is not expected to increase the risk to Peck's mariposa lily. On highly disturbed sites such as roads, seeded grass and forbs can colonize these sites and reduce risk of some noxious weeds, such as teasel, which appears to be a greater threat to Peck's mariposa lily. Habitat for the six moonworts, porcupine sedge, and interior sedge is very moist. Seeding upland grasses and forbs of the species proposed is not likely to expand into this habitat and affect these species. Though some localized impacts due to non-native invasive plants, such as teasel, are apparent in Peck's mariposa lily habitat, they presently do not appear to threaten the viability of this or other sensitive species on the Ochoco National Forest.

The riparian habitat for these species is typically excluded from timber harvest. Moist habitat is unlikely to burn during prescribed burning. However, other actions including road maintenance, reconstruction, and decommissioning, precommercial thinning, and fuels treatments that would occur within the RHCAs may damage some individual Peck's mariposa lily, moonworts, porcupine sedge, interior sedge, silverskin lichen, and margined streamside moss plants or their habitats. However, these activities: (1) are expected to only affect the periphery of such habitat (e.g. thinning along a meadow edge); (2) are not expected to burn with high intensity; (3) would affect areas already heavily disturbed (e.g. road decommissioning); or (4) would occur primarily in marginal habitat or other areas unlikely to affect viability of populations. Therefore, anticipated short-term effects (less than 10 years) would be that some individuals or habitat may be affected, but would not be likely to contribute to a trend towards federal listing or a loss of viability to sensitive plant species associated with riparian areas, wet meadows, or seeps and springs.

Where precommercial thinning and prescribed burning would occur along forest/meadow interface that contains habitat for Peck's mariposa lily, the expected long-term effects (more than 10 years) would be enhanced habitat resulting from the reduction of shade and the expansion of meadow habitat. This may result in expansion of populations. Road decommissioning may result in less vehicle use in riparian areas, which may also further protect, and may enhance habitat.

Cumulative Effects

Habitat quality for the majority of sensitive plant species has likely declined since historic conditions. Road construction, livestock grazing, fire exclusion, logging, vehicle use, stream channelization, introduction and spread of non-native invasive plants (noxious weeds), and other factors have resulted in changes to meadow and riparian habitat.

Observations and monitoring over the last decade indicate habitats for these sensitive species are generally stable, despite continuing influences from livestock, noxious weeds, and recreation use (Lesko, pers. observation, and Halvorson 2003, pers. comm). In some areas, riparian improvement projects, such as planting, and headcut (stream channel) repair appear to have enhanced or expanded habitat for sensitive species associated with riparian areas. Where conifer thinning (and follow-up burning) has occurred, forest stands have moved towards conditions more closely approximating historic conditions. This is expected to benefit sensitive plant species that favor open conditions. An example is where thinning and prescribed burning occurred along a forest/meadow interface where fire exclusion has resulted in conifer expansion into meadow habitat (Arno 2000). Meadow habitat associated with Peck's mariposa lily has increased, reversing the trend of shrinking meadows.

Noxious weeds are expected to continue to be introduced by vehicles and livestock, but control measures are occurring under the 1998 Integrated Weed Management Plan, and are expected to continue. The Deschutes and Ochoco National Forests are currently completing an EIS for site-specific management of noxious weed infestations. This is expected to result in additional treatment areas on the Ochoco National Forest and in the Spears project area. Implementation of additional weed management is expected to have little short-term effect on sensitive plant species, and may have long-term beneficial effects.

Existing untreated infestations of non-native invasive plants are expected to spread, and threaten plant communities by directly displacing native vegetation, including sensitive plant species. Though teasel appears to have impacted at least one sensitive plant subpopulation, and Canada thistle also occurs in sensitive plant habitats, they currently do not appear to have a measurable effect on the overall viability of sensitive plant populations. Though Canada thistle is expected to expand, impacts to viability of sensitive plants are presently not foreseen. Spread of biological control agents on the Ochoco National Forest may ultimately result in a decline of Canada thistle.

Assuming noxious weed control continues, weeds are less likely to affect sensitive plant habitats. Therefore, no cumulative effects are expected on sensitive plant species that would add to the direct and indirect effects described in the previous section. Noxious weeds may pose a long-term threat (>10 years), but due to variables that are hard to predict, long-term assessment of weed effects on sensitive plants would be speculative.

The sensitive plant species associated with riparian areas are not expected to be affected by wildfire. These species occur in areas that are generally moist year-round, or in the case of Peck's mariposa lily, are dormant during wildfire season.

Monitoring indicates where livestock have been fenced out of Peck's mariposa lily habitat, densities of this species appear to be decreasing, possibly due to increased competition from grasses (Halvorson 2003, pers. comm.). Where thinning and burning activities improve forage production and palatability, there may be some increased use by livestock. This improved forage may help to distribute livestock and its impacts over a larger area. This is not expected to result in cumulative effects to sensitive plant populations.

Moist Forest Species

Alternative 1

This alternative does not include road construction, road decommissioning, timber harvest, hardwood thinning, seeding, burning, or other activities that may affect viability of these species. Habitat would be maintained. Therefore, no impact is expected that would likely contribute to a trend towards federal listing or a loss of viability to populations of yellow lady's-slipper orchid or Back's sedge.

Alternative 3

This alternative includes no disturbance from road construction, timber harvest, or grapple piling. However, other activities, including thinning and hand piling and burning of slash, may potentially affect these species. Heavy thinning slash can bury plants, and burning these higher fuel loads can scorch soils, damaging plants and their habitat, and increasing risk for introduction and spread of non-native invasive plants that may displace sensitive plants. However, the majority of habitat would be maintained. Therefore, anticipated short-term effects (less than 10 years) would be that some individuals or habitat may be affected, but would not be likely to contribute to a trend towards federal listing or a loss of viability of yellow lady's-slipper orchid or Back's sedge.

Alternatives 2, 4, and 5

Most of the suitable habitat for these species is associated with moist grand fir habitat and upland portions within RHCAs. Specific measures to protect habitat were incorporated into each of these alternatives.

While yellow lady's-slipper orchid appears to be somewhat tolerant of moderate disturbance, heavy ground disturbance such as road construction or log skidding may destroy plants or habitat. Burning may remove large woody debris on which this species may depend. In yellow lady's-slipper orchid these alternatives would maintain partial shade and would not pile slash or burn areas identified as yellow lady's-slipper orchid habitat, unless reviewed by the district botanist. Additionally, harvest unit layout, activity fuels burning, and post-sale tilling in these areas would be reviewed by the district botanist to avoid loss of suitable habitat.

Though surveys indicate Back's sedge is not likely to occur in the project area, and may no longer occur in central Oregon, potential habitat does exist in the project area. The moist sites associated with this species are primarily in RHCAs. With a few exceptions, timber harvest within RHCAs would be completed without the use of ground-based machinery. In addition, large wood would be maintained in moist grand fir habitats. Weather and fuels moisture conditions associated with natural fuels underburning generally result in little to no fuels consumption in the moist forest habitats associated with these species. Therefore, this activity is not expected to affect viability of these species.

Seeding of upland grasses and forbs would occur on portions of decommissioned or closed roads, log landings, and skid trails, including those in habitats associated with yellow lady's-slipper orchid and Back's sedge, to stabilize soils and reduce potential for noxious weed introduction or spread. If available, native seed produced from local collections of pinegrass, blue wildrye, and bottlebrush squirreltail would be used. Otherwise, native cultivars would be used. They include red fescue and big bluegrass. These grasses are already present in many areas of the Ochoco National Forest, and primarily occur on heavily disturbed areas such as road shoulders and log landings. In general, they do not appear to be aggressive in displacing existing native vegetation (Lesko, pers. observation). Seeding these cultivars is not expected to colonize undisturbed areas and affect the viability of yellow lady's-slipper orchid or Back's sedge. Even less risk would be expected with the seeding of locally collected native grasses and forbs.

Activities such as road maintenance and road decommissioning may in the short-term affect some habitat, but are expected to result in long-term enhancement of associated habitat by reducing impacts from vehicles. Aspen thinning would include removing conifers and piling slash that may impact habitat, but this activity is limited to less than 200 acres. Therefore, some individuals or habitat may be impacted by implementation of these alternatives, but is not expected to lead to a trend towards federal listing or affect viability of yellow lady's-slipper orchid or Back's sedge.

Cumulative Effects

Habitat quality for the majority of sensitive plant species has likely declined since historic conditions. Road construction, livestock grazing, fire exclusion, logging, vehicle use, stream channelization, introduction and spread of non-native invasive plants (noxious weeds), and other factors have resulted in changes to forest habitat.

Observations and monitoring over the last decade indicate habitats for Ochoco National Forest sensitive species are generally stable, despite continuing influences from livestock, noxious weeds, and recreation use. (Lesko, pers. observation, and Halvorson 2003, pers. comm). On upland forest sites, prescribed burning has resulted in increased exposed soils, which have increased susceptibility to noxious weed introduction and spread. This risk increases when prescribed fire exceeds normal intensities, such as occurs during unanticipated weather changes during burning activity. Burning has improved forage production and palatability, and in some areas resulted in increased livestock use. Where areas burn too hot or where livestock grazing occurred before sufficient recovery of vegetation and the soil organic layer, grazing has affected these areas by compacting and displacing soil. This increases the risk of erosion, riparian degradation, and serves as vectors for introduction and spread of noxious weeds (DeClerk 1997, DiTomaso 1997, Arno 2000, Asher et al. 2001, and Zimmerman et al. 2002). This may affect long-term (>10 years) viability of sensitive plants and habitat. However, large-scale burning can also help distribute livestock, and its impacts, over a wider area. Grazing has occurred on what is now the Ochoco National Forest for a century, and a 20-year history of prescribed burning and successive livestock use. Sensitive plant populations presently appear stable following these activities (Lesko, pers. observation).

Noxious weeds are expected to continue to be introduced by vehicles and livestock, but control measures are occurring under the 1998 Integrated Weed Management Plan, and are expected to continue. The Deschutes and Ochoco National Forests are currently completing an EIS for site-specific management of noxious weed infestations. This is expected to result in additional treatment areas on the Ochoco National Forest for integrated noxious weed management. Implementation of additional weed management is expected to have little short-term effect on sensitive plant species, and may have long-term beneficial effects.

Existing untreated infestations of non-native invasive plants are expected to spread, and threaten plant communities by directly displacing native vegetation, including sensitive plant species. Teasel and Canada thistle currently do not appear to have a measurable effect on the overall viability of sensitive plant populations. Though Canada thistle is expected to expand, impacts to viability of sensitive plants are presently not foreseen. Spread of biological control agents on the Ochoco National Forest may ultimately result in a decline of Canada thistle.

Assuming noxious weed control continues, weeds are less likely to affect sensitive plant habitats. Therefore, no cumulative effects are expected on sensitive plant species that would add to the direct and indirect effects described in the previous section.

Scabland Species

Alternative 1

Alternative 1 avoids ground-disturbing activities on scablands that provide the primary habitat for both of the sensitive needlegrass species. Therefore, this alternative is expected to result in no impact to these species.

Alternative 3

Alternative 3 avoids ground-disturbing activities on scablands that provide the primary habitat for Henderson's and Wallowa needlegrass. Observations indicate that scabland habitats are affected little, if at all, by prescribed burning activities, because these areas have very low fuel levels. Therefore, this alternative is expected to result in no impact to these species.

Alternatives 2, 4, and 5

Project design includes measures to avoid disturbance of primary habitats for sensitive plant species. Other actions including road maintenance, reconstruction and decommission, precommercial thinning, and fuels reduction activities may damage some individual Henderson's and Wallowa needlegrass plants or their habitats. These activities are expected to only affect the periphery of such habitat (e.g. thinning along a scabland edge) or would affect areas already heavily disturbed (e.g. road decommissioning). Therefore, the anticipated effects would be that some individuals or habitat may be affected, but would not be likely to contribute to a trend towards federal listing or a loss of viability to sensitive plant species associated with scabland habitats.

Cumulative Effects

Habitat quality for the majority of sensitive plant species, including those mentioned above, has likely declined since historic conditions. Road construction, livestock grazing, fire exclusion, logging, vehicle use, introduction and spread of non-native invasive plants (noxious weeds), and other factors have resulted in changes to scabland habitat.

Observations and monitoring over the last decade indicate habitats for Ochoco National Forest sensitive species are generally stable, despite continuing influences from livestock, noxious weeds, and recreation use (Lesko, pers. observation, and Halvorson 2003, pers. comm). Sensitive species associated with scablands, or non-forest balds, have changed little in the last few decades, and are expected to remain in their current condition.

Species associated with scabland occur on areas with relatively low fuel levels. Because of low fuel levels on scablands, these sites only burn during extreme conditions, such as during high winds on hot summer days. This is the time when associated species are dormant, and less susceptible to damage by fire. These species are likely to be adapted to, and remain viable with periodic wildfire. Observations indicate these sites are also generally less susceptible to noxious weeds. Therefore, sensitive species associated with scablands are expected to be unaffected by wildfire or noxious weeds.

Forest Wood Products and Jobs

Affected Environment

For the purposes of describing socio-economics effects on the economy, the economy was considered central and southeastern Oregon. The effects to the local economies are based on the estimated number of jobs created.

The bulk of the area and communities potentially influenced by actions on the Ochoco National Forest lie within Deschutes, Crook, and Jefferson, the southern most part of Wheeler, eastern most part of Grant, and the northern most sections of Harney and Lake Counties (zone of influence or zone). The major population centers within the zone and their population figures based on the 2000 census are: Prineville (7,356), Bend (52,029), Redmond (13,481), Madras (5,078), John Day (1,821) Prairie City (1,080) and Burns/Hines (3,490) (U.S Department of Commerce 2001a). Populations and change for the region and by each individual county are displayed in Table 41.

Table 41. Central Oregon population growth.

County	Population		Change	Percent
	1990 Census Data	2000 Census Data		
Crook	14,111	19,182	5,071	35.9%
Deschutes	74,958	115,367	40,409	53.9%
Grant	7,855	7,950	95	1.2%
Harney	7,060	7,609	549	7.8%
Jefferson	13,676	19,009	5,333	39%
Lake	7,176	7,422	245	3.3%
Wheeler	1,380	1,550	170	11%
Totals	126,216	178,089	51,873	40%

Sources: US Bureau of the Census, Vital Records, Oregon Health Division.

Future population projections mimic that of the past decade. Deschutes, Crook, and Jefferson Counties are expected to continue with aggressive growth, whereas the more rural counties, Wheeler, Grant, Harney, and Lake are projected to grow slowly, if at all.

According to the 2000 Census, estimated civilian labor force was: Crook, 7,525, up 12 percent since the 1990 census; Deschutes, 57,614, up 40 percent since the 1990 census; Jefferson, 8,570, up 31 percent since the 1990 census; Wheeler, 598, up 14 percent since the 1990 census; Harney, 3,110, up 16 percent since the 1990 census; Grant, 4,051, down 4 percent since the 1990 census; and Lake, 3,371, down 9 percent since the 1990 census. The labor force in Oregon as a whole increased 18 percent.

In Crook County, the three largest sectors were trade (1,640), lumber and wood products (1,510), and government (1,180). Since 2000, with the closure of the remaining sawmills, employment in the lumber and wood products has decreased. In August 2006 there were 1,110 people employed in this sector. In Deschutes County the three largest sectors were Finance/Insurance/Real-estate (14,170), trade (13,080), and government (6,900). In Jefferson County the three largest sectors were government (2,460), trade (1250), and lumber and wood products (1,150). In Wheeler County the three largest sectors were government (200), trade (50), and finance/insurance/real-estate (20). In Harney County, the three largest sectors were manufacturing (590), trade (600), and government (1,060). In Grant County the three largest sectors were government (1,101), trade (500), and finance/insurance/real-estate (430). In Lake County the three largest sectors were government (940), trade (500), and lumber and wood products (290) (U.S Department of Commerce 2001c, and Labor Trends 2006).

Unemployment rates in the individual counties were: Crook, 9.1 percent; Deschutes, 6.4 percent; Jefferson, 6.5 percent; Wheeler, 10 percent; Harney, 8.8 percent; Grant, 12.1 percent; and Lake, 10.1 percent. The unemployment rate in Oregon as a whole was 5.7 percent (U.S Department of Commerce 2001a).

Since then the economies have had both better and worse years. However, in Grant, Harney, and Lake Counties the unemployment rate has not dipped below the 2000 unemployment rate. As of February 2006 unemployment rates in the individual counties were: Crook, 7.7 percent; Deschutes, 6.1 percent; Jefferson, 8.5 percent; Wheeler, 8.3 percent; Harney, 12.3 percent; Grant, 12.7 percent; and Lake, 10.7 percent. The unemployment rate in Oregon as a whole was 6.5 percent (Labor Trends 2006)

The economies of Deschutes and Jefferson Counties, followed by Crook, are the most robust in the zone. In Deschutes County, although there has been an increase in the number of jobs created, the huge increase in the labor force (up 40%) has negated much of this success, at least in terms of the unemployment rate. Crook County's overall economic diversity which is dominated by one manufacturing sector industry (lumber and wood products) and one wholesale trade sector company (Les Schwab) is lower than the other two. However, because of the diversity of all three, their economies are expected to remain strong. Future projections call for continued growth and diversification of these economies. Even in Crook County, with the announcement by Les Schwab that they are going to move their corporate headquarters to Bend, economic expansion is expected to out pace the impact of this move. Wheeler (small agricultural based economy), Grant (heavy reliance on lumber and wood products and government), Harney (government and agriculture), and Lake (heavy reliance on lumber and wood products, government, and agriculture) Counties' economies, due to their small size and lack of diversity, have had their economies lag substantially behind Crook, Deschutes, and Jefferson and Oregon as a whole. Future projections also call for continued slow growth in these three economies (U.S Department of Commerce 2001b, Oregon Employment Department 1992, and Yohannan 2006, pers. comm.). In fact Grant and Harney Counties had the highest and second highest unemployment rates in the state in 2005.

Although the past decade (1990-2000) has seen a significant reduction in employment within the lumber and wood products industry, the lumber and wood products industry is still an important contributor to the local economies. In Crook County (2000), 1,510 people were employed in the lumber and wood products industry. This accounted for 25 percent of all wage and salary employment in the county, and represented the third highest paying job in the county. Since then, with the closure of additional sawmills, employment in the lumber and wood products has decreased. In August 2006 there were 1,110 people employed in this sector. Most of these jobs are located in the logging and secondary wood products sectors. In Deschutes County, 4,770 people were employed in the lumber and wood products industry. This accounted for 10 percent of all wage and salary employment, and represented the seventh highest paying job in the county. In Jefferson County, 1,150 people were employed in the lumber and wood products industry. This accounted for 19 percent of all wage and salary employment, and represented the third highest paying job in the county. As of February 2006, 1,080 individuals were employed in this sector. In Harney County, 204 people were employed in the lumber and wood products industry. This accounted for 11 percent of all wage and salary employment, and represented the highest paying job in the county. Today, only a handful of people still work in this sector. In Grant County, 370 people were employed in the manufacturing sector. This accounted for 14 percent of all wage and salary employment (the State does not separate out the lumber and wood products from the other manufacturing employment), and represented the third highest paying job in the county. As of February 2006, 250 individuals were still employed. Of all the counties in the zone, Grant is the only local economy remaining with a significant dependency on logging and primary manufacturing (sawmills). In Lake County, 290 people were employed in the lumber and wood products industry, and other manufacturing. This accounted for 13 percent of all wage and salary employment, and represented the third highest paying job in the county. Today, 260 people are employed in this sector. Wheeler County has no manufacturing sector industries (U.S Department of Commerce 2001c and Labor Trends 2006).

Environmental Consequences

Timber harvest (lumber and wood products) and road work (road construction, reconstruction, and decommissioning) would affect employment and income in three ways: (1) direct effects attributable to employment associated with the harvesting, transportation, and manufacturing, (2) indirect effects attributable to industries that supply materials, equipment, and services to these activities, and (3) induced effects attributable to personal spending by the owners, employees, families, and related industries. Employment and personal income impacts were made from estimates derived from Gebert et al. (2002) and Phillips (2004 pers. comm.). The jobs associated with prescribed fire and precommercial thinning are based on local observations and do not include indirect and induced jobs.

Table 42 shows the annual estimated job and income impacts by alternative. These estimates are for commercial forest products, precommercial thinning, piling of small woody debris (slash), road construction, road reconstruction, road decommissioning, and prescribed fire. No attempt has been made to value what has been termed ecosystem service values. This type of analysis, if done at all, is more appropriate at the Forest Plan level, not at the project level (Bartuska 2000).

Timber harvest jobs and income shown in Table 42 are based on State-wide relationships and are not necessarily the expected impact in any one county. Because of this, the estimated jobs and income figures in Table 42 are likely to be higher than what one would expect in a less developed rural economy. For example, the indirect and induced jobs described above would be less in a rural economy such as Crook's as money "leaks" out of the local economy to Redmond, Bend, and the Willamette Valley. The jobs and income associated with the road work are directly tied to Crook County's economy (Phillips 2005). However, they are based on all road work within the County. Because the road work on the Ochoco National Forest is generally less intensive, the number of jobs portrayed in Table 42 is likely overstated.

Over half of the timber jobs displayed in Table 42 are associated with primary manufacturing (sawmills), and since there is no certainty on where this manufacturing would occur (may not be processed even within the zone); it is not possible to predict where many of these jobs would exist.

Table 42. Annual employments and income maintained or created.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Estimated Timber Volume to be Harvested (MMBF)	0	15.4	0	12.3	8.9
Jobs, timber harvest	0	245		196	141.5
Income, timber harvest ($1000)	0	8,384		6,696	4,845
Jobs, road work	0	9.1	0	5.3	4.6
Income, road work ($1000)	0	0.29		0.17	0.15
Jobs, precommercial thinning /slash piling	0	17.1	14.9	16.7	16.2
Jobs, prescribed fire	0	10.7	8.3	10.3	9.6

Alternative 1

Direct and Indirect Effects

There would not be any activities implemented; therefore, no jobs would be created. As a result there would be no direct benefits to the local, regional, or State economies. This alternative would not contribute to maintaining forest product jobs. The ability to substitute this material from another source is questionable given the current availability of timber, especially from Federal lands. As noted in the affected environment section, Crook County no longer has any primary manufacturing capacity and more than half of the direct jobs supported by the harvesting, transporting, and processing of timber are associated with primary manufacturing. It is unlikely that many of these local logging jobs would be supported by another harvest activity on the Ochoco National Forest or within the zone. This would result in some downward pressures on all facets of Crook County's economy.

The economic activity associated with road work, and vegetation and fuel treatments would not occur under this alternative. Except for the prescribed fire treatments (these are usually accomplished with local Forest resources), many of the jobs associated with these activities, especially the precommercial thinning and slash piling, are accomplished through the use of contracting and many of the resources needed, including workers, are from outside the zone.

Alternative 3

Direct and Indirect Effects

Alternative 3 is similar to Alternative 1 because it does not include any commercial harvest activities. Since most of the economic activity associated with the action alternatives is tied directly to commercial harvest activities, the economic effects would be similar to the No Action Alternative.

Alternatives 2, 4, and 5

Direct and Indirect Effects

Alternatives 2, 4, and 5 propose commercial harvest activities and would contribute to the local, regional, and State economies. Table 42 displays the expected level of harvest in million board feet and the number of timber and related jobs that would be created or maintained by each alternative. The estimated jobs would occur over several (3-7) years as timber is harvested and processed. Given the major restructuring of the wood product industries over the past 10 to 15 years, it is likely that these would not be new jobs but jobs needed to maintain current levels of employment in the forest products industry. As noted in the affected environment section, Crook County no longer has any primary manufacturing capacity. Over half of the direct jobs supported by the harvesting, transporting, and processing of timber are associated with the primary manufacturing. Although many of the logging activities may be associated with Crook County, the most likely location for processing is in either Grant or southern Deschutes County.

In addition to the employment and income figures from harvesting and manufacturing of wood products, the vegetation, fuel treatments, and road work, would also generate jobs and income over the next 3 to 10 years.

It is reasonable to expect a good proportion of the precommercial thinning work would go to minority-based small businesses, as they have in the past. The vast majority of these businesses and their employees are based along the I-5 corridor, so most of the disposable income from these activities would not flow into local communities. There would be some local economic activity generated from these activities but it may be outside the area. The primary services needed by the workers would be food and shelter. Local businesses that can supply food (grocery stores and restaurants) and other services would capture most of the money being spent by the workers in the area. Some businesses may increase their employment, either by temporarily adding employees, or giving present employees more hours. This would likely result in increased local household incomes during implementation of project activities. Since these businesses have supported similar workforces in the past, capitol expansion would probably not be required.

Within the social context presented above, the action alternatives have the potential to bring in workers from the outside to perform logging and related activities. While the outside workforce is more likely to be racially diverse than the local resident population, the residents have worked effectively with and supported anticipated fluctuations in the workforce expected with the implementation of an action-based alternative.

Cumulative Effects

Overall, the economic influence from implementation of any of the alternatives is likely to be small within the economic context of the zone as a whole. Trends in employment indicate increased employment, primarily in construction, services, and trade. This would help ameliorate any adverse economic impacts under Alternatives 1 and 3. Alternatives 2, 4, and 5 which provide commercial wood products in addition to economic activities associated with the other management activities, along with these same overall economic trends, will help strengthen local, particularly Crook's, and regional economies. In the context of larger economies, regional or State-wide scales, the amount lost under Alternatives 1 and 3, or the amount provided in Alternatives 2, 4, and 5 would not be measurable.

Heritage Resources and Plants of Cultural Value

Affected Environment

Central Oregon and the Ochoco Mountains are within the ancestral domain of several tribes including The Confederated Tribes of the Warm Springs Reservation, The Burns Paiute, The Klamath Tribes, and The Confederated Tribes of the Umatilla Indian Reservation. The Ochoco National Forest is within lands ceded to the government through the 1855 Treaty with the Tribes of Middle Oregon, or The Confederated Tribes of The Warm Springs Reservation.

All tribes took advantage of root crops, fruits, berries, and a variety of plant life. Although the availability of resources fluctuated over the millennia, the archaeological record suggests the native inhabitants followed life ways similar to those documented through ethnographic studies during the late 1800's and early 1900's. The Northern Paiute, Wasco, Walla Walla (later called Warm Springs), Cayuse, Umatilla, Klamath, Modoc, and Yahooskin were present when Lewis and Clark arrived and each tribe has its own unique history and heritage. Archaeological sites today are recognized through the remaining stone tools and features. Site patterns in the Ochoco Mountains show a broad distribution of upland use with preferences for south facing slopes, major drainages, and high elevation spring sites. The environment, available resources, travel routes and corridors, and traditional use areas also contributed to site location preferences.

Prior to European contact, expected site types would include lithic scatters, plant processing sites, habitation or residential sites, resource procurement, or quarry sites. The most common site type in this early time period are lithic scatter sites which include flaked stone debitage and flaked stone tools.

Historic sites represent several themes including exploration, settlement, mining, trapping, transportation routes, livestock grazing, and ranching. Historic sites often involve wooden structures or cabins, carved trees, blazed trees, fence lines, trails, roads, and log watering troughs which may be adversely affected by fire, heavy equipment, and tree falling.

Hanging black moss (*Bryoria fremotii*) is the most abundant culturally significant plant in the Spears project area. It primarily grows on the lower branches of conifers. Decades of fire exclusion has likely resulted in an increase of this plant. Bitterroot (*Lewisia rediviva)* and several *Lomatium* species occupy non-forested habitats often called scabland. Soils associated with scabland or lithosols are shallow with high clay content. There are small amounts of these roots in the Spears project area. Gathering areas are more common in the North Fork of the Crooked River drainage to the east of the project area. Camas (*Camassia quamash)*, generally found in moist meadows, is not abundant in the Spears project area. Yampa (*Perideridia gairdneri)* generally found in forested areas is not abundant in the Spears project area.

The project area has a variety of archaeological and historic period sites. Known sites would be managed to protect and retain features that make these sites eligible to the National Register of Historic Places (NRHP). In general, the project area is viewed as a moderate use area for early inhabitants. Archaeological sites tend to concentrate along the main stem of Marks Creek. Historic period sites are most representative of the livestock grazing theme. The historic Summit Trail corridor represents a travel corridor for moving livestock and a transportation route along the high elevation summit of the Ochoco Mountains. The route has been determined eligible to the NRHP and is managed to retain physical features and the natural setting along the route. Segments are rated by their integrity and the setting is managed through preservation, retention, or partial retention objectives. The corridor corresponds to existing travel routes known as Road 27 and Road 2630.

Environmental Consequences

The effects analysis is based on the potential for damage to artifacts, features, environmental settings, and alteration of the surface and subsurface arrangement by machinery, fuel loadings, potential fire temperatures, and duration of fire activities. Portions of the Spears Project Area was surveyed during planning efforts for several small projects; then, in 1993 the entire Marks Creek watershed was surveyed as a whole (Maercklein 1993). During planning efforts for the Bandit II project, additional surveys and consultation with the Oregon State Historic Preservation Office was completed. During the past 10 years, no new sites have been identified.

Direct and Indirect Effects

Alternative 1

Levels of natural fuels would continue to accumulate. Densely stocked understory trees would not be treated and thinning of larger trees would not occur. Untreated fuels under this alternative would increase the potential for high-intensity wildland fire. Catastrophic stand replacement fire may have a negative affect on physical materials, historic features, and natural setting.

There would be no change to the natural setting along Road 27. Fuel loadings along the Summit Trail corridor (Road 27 and Road 2630) would continue to increase. No new roads would be constructed and closed roads would not be opened for use. High fuel loadings would increase the risk for wildfire and the subsequent fire suppression activities. Uncontrolled fire and fire suppression activities may lead to damage of historic features and loss of natural setting.

The no action alternative would not modify the availability of plants of cultural value in the project area.

Alternatives 2, 4, and 5

These three action alternatives include commercial harvest activities, thinning of small trees (less than 9 inches dbh), and treatment of slash through piling and burning. Implementation would likely occur within a 10-year period. The area has been surveyed for heritage resources and known sites sensitive to disturbance would be avoided or qualities which make them eligible to the NRHP would be protected.

Design elements were created specifically for the action alternatives in the Spears project area to manage cultural resources, protect heritage values, and avoid ground-disturbing activities on sensitive sites (see the design elements for heritage resources in Chapter 2). These design elements would be applied to all the action alternatives.

Layout and marking of several units would be coordinated with the archaeologist to ensure cultural objectives are met. In some units, heritage sites would be avoided during unit layout and design. In other units, features like trails, blazes, or signs on mature trees would be retained within the proposed treatment unit.

Alternatives 2, 4, and 5 propose a sequence of activities including commercial harvest, followed by precommercial thinning of small trees (less than 9 inches dbh), hand or grapple piling of slash, jackpot burning, and underburning based on stand need. The sequence of activities are displayed by alternative and by unit in Appendix A. These activities often include multiple contracts, such as one for the commercial harvest, one for thinning, and one for grapple piling. There is a greater risk for damage to heritage sites when multiple activities are identified under separate contracts, handled by a variety of specialists, and implemented over an estimated 10-year period.

Commercial harvest and precommercial thinning both increase the amount of surface fuels. Heritage sites that are sensitive to underburning and heat from burning are at risk of damage from the fuel reduction activities. Design elements would be applied to 20 units to reduce the risk of damage. Reducing stand density and removing ladder fuels through these thinning activities has a long-term benefit of reducing the potential for high-intensity wildfires. Grapple piling is also included in some units to reduce the risk by rearranging surface fuels and increasing the window when burning can occur.

Grapple piling is proposed on an estimated 3,000 acres followed by pile burning. Grapple piling on 10 units overlaps with heritage sites where design elements would be applied to protect heritage values and features. Grapple piling has the potential to damage sites on the surface and subsurface. The grapple piles are likely to burn hotter than if the fuels were not piled, which has the potential to scorch the soil and alter lithic artifacts. Grapple piles along the Summit Trail corridor would alter the natural setting for 2-3 years until the piles are burned. Grapple piles would not be placed in the foreground area so that a more natural setting adjacent to Road 27 is retained.

The historic Summit Trail corridor (MA-F7) is managed to retain the natural setting as well as physical features. This early transportation corridor includes Road 27, Road 2630, and segments of trails or stock driveways designated in the early 1900's to move livestock across the forest. Design elements were developed with emphasis on the natural setting and foreground area (varies from 100 to 300 feet depending on terrain). Harvest in the foreground area would be minimized and low stump heights required. Skid trails, log decks, and landings would be restricted from the foreground area. Hand piles would be allowed and grapple piling would be restricted. The project identified the need for fuels reduction along Road 27 to provide for vehicle safety. These design elements help to ensure that the natural setting is retained along the Summit Trail corridor.

Proposed treatments would reduce fuels and stand density along 1.5 miles of Road 27 Summit Trail corridor using a variety of methods. The activity units along the Summit Trail corridor include hardwood thinning (units 502, 745, 904, and 905); underburning (units 741, 747, and 900); a combination of tractor harvest, precommercial thin, grapple pile, and underburn (units 742, 748, 751, and 752); and a combination of precommercial thin, hand pile, and underburn in unit 743. The natural setting would be altered with the construction of one new road to access unit 748 (road 2700-748) and re-use of several roads (2700-655, 2700-554, and 2700-402). These roads would be closed when project activities have been completed. Tractor harvest activities would primarily treat areas adjacent to the foreground to reduce stand density and in some cases remove trees within the foreground area. Log decks and landings would be restricted from the foreground areas to retain more natural conditions adjacent to Road 27.

Thinning of young trees and underburning would be used to reduce ladder fuels and slash in the foreground areas adjacent to Road 27. Stand density would be reduced and clumps of young trees would be left to retain a more natural setting. Thinning slash in the foreground areas would be lopped or hand piled. Thinning of small trees in several aspen stands (units 502, 745, 904, 905) would emphasize aspen trees and slash would be lopped or hand piled to protect young aspen.

Approximately 3 miles along Road 2630 Summit Trail corridor would be treated using underburning (508, 510, 514, and 555), precommercial thinning (520 and 893), and thinning in aspen stands (552, 909, and 407). Thinning slash would be lopped or hand piled and burned within 1-2 years. These activities would retain the natural setting while reducing the risk for wildland fire.

The features, integrity, and natural setting of the historic Summit Trail would benefit from these activities in the long term (more than 10 years). Fuels would be reduced and the potential for high-intensity wildfires would decrease. There would be short-term (up to 10 years) effect to the natural setting with the increase and use of spur roads. The natural setting would be affected in the short-term because management activities would be visible. The casual forest visitor may see the removal of young trees, hand piles, scorched bark, and black or yellow needles from underburning in the short-term (1 to 3 years) but would not see evidence of logging or ground-based equipment. Alternatives 2, 4, and 5 would result in reducing fuels and stand density and maintaining the natural setting and features of the historic Summit Trail.

The dominant culturally significant plant in the project area is hanging black moss. Proposed activities may reduce the density of trees that provide habitat for the hanging black moss and current levels would be maintained on untreated acres. Habitat and populations of the hanging black moss would continue to exist throughout the project area. Less than 1 percent of scabland habitat would be disturbed by proposed activities in the action alternatives. Populations and the abundance of culturally significant root crops would be expected to remain the same although individual plants may be affected. These species occur in open rocky areas with shallow soils. Such areas are sparse in the Spears project area but have been identified in rocky areas along Marks Creek near the Oregon Department of Transportation rock pit.

Alternative 3

Alternative 3 proposes prescribed fire and thinning of young trees using chainsaws. Design elements would be applied to protect and retain features sensitive to fire and to retain the natural setting along Road 27 (6 thinning units) and stock driveway segments of the historic Summit Trail (4 thinning units). Alternative 3 may take an estimated 10 years to complete. Heritage sites overlap with 26 precommercial thinning units, 14 underburn units, and 9 hardwood thinning units. Design elements would be applied to manage and protect the qualities which make these sites eligible to the NRHP.

Alternative 3 would reduce the risk of potential stand replacement fire through understory thinning and underburning on 1.5 miles along Road 27 and 3 miles along Road 2630. Fuel loadings and stand density would be reduced. The natural setting along Road 27 would be retained while reducing young trees using precommercial thinning methods, lopping or hand piling slash, and subsequent burning of slash. There would be no new road construction or reconstruction on closed road systems and no use of ground based equipment. Activities along the Historic Summit Trail on Road 2630 would retain the natural setting, although some evidence of thinning and underburning activities would be evident. Alternative 3 would result in reducing fuels and stand density and maintaining the natural setting and features of the historic Summit Trail.

Proposed activities may reduce the density of trees that provide habitat for the hanging black moss and current levels would be maintained on untreated acres. Habitat and populations of the hanging black moss would continue to exist throughout the project area. Less than 1 percent of scabland habitat would be disturbed by proposed activities. Populations and the abundance of culturally significant root crops would be expected to remain the same although individual plants may be affected. These species occur in open rocky areas with shallow soils. Such areas are sparse in the Spears project area but have been identified in rocky areas along Marks Creek near the Oregon Department of Transportation rock pit.

Cumulative Effects

Ongoing activities include livestock grazing, recreation events, wildfire suppression, firewood cutting, mining (agate and thunder egg claims), and road maintenance. Livestock grazing in the Marks Creek, Wildcat, Burn, and Crystal Springs Allotments would continue. Cattle tend to graze and damage artifacts near water sources, spring developments, salting grounds, and along fences. Artifact breakage and surface disturbance is most likely to occur where cattle trail or concentrate. Recreation activities like camping, off road vehicle use, and unauthorized artifact collecting are most damaging to heritage sites. Disturbance to sites results from human use, vehicle use, fire rings, temporary outhouses, and vandalism. In general increased recreation use correlates to increased vandalism and damage to heritage sites through removal of artifacts or disturbance to features. Recreation use is expected to continue at the current rate and disturbance to sites would also continue.

Tribal access, gathering, and collection activities would continue.

Past projects in the vicinity of the Spears project include the Hash Rock Fire and restoration activities. These projects have been completed and heritage issues were addressed under a case-by-case review with the Oregon State Historic Preservation Office. There was a loss of integrity on a portion of the Summit Trail (Road 27) from the Hash Rock Fire and suppression activities.

The Crystal Springs Organizational Camp permit has expired and there are no plans to renew the special use permit. At this time, it is likely that the structures will be removed. Any effort to remove these structures would be coordinated with the Oregon SHPO on a separate case-by-case review.

At this time, the Forest Service is developing a proposal to modify grazing in the Burn and Crystal Springs Allotments. The proposal for the Burn Allotment is to change to an earlier grazing season. The proposal for the Crystal Springs Allotment is to change to an earlier grazing season with a slight reduction in AUMs (animal unit months). Proposed activities may include fence construction or water developments. These projects would address effects to heritage resources under a separate case-by-case review with the Oregon SHPO.

The Forest Service is also developing the Snowshoe Fuels Reduction Project adjacent to the north boundary of the Spears project. The Snowshoe proposal is to reduce fuels by underburning and precommercial thinning young trees. As part of the planning efforts for the Snowshoe proposal, effects to heritage resource would be addressed under a separate case-by-case review with the Oregon SHPO.

The Oregon Department of Transportation will continue their efforts to replace bridges on Highway 26 and expand the Sears Rock Pit. Both of these projects have addressed heritage resources under a separate case-by-case review with the Oregon SHPO.

Relative to heritage resources and plants of cultural value, the effects of these projects and the Spears project area do not overlap spatially with the exception of livestock grazing. The action alternatives would result in more open stands and more grass and forb species which would increase forage availability for livestock. Livestock may use these areas, but concentrated livestock use in these areas is not expected. If undiscovered heritage sites exist in these areas, livestock use may result in some artifact breakage.

Non-native Invasive Plants (Noxious Weeds)

Affected Environment

Non-native invasive plants are aggressive plants capable of degrading environmental quality or causing economic harm. Noxious weeds are a subset of these plants and are designated "noxious" by the Secretary of Agriculture or state agencies. Because some non-native species that are known to be aggressive have not been officially designated as "noxious," the term "non-native invasive plants" is becoming more common. Many use the term "noxious weeds" for all non-native invasive plants (Sheley et al. 1999c). Both terms are used interchangeably in this EIS.

Noxious weeds have many characteristics, such as rapid growth rates, high seed production, and extended growing periods that give them advantages over native plants (Sheley and Larson 1994a, DeClerck 1997, Sheley et al. 1999b, and Roche and Roche 1998).

In 2000-2003, pre-project noxious weed surveys were completed along both open and closed roads within the project area. The surveys focused on roads because that is where noxious weeds are most commonly found. Additional weed surveys occurred in 2006. Common weed species, such as teasel and Canada thistle, have not been completely documented, especially where scattered individual plants occur along road shoulders. However, along the road system, at least 95 percent of infestations of these common weed species have been documented.

At least 60 noxious weed infestations have been documented within the Spears project area. Most weeds have been present in the area for at least a decade. Noxious weed inventories indicate most infestations begin on disturbed areas, such as road shoulders, old log landings, and recreation sites. With most infestations along roads, primary introduction of noxious weeds appears to be through vehicles. Other vectors include water (e.g. streams), wind, livestock, wildlife, and mineral material and heavy equipment used for road maintenance and construction projects.

Noxious weeds that are known to occur in the project area include:

bull thistle (*Cirsium vulgare*)
Canada thistle (*Cirsium arvense*)
Dalmatian toadflax (*Linaria dalmatica*)
diffuse knapweed (*Centaurea diffusa*)
hound's-tongue (*Cynoglossum officinale*)
leafy spurge (*Euphorbia esula*)
Mediterranean sage (*Salvia aethiopis*)
medusahead (*Taeniatherum caput-medusae*)
morning glory (*Convolvulus arvensis*)
Russian knapweed (*Centaurea repens*)
Scotch thistle (*Onopordum acanthium*)
spotted knapweed (*Centaurea maculosa*)
St. John's wort (*Hypericum perforatum*)
sulfur cinquefoil (*Potentilla recta*)
teasel (*Dipsacus sylvestris*)
whitetop (*Cardaria draba*)
yellow starthistle (*Centaurea solstitialis*)

Teasel is not listed as noxious by the State of Oregon, but is considered a non-native invasive plant on the Ochoco National Forest because of its potential for displacing native vegetation.

The Ochoco National Forest is currently managing noxious weeds under the 1998 Integrated Weed Management Plan Decision Notice. Weed management includes a variety of strategies, depending on the species, size of infestation, and location. Included are chemical, cultural, mechanical, and biological controls. The aggressiveness of the treatment strategy varies by weed species. For the more aggressive species such as spotted knapweed and medusahead, the threshold for control is one plant. Monitoring of treated infestations has shown that weed control has been effective, and herbicide use has declined where treatment has occurred. However, noxious weeds are continuing to spread and new infestations are being discovered. The continued spread of noxious weeds is likely.

For species such as knapweed, controls are being implemented, and density of weeds is decreasing, though on the majority of sites, some seed production still occurs from plants that germinate after treatment, re-sprout after incomplete pulling, or otherwise escape the control. As long as seed production continues, eradication is difficult. This situation is complicated by the persistence of viable seed in the soil for many years (Eddleman 1996, pers. comm.).

Canada thistle may be the most common noxious weed on the Ochoco National Forest. It can be found on a variety of sites, including rock pits, roadsides, dispersed camping areas, meadows, and old harvest units. In susceptible areas, numerous, small infestations of this plant are often followed by rapid expansion (Sheley 2004). This perennial plant has a deep root system which makes hand pulling infeasible. Because Canada thistle is so common, management has focused on biological controls; some biological controls have become established in some areas of the Ochoco National Forest. Ongoing research and monitoring has shown some success in reducing weed densities in central Oregon. Within the Spears project area, the effectiveness of biological controls has been limited and Canada thistle infestations continue to expand.

Common, widespread species, such as bull thistle, Canada thistle, and teasel have not all been documented, and are not receiving herbicide or mechanical treatments. Though bull thistle quickly establishes the first few years following burning or timber harvest, its density decreases over time as other vegetation becomes re-established. Teasel is common, especially in riparian areas along U.S. Highway 26.

New infestations of a variety of species have been documented within the project area over the last several years. These new infestations were not included in the 1998 integrated weed management decision. Currently, treatment of these infestations is limited to hand pulling. Individual noxious weed plants are occasionally found by field-going personnel; many of these weeds are hand pulled and removed when encountered.

The Deschutes and Ochoco National Forests are in the process of completing an EIS that analyzes a proposal for site-specific treatment of specific noxious weed infestations. This planning effort will expand noxious weed treatments. The EIS includes a proposal to use new herbicides and methods. Noxious weed management on the Ochoco National Forest will be modified and will depend on the upcoming decision that results from the Deschutes and Ochoco National Forest Invasive Plant Treatment EIS. The upcoming decision is expected to increase weed treatments in the Spears project area.

The degree of environmental impact due to noxious weeds is relative to weed density. Although more than 60 infestations occur within the project area, infestations are generally limited to road corridors. Due to ongoing weed management, these infestations are typically small, less than 1/10 acre, and collectively they occupy less than 1 percent of the project area. At this time, environmental effects related to noxious weeds is low. With current control measures, weed densities are not expected to increase substantially in the next 10 years.

Environmental Consequences

The Forest Service is required to determine factors that would increase the risk for introduction and spread of noxious weeds, and design projects to reduce these risks, especially for ground disturbing and site altering activities (FSM 2081). Proposed commercial harvest activities would remove vegetation and disturb the soil organic layer, increasing potential for introduction and spread of noxious weeds. Though prescribed burning is normally low intensity, burning slash piles or intense burning that results in scorched soils can increase risk by increasing the time needed for vegetation to re-establish. Chapter 2 includes design elements that are incorporated into all the action alternatives to reduce the risk of introducing and spreading noxious weeds.

Direct and Indirect Effects

Alternative 1

Alternative 1 does not create any additional ground disturbance. Alternative 1 does not include any road construction, timber harvest, slash piling, or burning that would result in exposed soils. This alternative would have no potential for increasing the risk for introduction and spread of noxious weeds. The present level of risk would continue from existing infestations. New weed infestations are likely to become established within the project area as a result of ongoing activities, such as vehicle use by the public and livestock grazing. Compared with the other alternatives, Alternative 1 offers the lowest risk for introduction and spread of noxious weeds.

Alternatives 2, 4, and 5

Alternatives 2, 4, and 5 would create additional ground disturbance and exposed soils from road construction, timber harvest, grapple and hand piling of slash, and underburning. Alternative 2 would create an estimated 4,994 acres of ground disturbance, the highest amount among the action alternatives. Alternative 4 would create 4,577 acres, and Alternative 5 would result in an estimated 4,157 acres of new ground disturbance.

Though risk would increase due to additional ground disturbance, these alternatives also include prevention measures, such as minimizing exposed soils and requiring “certified clean” equipment. Measures to reduce these risks have been incorporated in all action alternatives, either as project design elements, such as requiring clean equipment, or site-specific, such as the omission of commercial harvest from Units 501 and 503. Following project activities, road closures and seeding would reduce risk of weed introduction and spread. Increased risk from ground disturbance would be partially offset by reduced vehicle use. Post-project weed monitoring would occur and is expected to detect infestations while they are relatively small.

Alternatives 5, and then 4 have progressively higher risk, with Alternative 2 creating the most exposed soils and having the highest risk of introducing and spreading noxious weeds.

Alternatives 3

Alternative 3 does not include any ground disturbance resulting from road construction or timber harvest. However, hand piling of slash and underburning would result in exposed soils and increase the risk for introduction and spread of noxious weeds. Hand piling and burning of slash would create an estimated 2,956 acres of exposed soils. Alternative 3 has the least amount of increased risk when compared to the other action alternatives.

Cumulative Effects

The exact source of non-native invasive plant infestations is unknown, but they are expected to have originated from several areas. The location pattern shows concentrated sites along roads. Other infestations are associated with recreation sites and mineral material sites, indicating the primary vector for noxious weeds appears to be vehicles. Vehicle use and other activities will continue in the Spears project area, regardless of the alternative chosen, including no action. Additional introduction and spread of noxious weeds, especially hound's-tongue, appears to be through livestock and wildlife (Lesko, pers. observation, and DeClerck 1997). Some infestation in the project area have been documented on sites that have had relatively little disturbance. There is an inherent risk of new infestations (such as from windblown seed) in all alternatives, regardless of other activities.

The cumulative effects of present and reasonably foreseeable activities indicate a high risk for introduction and spread of noxious weeds. Weeds will continue to be introduced and spread by vehicles, livestock, fence maintenance, the recreating public (horseback riders, hikers, and campers), water, windborne seed, wildlife, and other sources.

Prevention techniques for weed risk associated with reasonably foreseeable activities, such as requiring clean equipment for road maintenance are expected to be effective in reducing weed risk. The majority of other activities, including legal recreational driving and illegal off-road vehicle use, are more difficult to control. Wet season illegal off-road use and legal road use can be conducive to weed spread because mud can contain weed seeds and can cling to tires. The current weed treatment activities are reducing the cumulative effects related to weed risk.

Wildfire and fire suppression can result in introduction or spread of weeds by equipment brought in from different areas that may contain weed seed or plant parts. Because of the emergency nature of wildfire, prevention measures including equipment cleaning are not always implemented or feasible. Dozer lines, hand lines, drop points, safety zones, and staging areas, all result in exposed soils which increase the risk of spread of noxious weeds. These sites are all heavily traveled which again increases the risk of introducing and spreading noxious weeds. Vehicle traffic during and after suppression activities can introduce weeds to highly susceptible soils. Therefore, introduction and spread from wildfire suppression activities is possible. Use of natural fire control lines, such as rocky ridges and existing roads, can reduce the risk of weed spread. Fire rehabilitation efforts are normally implemented that can mitigate many of the effects of the suppression activities.

Human use of the National Forest is increasing and is expected to continue to increase in the future as populations in nearby towns continue to grow. Increased human use and expanding non-native noxious weed infestations outside the Spears project area will likely increase the potential for new noxious plant infestations.

Where controls have been implemented, weed infestations have generally decreased. Management of weed infestations included in the 1998 Integrated Weed Management Plan is expected to continue until a new management plan is adopted. The remaining untreated infestations would continue to spread, displacing native and desirable non-native vegetation and reducing biodiversity.

The Deschutes and Ochoco National Forests are currently completing an EIS for integrated noxious weed management. Integrated weed management on the Ochoco National Forest will be modified based on upcoming decisions resulting from this EIS process. A decision on this EIS is expected to occur in 2007.

The degree of environmental impact due to noxious weeds is relative to the acres infested. Collectively, noxious weeds occupy less than 1 percent of the project area. Therefore, at present, environmental effects due to noxious weeds is considered low. Assuming noxious weed control continues, anticipated effects resulting from introduction and spread of noxious weeds is expected to remain relatively low.

Recreation

Recreation use in the project area includes wildlife viewing, hunting, fishing, driving for pleasure, camping, hiking, mountain biking, rock hounding, geo-caching, off-highway vehicle driving, horseback riding, cross-country skiing, snowshoeing, sledding, dog sledding, and snowmobiling. The project area includes a small portion of the Mill Creek Wilderness.

There are several developed recreation sites within the project area: Ochoco Divide Campground, White Rock Campground, White Fir Springs, Bandit Springs Recreation Area, Ochoco Divide Snow Park, and Marks Creek Snow Park. There are also numerous dispersed campsites, such as the Corral Flat area.

This section has been divided into five topics including Bandit Springs Recreation Area, Developed and Dispersed Camping Areas, Snow Parks, Trails, and Wilderness. Changes to the visual character of the scenery are described in the Visual Quality section later in this chapter.

Bandit Springs Recreation Area

Affected Environment

The Bandit Springs Recreation Area consists of 1,580 acres and is located near Ochoco Divide between the Mill Creek Wilderness and U.S. Highway 26. The area is a popular cross-country ski area and contains approximately 14 miles of designated ski trails. The Forest Plan emphasis for the area is to provide a variety of dispersed, non-motorized recreational opportunities within a setting where most management activities are generally not evident to the casual observer. Forest Plan direction specifies that periodic manipulation of the vegetation, including timber harvest, will occur to develop and maintain resistance to catastrophic events which would detract from the recreational experience. Management activities would be apparent in the area.

Many of the forest stands in the area feature large diameter ponderosa pine with developing understories of fir, pine, and larch. The Forest Plan notes that ponderosa pine areas should be managed for a combination of multi-storied stands and open, park-like stands. Mixed conifer areas should be managed to maintain a mix of species with an emphasis on maintaining western larch.

Approximately 975 acres of the Bandit Springs Recreation Area and 6.2 miles of trail in the recreation area were burned in the Hash Rock Fire. Intensities varied from high-intensity stand replacement fire to low-intensity underburning. Most of the high-intensity fire occurred adjacent to and south of McGinnis Creek.

Environmental Consequences

Alternative 1

This alternative does not include any vegetative treatments. The recreational experience would not be directly affected by harvest or non-harvest activities. Understories would continue to develop and increase the amount of multi-storied conditions. The amount of open, park-like stands of ponderosa pine would continue to decrease. Stand densities would continue to increase placing additional stress on older overstory trees. Shade-tolerant grand fir would continue to become more abundant, while ponderosa pine and larch dominance would decrease. Fuel loadings, including small understory trees, would continue to increase. Susceptibility to wildfire and/or insects and disease would continue increasing over time. Dense, multi-storied stands are susceptible to disturbance and, as these conditions increase over time, additional high-intensity wildfires would be expected to occur. In the long term, scenic quality would be degraded as open stands of large diameter ponderosa pine become less abundant. Riparian and upland vegetation along McGinnis Creek would recover from the Hash Rock Fire. Riparian vegetation would recover unaided by aspen improvement projects.

Alternative 2

Within the Bandit Springs Recreation Area, this alternative includes 327 acres of commercial harvest and 278 acres of precommercial thinning designed to develop or maintain resilience to natural disturbance events. (The prescriptions for commercial activities also include precommercial thinning and activity fuels underburning; the prescriptions for precommercial thinning also include activity fuels underburning). Forest stands would move toward conditions that are more sustainable and resistant to high-intensity wildfire or large-scale insect and disease outbreaks. Commercial harvest and precommercial thinning activities would focus on removing small tress from the understory. Large trees would be retained. Stand densities would be decreased, single-storied open conditions would become more abundant, and fire-tolerant ponderosa pine and larch would be maintained. Competitive stress within stands would be reduced which would increase growth rates and encourage the development of more large trees over time. More of the older, larger diameter trees would be maintained over time. Stand resiliency would be increased and the likelihood of disturbances, like the Hash Rock Fire, would be reduced. A variety of stand conditions, including both ponderosa pine and mixed conifer, would be retained in the Bandit Springs Recreation Area.

Natural fuels underburning (39 acres) would be used to maintain or reduce fuel loadings and reduce the abundance of small understory trees. Reducing or maintaining low fuel loadings would increase the resistance to catastrophic wildfire events. This was demonstrated during the Hash Rock Fire when the fire essentially stopped at the boundary of the 1995 Mill Creek Prescribed Natural Fire (PNF). The Mill Creek PNF effectively reduced the intensity and rate of spread of the Hash Rock Fire (Owens 2001). Table 43 displays the acres of activities within the Bandit Springs Recreation Area for all alternatives.

Commercial harvest, precommercial thinning, and underburning activities would create short term (3-5 years) and long term (10-15 years) effects that would be evident to the casual visitor. Such effects include impacts to visual quality, recreational experiences, and trails. In the short term (up to 10 years), the visual quality may be affected as visitors would see stumps, slash piles (grapple and hand piles), bare soil, skid trails, smoke, and boundary tags. There would be decreased stand densities and fewer small trees which would open up the views of surrounding areas and natural features. In the long term (more than 10 years), the visual quality would be enhanced as more large ponderosa pines develop and views of open, park-like stands become more frequent.

Summer users may encounter noise, dust, smoke and logging-related traffic if they are present when these activities occur. As a result, the natural recreation experience may be altered due to short term disturbance of solitude and primitiveness. Precommercial thinning would leave small diameter (9 inches dbh) trees on the ground after they have been cut. Thus, traveling off of trails and roads would be more difficult for 3-8 years until slash from logging and precommercial thinning is burned. Mountain bikers would have a difficult time if riding off trails and roads, but hikers and horseback riders would still be able to step over the small trees. Users may be temporarily displaced during harvest activity due to area closures for safety reasons. Cross-country skiers and other winter users would not be displaced or disturbed because commercial timber harvest activities would be restricted between Thanksgiving and March 30.

Some of the cross-country ski trails are on existing roads which would be reopened during harvest activities. The trails may appear wider because they would be cleared and used for logging traffic. There would be approximately 2.4 miles of road work within the Bandit Springs Recreation Area. This includes approximately 0.3 mile of new road construction and closing the roads after timber hauling and 0.2 mile of new road construction and decommissioning the roads after timber hauling. 0.2 mile of existing roads would be decommissioned and 1 mile of existing roads would be closed following timber haul. Visuals may be affected as road beds would be evident in the long run but would eventually become overgrown with vegetation. Decommissioned roads would be torn up, seeded, and water barred after use. These roadbeds may provide cross-country skiers more trail opportunities.

Out of the 14 miles of designated ski trails within Bandit Springs Recreation Area, 7.1 miles are either within or adjacent to units. Bike Tie Trail is not in any units. 0.7 miles of Easy Trail, 0.4 miles of McGinnis Creek Trail, and 0.2 miles of Woodpecker Trail are in or adjacent to precommercial units. 0.1 miles of McGinnis Creek Trail, 1.4 miles of Ponderosa Loop Trail, and 0.4 miles of Ochoco Way Trail are in or adjacent to underburn units. 1.9 miles of McGinnis Creek Trail, 0.1 miles of Ponderosa Loop Trail, 0.2 miles of Ridge Climb Trail, 0.7 miles of Woodpecker Trail, and 0.7 miles of Ochoco Way Trail are in or adjacent to commercial harvest units. Table 44 displays a summary of miles of trail within units for all alternatives.

Design elements (see Chapter 2) have been incorporated to reduce impacts to recreational users. These include timing of activities to avoid the high-use winter season, minimizing stump heights so stumps are less visible, placing boundary tags and marking paint on the back side of trees or removing them after treatment to reduce the visibility, and clearing ski trails of slash prior to the winter season.

Alternative 3

This alternative includes 536 acres of precommercial thinning and activity fuels underburning designed with similar objectives as described for Alternative 2. Activities would focus in stands which have abundant numbers of small (less than 9 inches dbh) trees. Small tree densities would be decreased, single-storied open conditions would become more abundant, and fire-tolerant ponderosa pine and larch would be maintained. Stand resiliency would be increased where treatment occurs and the likelihood of disturbances like the Hash Rock Fire would be reduced, although not to the same extent as Alternatives 2, 4, and 5. Precommercial thinning alone would not remove enough competitive stress to achieve objectives for increasing the amount of late and old structure.

Natural fuels underburning (39 acres) would occur as discussed in Alternative 2 to maintain or reduce fuel loadings and reduce the abundance of small understory trees. Reducing or maintaining low fuel loadings would increase the resistance to catastrophic wildfire events.

Precommercial thinning and fuels activities would create short term (3-5 years) and long term (10-15 years) effects that would be evident to the casual visitor. Such effects include impacts to visual quality, recreational experiences, and trails. In the short term, the visual quality may be affected as visitors would see stumps, hand piles, bare soil, smoke, and boundary tags. The exposed stumps would be smaller and, therefore, would deteriorate faster. There would be decreased stand densities and fewer small trees which would open up the views of surrounding areas and natural features. There would be reduced screening along the trails due to the decrease in small diameter trees. In the long term, the visual quality would be enhanced as more large ponderosa pines develop and views of open, park-like stands become more frequent.

This alternative includes using existing roads and no new roads would be constructed. As a result, the natural recreation experience may be better retained than Alternatives 2, 4, and 5. The scatter/lop fuel treatment would leave more small trees scattered on the ground. Traveling off of trails and roads would be more difficult for 3-8 years until slash from precommercial thinning is burned. Thus, mountain bikers would have a difficult time if riding off trails and roads, but hikers and horseback riders would still be able to step over the small trees. The activity area would not be closed and summer users would not be temporarily displaced. There would be no conflicts between recreation users and logging traffic.

Out of the 14 miles of designated ski trails within Bandit Springs Recreation Area, 7.1 miles are either within or adjacent to units. Bike Tie Trail is not in any units. 0.7 miles of Easy Trail, 2.3 miles of McGinnis Creek Trail, 0.1 miles of Ponderosa Loop Trail, 0.2 miles of Ridge Climb Trail, 0.7 miles of Woodpecker Trail, and 0.7 miles of Ochoco Way Trail are in or adjacent to precommercial units. 0.1 miles of McGinnis Creek Trail, 1.4 miles of Ponderosa Loop Trail, 0.2 miles of Woodpecker Trail, and 0.4 miles of Ochoco Way Trail are in or adjacent to underburn units.

Alternative 4

This alternative includes 327 acres of commercial harvest and 278 acres of precommercial thinning. Precommercial thinning would focus on stands which have abundant numbers of small (less than 9 inch dbh) trees. Small tree densities would be decreased, single-storied open conditions would become more abundant, and fire-tolerant ponderosa pine and larch would be maintained. Stand resiliency would be increased where treatment occurs and the likelihood of disturbances like the Hash Rock Fire would be reduced.

Natural fuels underburning (113 acres) would occur as discussed in Alternative 2 to maintain or reduce fuel loadings and reduce the abundance of small understory trees. Reducing or maintaining low fuel loadings would increase the resistance to catastrophic wildfire events.

Commercial harvest, precommercial thinning, and underburning activities would create short term (3-5 years) and long term (10-15 years) effects that would be evident to the casual visitor. Such effects include impacts to visual quality, recreational experiences, and trails. In the short term, the visual quality may be affected as visitors would see exposed stumps, slash piles (grapple and hand piles), bare soil, skid trails, smoke, and boundary tags. There would be decreased stand densities and fewer small trees which would open up the views of surrounding areas and natural features. In the long term, the visual quality would be enhanced as more large ponderosa pines develop and views of open, park-like stands become more frequent.

This alternative focused on using existing roads. There would be approximately 2.1 miles of road work within the Bandit Springs Recreation Area. This includes approximately 0.2 mile of new road construction and decommissioning the road after timber hauling. 0.2 mile of existing road would be decommissioned and 1 mile of existing road would be closed following timber haul. Visuals may be affected as road beds would be evident in the long run but would eventually become overgrown with vegetation. Decommissioned roads may be torn up and water barred after use. The roads may provide cross-country skiers more trail opportunities.

Summer users may encounter noise, dust, smoke and logging-related traffic if they are present during these activities. The natural recreation experience may be altered due to short term disturbance of solitude and primitiveness. Precommercial thinning would leave small diameter (9 inches dbh) trees on the ground after they have been cut. Thus, mountain bikers would have a difficult time if riding cross-country. Hikers and horseback riders would be able to step over the small trees. Summer users may be temporarily displaced during harvest activity due to area closures for safety reasons. Cross-country skiers and other winter users would not be displaced or disturbed because commercial timber harvest activities would be restricted between Thanksgiving and March 30.

Out of the 14 miles of designated ski trails within Bandit Springs Recreation Area, 8.2 miles are either within or adjacent to units. 0.7 miles of Easy Trail, 0.4 miles of McGinnis Creek Trail, and 0.2 miles of Woodpecker Trail are in or adjacent to precommercial units. 0.5 miles of Bike Tie Trail, 0.2 miles of Easy Trail, 0.2 miles of McGinnis Creek Trail, 1.4 miles of Ponderosa Loop Trail, 0.3 miles of Woodpecker Trail, and 0.4 miles of Ochoco Way Trail are in or adjacent to underburn units. 1.9 miles of McGinnis Creek Trail, 0.1 miles of Ponderosa Loop Trail, 0.7 miles of Woodpecker Trail, 0.7 miles of Ochoco Way Trail, and 0.2 miles of Ridge Climb Trail are in or adjacent to commercial harvest units.

Alternative 5

This alternative includes 197 acres of commercial harvest and 315 acres of precommercial thinning. Precommercial thinning would focus on stands which have abundant numbers of small (less than 9 inch dbh) trees. Small tree densities would be decreased, single-storied open conditions would become more abundant, and fire-tolerant ponderosa pine and larch would be maintained. Stand resiliency would be increased where treatment occurs and the likelihood of disturbances like the Hash Rock Fire would be reduced, although not to the same extent as Alternative 2.

Natural fuels underburning (115 acres) would occur as discussed in Alternative 2 to maintain or reduce fuel loadings and reduce the abundance of small understory trees. Reducing or maintaining low fuel loadings would increase the resistance to catastrophic wildfire events.

Commercial harvest, precommercial, and fuels activities would create short term (3-5 years) and long term (10-15 years) effects that would be evident to the casual visitor. Such effects include impacts to visual quality, recreational experiences, and trails. In the short term, the visual quality may be affected as visitors would see exposed stumps, slash piles, bare soil, skid trails, smoke, and boundary tags. There would be decreased stand densities and fewer small trees which would open up the views of surrounding areas and natural features. The prescriptions in this alternative include variable density thinning, leaving clumpier stand structures, and leaving higher densities in moist areas. In the long term, the visual quality would be enhanced as more large ponderosa pines develop and views of open, park-like stands become more frequent.

Summer users may encounter noise, dust, smoke and logging-related traffic if they are present when these activities occur. As a result, the natural recreation experience may be altered due to short term disturbance of solitude and primitiveness. Precommercial thinning would leave small diameter (9 inches dbh) trees on the ground after they have been cut. Thus, mountain bikers would have a difficult time if riding cross-country. Hikers and horseback riders would be able to easily step over the small trees. Summer users may be temporarily displaced during harvest activities due to area closures for safety reasons. Cross-country skiers and other winter users would not be displaced or disturbed because commercial timber harvest activities would be restricted between Thanksgiving and March 30.

Some of the trails are on existing roads which would be reopened during harvest activities. The trails may appear wider due to clearing and use during harvest activities. There would be approximately 1.7 miles of road work within the Bandit Springs Recreation Area. This includes approximately 0.3 mile of new road construction and closing the road after timber hauling and 0.2 mile of new road construction and decommissioning the road after timber hauling. 0.1 mile of existing road would be decommissioned and 0.4 mile of existing road would be closed following timber haul. Visuals may be affected as road beds would be evident in the long run but would eventually become overgrown with vegetation. Decommissioned roads would be torn up and water barred after use. The roads may provide cross-country skiers more trail opportunities.

Out of the 14 miles of designated ski trails within Bandit Springs Recreation Area, 5.6 miles are either within or adjacent to units. 0.7 miles of Easy Trail, 0.4 miles of McGinnis Creek Trail, and 0.2 miles of Woodpecker Trail are in or adjacent to precommercial units. 0.1 miles of McGinnis Creek Trail and 0.4 miles of Ochoco Way Trail are in or adjacent to underburn units. 1.9 miles of McGinnis Creek Trail, 0.7 miles of Woodpecker Trail, 0.7 miles of Ochoco Way Trail, and 0.2 miles of Ridge Climb Trail are in or adjacent to commercial harvest units.

Table 43. Acres of activities within the Bandit Springs Recreation Area.

Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Commercial	0	327	0	327	197
Precommercial Thinning	0	278	513	278	315
Hardwood	0	23	23	23	23
Natural Fuels Underburning	0	39	39	113	115
Total	**0**	**644**	**575**	**741**	**649**

Table 44. Miles of trail in the Bandit Springs Recreation Area within or adjacent to units.

Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Commercial	0	3.6	0	3.6	3.5
Precommercial Thinning	0	1.3	4.7	1.3	1.3
Hardwood	0	0.3	0.3	0.3	0.3
Natural Fuels Underburning	0	1.9	2.1	1.9	0.5
Total	**0**	**7.1**	**7.1**	**7.1**	**5.6**

Cumulative Effects

In 2005, the Forest Service published a new rule for providing motor vehicle access to the national forests and grasslands. When implemented, the rule prohibits use of motor vehicles outside or off designated roads, trails, and areas. Some trails, roads, and areas will be closed in the future and others will be designated for motorized travel. The implementation date is expected to be in 2009. The Ochoco National Forest is in the preliminary process of developing a proposed action. This effort is not expected to alter recreational use in the Bandit Springs Recreation Area because the emphasis for this area is non-motorized recreational opportunities.

There are no other planned or reasonable foreseeable activities that are expected to alter recreational use in the Bandit Springs Recreation Area.

Developed and Dispersed Camping Areas

Affected Environment

Developed recreation areas include sites that are currently developed for camping, trailhead parking, and other recreational activities. The campgrounds within the project area include Ochoco Divide and White Rock Campgrounds. Dispersed recreation areas include user-created sites generally along roads and riparian areas, such as White Fir Springs and Corral Flat. Within the project area boundary, there are approximately 52 Forest Plan identified dispersed sites.

Ochoco Divide Campground is a popular, heavily used site within a mature stand of predominantly ponderosa pine just off U.S. Highway 26. It is located 30 miles northeast of Prineville at the summit of Ochoco Pass. This concessionaire-operated campground provides 28 campsites with potable water and garbage service. The primary use season is May 1 through September 15. Most visitors arrive late in the evening and continue on their trip in the morning, so the area is generally quiet and vacant during the day.

White Rock Campground is a primitive camp within a stand of mostly grand fir. It is located at the eastern boundary of Mill Creek Wilderness, approximately 31 miles east of Prineville at the end of Forest Road 3350-300. There are two campsites with tables, fire rings, and a toilet. This campground also serves as the trailhead for the Wildcat Trail. Most use at this site is by people accessing the Wildcat Trail. The primary season of use is from late May through early November. Hunters usually occupy this area during the latter months of the use season. There is also a popular rockhounding area near this campground. Fire line construction during the Hash Rock Fire increased potential rockhounding activities in the area. Ground-disturbing activities generally bring thundereggs and agates closer to the surface.

White Fir Springs is a primitive site used primarily by rockhounders during early spring and summer and by hunters during late fall. This site is located off Forest Road 3350. There are two popular rockhounding sites near this camp.

Corral Flat is a dispersed camping site that is primarily used by equestrian enthusiasts. Annual Special Use Permit (SUP) events, such as Endurance Rides, are staged at this area. The Prineville Ridge Riders have a 5-year endurance ride SUP that authorizes use of non-system trails that connect to the camping area. The trails consist of a 12, 20, and 30-mile loop. On average, 90 riders participate in this ride. This dispersed site is located approximately 27 miles east of Prineville off Forest Road 2630. The open meadows and large ponderosa pine stands draw visitors to the area. There are no units near or adjacent to the Corral Flat dispersed camp site. Campers at this area would not be affected.

Environmental Consequences

Alternative 1

There would be no direct effect on camping sites within the project area. Use of these sites is not expected to change. Over time, the visual character of the areas would change as understory trees grow and stands become denser. Large diameter ponderosa pine trees would become less common.

Alternative 2

Treatments would improve the long-term health of timber stands adjacent to the above camping areas (developed and dispersed sites), thus creating a more appealing natural setting. Visitors would be able to see the 'before and after' effects of vegetation treatments if they visit the sites frequently. Commercial harvest, precommercial thinning, and fuels activities would create short term (3-5 years) and long term (10-15 years) effects that would be evident to the casual visitor. Short-term impacts would be evident near some of the camping areas. Effects from commercial harvest activities would include increased noise and dust from logging operations, increased traffic from timber hauling, reduced visual quality due to logging slash, stumps, exposed dirt, smoke, and blackened ground and vegetation from underburning activities. In the long term, the visual quality would be enhanced as more large ponderosa pines develop and views of open, park-like stands become more frequent.

There are no units adjacent to Ochoco Divide Campground, but underburning (approximately 88 acres total) within one-quarter of a mile of the campground would occur. Smoke would be present during burning. Visitors would not be displaced, but may encounter smoke. There are no units adjacent to White Rock Campground, but within one-quarter of a mile, units (approximately 36 acres total) would be commercially harvested and impacts from logging activities would be apparent to visitors. Table 45 displays the acres of treatment within 0.25 miles of campgrounds for all alternatives.

Ground disturbance associated with tractor logging systems and road construction activities may increase the potential for rockhounding because agates and thundereggs would be more exposed. The amount of rockhounding activities near White Rock Campground and White Fir Springs may increase.

Vegetation treatments would be evident in and around dispersed campsites. Some users may be temporarily displaced due to loss of access during harvest activities. This may increase camping at other dispersed sites. See Table 46 for number of dispersed sites within treatment units for all alternatives.

Alternative 3

Precommercial thinning and underburning activities would have short-term impacts on users, such as noise from thinning activities and smoke during underburning. Blackened ground and vegetation, and slash and small stumps would be visible. Visual evidence of activities may be apparent to the casual forest visitor at or near some camping areas. Over time, large ponderosa pine trees would be more apparent. This alternative has no commercial harvest or road building.

There are no units directly adjacent to Ochoco Divide Campground, but within one-quarter of a mile, units (approximately 24 acres total) would be precommercial thinned, and approximately 40 acres would be underburned. Smoke would be present during burning. Visitors would not be displaced. There are no units directly adjacent to White Rock Campground, but within one-quarter of a mile, units (approximately 21 acres total) would be precommercial thinned.

Vegetation treatments would be evident in and around dispersed campsites. Some users may be temporarily displaced while thinning activities occurred. This may increase camping at other dispersed sites.

Alternative 4

Treatments would improve the long-term health of timber stands adjacent to the above camping areas (developed and dispersed sites), thus creating a more appealing natural setting. Visitors would be able to see the ‘before and after’ effects of vegetation treatments if they visit the sites frequently. Commercial harvest, precommercial thinning, and fuels activities would create short term (3-5 years) and long term (10-15 years) effects that would be evident to the casual visitor. Short-term impacts to the camping areas would be evident near some of the areas. Effects from commercial harvest activities would include increased noise and dust from logging operations, increased traffic from timber hauling, reduced visual quality due to logging slash, stumps, exposed dirt, smoke, and blackened ground and vegetation from underburning activities. In the long term, the visual quality would be enhanced as more large ponderosa pines develop and views of open, park-like stands become more frequent.

There are no units adjacent to Ochoco Divide Campground, but within one-quarter mile, units (approximately 88 acres total) would be underburned. Smoke would be present during burning. Visitors would not be displaced, but may encounter smoke. There are no units adjacent to White Rock Campground, but within one-quarter mile, units (approximately 29 acres total) would be commercially harvested and impacts from logging activities would be apparent to visitors.

Ground disturbance associated with tractor logging systems and road construction activities may increase the potential for rockhounding because agates and thundereggs would be more exposed. The amount of rockhounding activities near White Rock Campground and White Fir Springs may increase.

Vegetation treatments would be evident in and around dispersed campsites. Some users may be temporarily displaced due to loss of access during harvest activities. This may increase camping at other dispersed sites.

Alternative 5

Commercial harvest, precommercial thinning, and fuels activities would create short term (3-5 years) and long term (10-15 years) effects that would be evident to the casual visitor. In the short term, there would be effects to visual quality, recreational experiences, and trails. The visual quality may be affected as visitors would see stumps, slash piles, bare soil, skid trails, smoke, and boundary tags. There would be decreased stand densities and fewer small trees which would open up the views of surrounding areas and natural features. In the long term, the visual quality would be enhanced as more large ponderosa pines develop and views of open, park-like stands become more frequent.

The prescriptions in this alternative include leaving clumpier stand structures and leaving higher densities in moist areas. Treatments would improve the long-term health of timber stands adjacent to camping areas (developed and dispersed sites), thus creating a more appealing natural setting.

There are no units adjacent to Ochoco Divide Campground, but within one-quarter of a mile, units (approximately 88 acres total) would be underburned. Smoke would be present during burning. Visitors would not be displaced. There are no units adjacent to White Rock Campground, but within one-quarter of a mile, units (approximately 36 acres total) would be commercially harvested and impacts from logging activities would be apparent to visitors.

Ground disturbance associated with tractor logging systems and road construction activities may increase the potential for rockhounding because agates and thundereggs would be more exposed. The amount of rockhounding activities near White Rock Campground and White Fir Springs may increase.

Vegetation treatments would be evident in and around dispersed campsites. Some users may be temporarily displaced due to loss of access during harvest activities. This may increase camping at other dispersed sites.

Table 45. Acres of activities within 0.25 mile of developed campgrounds.

Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Commercial	0	37.8	0	30.1	37.9
Precommercial Thinning	0	0	45	0	0
Hardwood	0	7.9	7.9	7.9	7.9
Natural Fuels Underburning	0	88.2	39.9	88.2	88.1
Total	**0**	**133.9**	**92.8**	**126.2**	**133.9**

Table 46. Number of Forest Plan dispersed sites within units.

Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Commercial	0	9	0	9	7
Precommercial Thinning	0	3	7	3	4
Hardwood	0	5	5	5	5
Natural Fuels Underburning	0	8	10	8	7
Total	**0**	**25**	**22**	**25**	**23**

Cumulative Effects

In 2005, the Forest Service published a new rule for providing motor vehicle access to the national forests and grasslands. When implemented, the rule prohibits use of motor vehicles outside or off designated roads, trails, and areas. Some trails, roads, and areas will be closed in the future and others will be designated for motorized travel. The implementation date is expected to be in 2009. The Ochoco National Forest is in the preliminary process of developing a proposed action. This effort may alter recreational use at developed and dispersed camping sites because motorized vehicle use would be restricted to designated roads, trails, and areas. However, until a proposed action is developed it is not possible to disclose the expected effects because the roads, trails, and areas that will be designated for motorized use is uncertain.

There are no other planned or reasonable foreseeable activities that are expected to alter recreational use in dispersed and developed camping areas.

Snow Parks

Affected Environment

Ochoco Divide, Bandit Springs, and Marks Creek Snow Parks are within the project area and are near or adjacent to Bandit Springs Recreation Area. The snow parks are located off of U.S. Highway 26, 25-30 miles northeast of Prineville. These parks require Sno-Park permits (between November 15 and April 30), are paved, and have toilets.

Environmental Consequences

Alternative 1

There would be no direct or indirect effects to the snow parks. Use at these sites is expected to continue.

Alternatives 2, 4, and 5

Ochoco Divide Snow Park is closed in the off-season; therefore, there would be no direct effect to visitors. The primary use period is from December 1 to March 15. Management activities would be conducted outside of the primary use season. Unit 502 (hardwood thinning in an aspen stand) is adjacent to the snow park. Within 0.25 miles of Ochoco Divide Snow Park, about 95 acres would be underburned. Activities would be visible, such as scorched trees, smoke, slash piles, and stumps. Visual evidence of activities may be apparent to the casual forest visitor at or near these areas. Over time, large ponderosa pine trees would be more apparent.

Bandit Springs and Marks Creek Snow Parks are accessible year round. Within 0.25 miles of Bandit Springs Snow Park, approximately 40 acres would be commercially harvested, 16 acres would be precommercial thinned, and 20 acres would be underburned. Within 0.25 miles of Marks Creek Snow Park, approximately 40 acres would be commercially harvested, 20 would be precommercial thinned, and 38 would be underburned. Activities would be visible, such as scorched trees, stumps, slash piles, and exposed dirt. There would be log haul traffic on Roads 2630 and 2630-113; however, haul would be restricted on weekends. See Table 47 for the amounts of activities by alternative within 0.25 mile of these snow parks.

Table 47. Acres of activities within 0.25 mile of snow parks.

Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Commercial	0	82.7	0	79.9	79.9
Precommercial Thinning	0	41.2	181.7	44	44
Hardwood	0	21.6	21.6	21.6	21.6
Natural Fuels Underburning	0	154.1	96.3	155.3	153.9
Total	**0**	**299.6**	**299.6**	**300.8**	**299.4**

Alternative 3

Precommercial thinning and underburning activities would have short-term impacts on users, such as noise from thinning activities and smoke during underburning. Blackened ground and vegetation, and slash and small stumps would be visible. Visual evidence of activities may be apparent to the casual forest visitor at or near these snow parks. Over time, large ponderosa pine trees would be more apparent.

Within 0.25 miles of Ochoco Divide Snow Park, approximately 60 acres would be precommercial thinned and 41 would be underburned. Within 0.25 miles of Bandit Springs

Snow Park, approximately 58 acres would be precommercial thinned and 17 acres would be underburned. Within 0.25 miles of Marks Creek Snow Park, approximately 34 acres would be precommercial thinned and 38 acres would be underburned. Activities would be visible, such as scorched trees, exposed stumps, slash piles, and exposed dirt.

Cumulative Effects

In 2005, the Forest Service published a rule (36 CFR 212) for providing motor vehicle access to the national forests and grasslands. When implemented, the rule prohibits use of motor vehicles outside or off designated roads, trails, and areas. Some trails, roads, and areas will be closed in the future and others will be designated for motorized travel. The implementation date is expected to be in 2009. The Ochoco National Forest is in the preliminary process of developing a proposed action. This effort is not expected to alter recreational use of these snow parks because the use of over-snow vehicles is exempted from the requirement to designate roads, trails, and areas for motor vehicle use.

There are no other planned or reasonable foreseeable activities that are expected to alter use of these snow parks.

Trails

Affected Environment

There are approximately 24.5 miles of designated trails within the project area. This includes the 14 miles of cross-country ski trails in Bandit Springs Recreation Area (already discussed in the above section), 2.5 miles of cross-country ski trails from the Walton Lake area (Butterfield, Corral Loop, and Drop-Off Trails), 6 miles of the Wildcat Trail in Mill Creek Wilderness, and 4.5 miles of designated snowmobile trails. The Snow Park Tie Trail is a 2.5-mile long snowmobile trail that connects Ochoco Divide Snow Park with the Marks Creek-Independent Trail. Two miles of the Marks Creek-Independent Mine snowmobile trail is within the project area boundary.

User-created trails exist in and around the project area. The endurance ride trail includes three loop trails that go in and out of treatment units. The Mustang Loop is approximately 20 miles, the High Loop is 30 miles, and the Pony Loop is 12 miles.

Environmental Consequences

Alternative 1

There would be no effects to the trails or trail use in the project area. Trail maintenance activities would continue.

Alternatives 2, 4, and 5

All of the action alternatives include activities near or adjacent to trails. Commercial harvest, precommercial thinning, and fuels activities would create short term (3-5 years) and long term (10-15 years) effects that would be evident to the casual visitor. Visitors would see stumps, piles, bare soil, smoke, and boundary tags. Trails that lie within or adjacent to commercial harvest units would be impacted directly from logging operations and post-harvest activities including noise, dust, logging traffic, altered scenery from slash or thinning, timber falling, and skid trails. As a result, the natural recreation experience may be altered due to short term disturbance of solitude and primitiveness. In the long term, the visual quality would be enhanced as more large ponderosa pines develop and views of open, park-like stands become more frequent.

Precommercial thinning activities would leave small diameter (9 inches dbh) trees on the ground after they have been cut. Thus, traveling off of trails and roads would be more difficult for 3-8 years until slash from logging and precommercial thinning is burned. Mountain bikers would have a difficult time if riding off trails and roads, but hikers and horseback riders would still be able to step over the small trees. To lessen the impacts to designated cross-country ski trails, there would be limited times to conduct logging operations. Prior to the use season, any logging slash on designated trails would be removed. Landings would not be located on designated trails. To lessen the impacts on the endurance ride held the third weekend in July, the portions of the permitted trail that are within the project area would have all slash pulled back from the trail 2 weeks prior to the event. See Tables 48 and 49 for the amount of trails and snowmobile trails within/adjacent to units by alternative.

Alternative 3

Activities would focus in stands which have abundant numbers of small (less than 9 inches dbh) trees. Small tree densities would be decreased, single-storied open conditions would become more abundant, and fire-tolerant ponderosa pine and larch would be maintained. Precommercial thinning and fuels activities would create short term (3-5 years) and long term (10-15 years) effects that would be evident to the casual visitor. In the short term, the visual quality may be affected as visitors would see exposed stumps, piles, bare soil, smoke, and boundary tags. The visible stumps would be smaller and, therefore, would deteriorate faster. There would be decreased stand densities and fewer small trees which would open up the views of surrounding areas and natural features. There would be reduced screening along the trails due to the decrease in small diameter trees. In the long term, the visual quality would be enhanced as more large ponderosa pines develop and views of open, park-like stands become more frequent.

The scatter/lop fuel treatment would leave more small trees scattered on the ground. Traveling off of trails and roads would be more difficult for 3-8 years until slash from precommercial thinning is burned. Thus, mountain bikers would have a difficult time if riding off trails and roads, but hikers and horseback riders would still be able to step over the small trees. The activity area would not be closed and summer users would not be temporarily displaced. There would be no conflicts between recreation users and logging traffic.

Table 48. Miles of Walton Lake cross-country ski trails within or adjacent to units.

Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Commercial	0	0.3	0	0.3	0
Precommercial Thinning	0	0.5	0.8	0.5	0.5
Hardwood	0	0	0	0	0
Natural Fuels Underburning	0	0.6	0.6	0.6	0.6
Total	**0**	**1.4**	**1.4**	**1.4**	**1.1**

Table 49. Miles of snowmobile trails within or adjacent to units.

Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Commercial	0	0.5	0	0.5	0.5
Precommercial Thinning	0	0.6	1.5	1.5	0.6
Hardwood	0	0.3	0.3	0.3	0.3
Natural Fuels Underburning	0	0.9	0.5	0.9	0.9
Total	**0**	**2.3**	**2.3**	**2.3**	**2.3**

Cumulative Effects

In 2005, the Forest Service published a rule for providing motor vehicle access to the national forests and grasslands. When implemented, the rule prohibits use of motor vehicles outside or off designated roads, trails, and areas. Some trails, roads, and areas will be closed in the future and others will be designated for motorized travel. The implementation date is expected to be in 2009. The Ochoco National Forest is in the preliminary process of developing a proposed action. This effort is expected to alter trail use. However, until a proposed action is developed it is not possible to describe the expected effects because the roads, trails, and areas that will be designated for motorized use is uncertain.

There are no other planned or reasonable foreseeable activities that are expected to alter trail use in the project area.

Wilderness

Affected Environment

The Mill Creek Wilderness encompasses 17,400 acres; 3,668 acres are within the project area. The Mill Creek Wilderness is the largest wilderness on the Ochoco National Forest and is the most heavily used. Use is primarily due to easy access and proximity to the city of Prineville. Elevations range from 3,725 to 6,640 feet above sea level. The terrain varies from the rugged, rocky cliffs of Desolation Canyon to the flat meadows of Bingham Prairie. Spectacular rock outcrops are present at Twin Pillars and Whistler Point. Many users accessing the eastern third of the wilderness camp or park at White Rock Campground and hike or ride horseback on the Wildcat Trail. There are also several dispersed campsites along the eastern boundary that receive heavy use during the fall hunting months. Other dispersed campsites exist within the wilderness area and are primarily located at springs, along streams, adjacent to meadows, or other attractive and accessible features. Management emphasis for this area is to protect the wilderness ecosystem and to maintain a natural setting and preserve solitude.

In August and September 2000, the Hash Rock Fire burned 14,236 acres of the Mill Creek Wilderness, including 2,846 acres within the Marks Creek Watershed. The Hash Rock Fire damaged approximately 15.5 miles of trail in the Mill Creek Wilderness. These trails have been repaired. These trails are scheduled to be maintained annually.

Environmental Consequences

Alternative 1

There would be no direct or indirect effects to the wilderness area. Recreation users would continue to access and enjoy the wilderness.

Alternative 2

There would be no direct effects to the Mill Creek Wilderness. Where commercial harvest units border the wilderness, users may encounter evidence of logging operations and post-logging treatments such as noise, stumps, slash piles, smoke, and blackened vegetation. Similar evidence of thinning and underburning activities would also be apparent. Over time, the health of remaining trees would be improved, which in turn, would improve scenic quality.

Roads that are reconstructed within 0.25 miles of the wilderness boundary would be closed to minimize illegal motorized access in the wilderness. Within 0.25 miles of the wilderness boundary, there would be approximately 0.2 miles of new road construction and 0.4 miles of road reconstruction. After commercial harvest activities, the new road would be decommissioned. Decommissioned roads would be scarified, seeded, and water barred after use. The reconstructed road would be closed when done using it. Visuals may be affected as road beds would be evident in the long run but would eventually become overgrown with vegetation.

Recreation users would continue to access the wilderness. Approximately 1.3 miles of the Wildcat Trail are within or adjacent to units. Users may encounter noise, dust, and smoke if they are present when these activities occur. As a result, the natural recreation experience may be altered due to short term disturbance of solitude and primitiveness. See Table 50 for number of miles of the Wildcat Trail within/adjacent to units for all alternatives.

Alternative 3

There would be no direct effects to the wilderness area. Where precommercial thinning units border the wilderness, indirect effects include noise and visual evidence from thinning and underburning activities such as chainsaw noise, smoke, and blackened vegetation. Over time, the health of remaining trees would be improved, which in turn, would improve the scenic quality. No road construction or commercial harvest would occur. Recreation users would continue to access the wilderness. Approximately 0.8 miles of the Wildcat Trail are within or adjacent to units. Users may encounter noise, dust, and smoke if they are present when these activities occur. As a result, the natural recreation experience may be altered due to short term disturbance of solitude and primitiveness.

Alternative 4

There would be no direct effects to the Mill Creek Wilderness. Where commercial harvest units border the wilderness, users may encounter evidence of logging operations and post-logging treatments such as noise, stumps, slash piles, smoke, and blackened vegetation. Similar evidence of thinning and underburning activities would also be apparent. Over time, the health of remaining trees would be improved, which in turn, would improve scenic quality. There would be no road construction or reconstruction within 0.25 miles of the wilderness boundary. Recreation users would continue to access the wilderness. Approximately 1.1 miles of the Wildcat Trail are within or adjacent to units. Users may encounter noise, dust, and smoke if they are present when these activities occur. As a result, the natural recreation experience may be altered due to short term disturbance of solitude and primitiveness.

Alternative 5

There would be no direct effects to the Mill Creek Wilderness. Where commercial harvest units border the wilderness, users may encounter evidence of logging operations and post-logging activities such as noise, stumps, slash piles, smoke, and blackened vegetation. The prescriptions in this alternative include leaving clumpier stand structures and leaving higher densities in moist areas. In the long term, the visual quality would be enhanced as more large ponderosa pines develop and views of open, park-like stands become more frequent. Treatments would improve the long-term health of timber stands, thus creating a more appealing natural setting. There would be no road construction or reconstruction within 0.25 miles of the wilderness boundary. Recreation users would continue to access the wilderness. Approximately 1.3 miles of the Wildcat Trail are within or adjacent to units. Users may encounter noise, dust, and smoke if they are present when these activities occur. As a result, the natural recreation experience may be altered due to short term disturbance of solitude and primitiveness

Table 50. Miles of the Wildcat Trail within or adjacent to units.

Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Commercial	0	0.7	0	0.5	0.7
Precommercial Thinning	0	0.6	0.8	0.6	0.6
Hardwood	0	0	0	0	0
Natural Fuels Underburning	0	0	0	0	0
Total	**0**	**1.3**	**0.8**	**1.1**	**1.3**

Cumulative Effects

There are no other ongoing, planned, or reasonable foreseeable activities that are expected to affect the Mill Creek Wilderness. Recreation users are expected to continue to access and enjoy the wilderness.

Soils

Compaction and Displacement

Affected Environment

The project area contains a wide variety of soils. Soils in the project area may be affected by erosion, compaction, and/or displacement. The potential for effects to soils is directly related to the number of acres of each activity proposed.

To maintain site productivity, the Forest Plan includes a standard for soil compaction and displacement. At a minimum, at least 80 percent of the activity area should be in a non-compacted/non-displaced condition within 1 year of any management activity. The standard is applied at an individual scale such as a unit of a timber sale. The January 10, 2007, Soils Report for this project more fully describes the soil standard and can be found in the project record.

Detrimental soil conditions result from compaction, displacement, and charring. Compaction is the packing together of soil particles by exerting force at the soil surface and a resulting increase in soil density. Roads, log landings, and skid trails are typically areas that are detrimentally compacted during commercial timber harvest activities. Displacement is the movement or rearrangement of the soil so that normal processes are affected. Displaced soils are often loosened and are more susceptible to erosion. Roads, log landings, and skid trails are typically areas that are detrimentally displaced during commercial timber harvest activities. Soil charring can occur when concentrations of fuels are burned and the soil becomes superheated. This causes loss of organic matter and hydrophobic soil conditions can result from the cooked waxes and resins in the surface ash layer. Typically, charring occurs on landings where large piles (concentrations) of slash are burned. Burning of hand and grapple piles does not typically result in detrimental charring because of the small pile size.

The existing condition of the soils resource was determined by the Forest soil scientist and other members of the interdisciplinary team. A combination of local knowledge, walk-through transecting, and aerial photo interpretation was used to determine existing soil disturbance for each unit. This unit-by-unit evaluation of existing soils condition was completed and is contained in Appendix B to this EIS. This unit-by-unit evaluation includes an assessment of harvest units and grapple piling units. Other non-harvest activities were not included because they are not expected to cause detrimental soil disturbance. Existing disturbance was quantified to the nearest ten percent bracket (0-10, 10-20, etc.), estimates were made as to tilling potential based on soil type and slope, and unit-specific mitigations identified where needed to ensure compliance with the soil standard. The evaluation of existing conditions reveals that more than half of the acres included in commercial harvest units currently exceed 20 percent detrimental soil conditions.

Environmental Consequences

Tractor (ground-based) logging systems can cause the highest amount of soil impacts and can result in exceeding the soil standard if not carefully designed and actively monitored. Classic, rubber-tired skidders and skidding crawler-type tractors are used on an average 100-foot skid trail spacing to skid logs to the landings which are accessed by roads. The main skid trails comprise the majority of the detrimental disturbance, which is largely compaction and displacement. Skid trails on an average of 100-foot spacing contribute roughly 10-15 percent detrimental disturbance in an average unit with landings and roads making up an additional 5 and 2 percent, respectively. Overall, potential for detrimental soil conditions is 17-22 percent per entry; this does not include any mitigation or other measures to reduce potential impacts, nor does it include existing levels of detrimental disturbance. Past harvest practices have often led to unacceptable amounts of detrimental soil conditions. Current practices confine disturbance largely to existing skid trails and landings from prior entries.

Helicopter logging systems are used on steeper slopes, in areas where road building is difficult or expensive, and/or in areas where tractor logging would cause unacceptable resource effects. The economic costs are higher for this type of logging and the impact to the soil resource are lower. Detrimental disturbance averages 2 to 5 percent per entry, primarily on roads and landings.

Skyline logging systems are used largely on steeper slopes where there is sufficient deflection for the use of cable operations. They usually have an access road at the top of the unit or drainage with landings along the roads. Detrimental disturbance averages 6 to 12 percent per entry, primarily on roads, skyline corridors, and landings.

Grapple piling of slash is used to reduce fuel loadings in harvest units. The objective is to lessen fuel loading and break up fuel continuity, not remove all fuel from a site. Grapple piling is achieved using boomed equipment that is required to stay on previously disturbed areas. Fuels objectives can be achieved with little or no additional soil impacts.

Yarding with tops attached (YTA) is another treatment to reduce fuel loadings in harvest units. This treatment results in lower fuel amounts inside the harvest unit by concentrating slash at the log landings. This requires larger landings and more intense heat results when the landing piles are burned, producing more charred soil. Since the landings are situated most often on top of old landings and disturbed areas from prior activities, this usually does not result in a net increase in detrimental soil conditions. For tractor harvest units, YTA skid trails are somewhat wider due to the sweeping action of the limbs.

Recent monitoring results on the Ochoco National Forest (Blackbear Timber Sale) show that detrimental soil conditions can be kept within acceptable levels using tractor logging systems. This requires that design elements be followed and that the need for tilling be evaluated after harvest activities. Reuse of existing detrimentally disturbed areas can result in little or no additional impacts to soils.

Several other types of treatments are also proposed which generally do not result in detrimental soil impacts. These treatments include: precommercial and hardwood thinning, underburning, and activity-fuels hand piling and burning. Soil disturbance that may result from these activities is limited in scale, and of such a light intensity, that no detrimental compaction, displacement, or charring is expected. These activities do not involve the use of heavy equipment such as bulldozers. No measurable detrimental effects to the soil resource are expected from these activities under any alternative.

Soil tilling is proposed to alleviate detrimental compaction. It is feasible in deeper ash soils on slopes of 30 percent or less. Heavy equipment is used and tilling would be focused on skid trails and landings which are excess to current and future management needs.

Table 51. Acres of activities by alternative.

	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Tractor Harvest	5,366	0	4,177	3,325
Helicopter Harvest	724	0	758	617
Skyline Harvest	82	0	0	0
Precommercial and Hardwood Thinning	11,356	9,899	11,131	11,148
Grapple Piling	3,015	0	2,490	2,150
Hand Piling	718	856	793	881
Yard Tops Attached	333	0	439	400
Activity Fuels Underburning	9,953	8,323	9,824	9,503
Natural Fuels Underburning	5,511	5,603	5,338	4,702
Road Impacts	30	0	8	6
Soil Tilling*	120	0	95	88

*The actual amount of tilling would be based on post-harvest monitoring. These acres are the minimum acres that are estimated to be required to meet the soil standards on a unit-by-unit basis (see Appendix B).

Alternative 1

This alternative is the no action alternative and would not affect soils. Existing natural processes would continue. No soil tilling would be performed. Recovery of existing soil compaction would occur through natural processes. These processes include frost heaving in the top 4 to 6 inches of soil and biopedoturbation (soil disturbance by organisms such as rodents, insects, arthropods, and worms). This natural process can take hundreds of years to fully restore damaged soils. Fire intensities would potentially be more severe resulting in more detrimental charring and hydrophobic soil conditions.

Fuels reductions would not occur thereby increasing the risk of increased oxidation and mineralization of nutrients such as nitrogen and potassium. This may result in increased fire severity which can reduce site productivity (Harvey et al. 1991).

This alternative would comply with the regional and Forest Plan soil standards.

Alternative 2

This alternative includes the most timber harvest, as well as the most ground-based harvest. This alternative has the greatest potential to increase the amount of detrimental soil compaction, displacement, and charring. This alternative has unit specific mitigations and practices identified which would ensure that activity units meet the soil standards (see unit-by-unit soils analysis in Appendix B and Chapter 2, design elements). These include design of logging systems, avoidance of specific areas, and soil tilling. This alternative creates approximately 30 acres of detrimental soil compaction and displacement due to construction of new roads. This alternative would result in approximately 120 acres of tilling to alleviate detrimental soil compaction.

Some detrimental soil charring is expected to occur under the grapple piles and at landings where YTA occurs. This detrimental charring would be of a low percentage (estimated to be 5 to 6 piles per acre at 100 square feet/pile which yields 1.1 to 1.3 percent impacts which are mostly on existing trails and landings). Underburning would result in a very small amount of detrimental charring in areas where existing fuel loadings are high. This is estimated to occur only on a fraction of 1 percent.

This alternative would comply with the regional and Forest Plan soil standards.

Alternative 3

This alternative has the least potential to increase the amount of detrimental soil disturbance. No soil tilling would be performed. Existing natural processes would continue. Recovery of existing soil compaction would proceed at a natural rate. Some small areas of charring may occur under fuel concentrations, but would be limited in scope and expected to be less than 5 percent of the treated acres. This alternative would result in no net increase in the amount of area which exceeds the 20 percent detrimental soil condition standard.

This alternative does not include grapple piling or commercial harvest. Underburning would result in a small amount of charring in areas where existing fuel loadings are high. This is estimated to occur only on a fraction of 1 percent of the area burned. There would be no net increase of detrimental soil conditions. The failure to thin young sawtimber component (from 9 to 14 inches dbh) would increase per acre standing fuel loadings which would increase fire intensity and severity in the future especially in reburn conditions (Shank 2004).

This alternative would comply with the regional and Forest Plan soil standards.

Alternative 4

This alternative proposes less harvest and less tractor harvest than Alternative 2. This alternative has unit specific mitigations and practices identified which would ensure that all activity units meet the soil standards (see Appendix B). These include design of logging systems, avoidance of specific areas, and soil tilling. Implementation of this alternative would result in approximately 95 acres of tilling to alleviate detrimental soil compaction, both existing and new.

This alternative includes approximately 8 additional acres of detrimental soil impact due to construction of roads.

Some detrimental soil charring is expected to occur under grapple piles and at landings where YTA occurs. This detrimental charring would be of a low percentage (estimated to be 5 to 6 piles per acre at 100 square feet/pile which yields 1.1 to 1.3 percent impacts which are mostly on existing trails and landings). Underburning would result in a very small amount of detrimental charring in areas where existing fuel loadings are high. This is estimated to occur only on a fraction of 1 percent.

This alternative would comply with the regional and Forest Plan soil standards.

Alternative 5

This alternative proposes less harvest and less tractor harvest than Alternatives 2 and 4. This alternative has unit specific mitigations and practices identified which would ensure that all activity units meet the soil standards (see Appendix B). Implementation of this alternative would result in approximately 88 acres of tilling to alleviate detrimental soil compaction, both existing and new. This alternative includes approximately 6 acres of detrimental soil impact due to construction of roads.

Some detrimental soil charring is expected to occur under the grapple piles and at landings where YTA occurs. This detrimental charring would be of a low percentage (estimated to be 5 to 6 piles per acre at 100 square feet/pile which yields 1.1 to 1.3 percent impacts which are mostly on existing trails and landings). Underburning would result in a very small amount of detrimental charring in areas where existing fuel loadings are high. This is estimated to occur only on a fraction of 1 percent.

This alternative would comply with the regional and Forest Plan soil standards.

Cumulative Effects

Analysis of the entire project area indicates that approximately 15 percent of the area has detrimental soil conditions. Existing detrimental soil conditions are primarily related to past harvest activities, road building, and activities on private land. There was a slight increase (10 acres) in detrimental soil conditions due to fire lines built during the suppression of the Hash Rock Fire. Rehabilitation of all fire lines has been completed. Detrimental soil conditions related to the fire itself were low and limited to localized charring. Post-fire monitoring within Harpo Timber Sale units that were burned indicates little soil damage caused by the fire and vegetative recovery of 75 to 80 percent has occurred. Other rehabilitation efforts associated with the Hash Rock Fire include culvert removal, road closure, and riparian/hardwood planting. None of these activities increased the amount of detrimental soil conditions across the project area.

The most recently logged sales in the project area, Marks and Harpo, have had the harvest activities complete for several years. Post-harvest monitoring indicated that soil tilling was not needed to decrease detrimental soil conditions as a result of the harvest activities.

The Pick-Up Salvage Sale (completed in 2002) removed already downed trees utilizing existing roads, skid trails, and landings. It did not contribute additional detrimental effects on the soil resource in the project area. The Cougar Salvage Sale (completed in 2006) removed dead trees and did not contribute additional detrimental effects on the soil resource.

Mass Wasting

Affected Environment

Massive rotational slump and earth flow landslides were the predominant land forming processes in the past. The dormant deep landslides, which shape the project area, were probably active throughout the past 1 million years. They were probably triggered by a combination of tectonic activity and high precipitation. They naturally adjust as the streams cut the toes of the landslide debris and as natural fires, insect and disease infestations removed vegetation, allowing increased precipitation to saturate the soils. Numerous seeps and springs are present all across the project area, confirming the scrambled nature of the landform.

Based on an air photo interpretation, the project area has a series of dormant and active landslide terrain composed of scarps and debris lobes. Seven small active landslides (2.5 to 4 acres in size) are located on midslopes, within larger dormant landslide terrain, on the Clarno Formation. One active landslide (4 acres) is contained within a small draw on Road 3350-230, which crosses the active landslide midslope. A rock blanket has been constructed on the cutslope adjacent to a more recent fill failure, which occurred during the winter of 1997. The culvert in the draw failed, causing a new translational slide on the already active slope. This site has been reconstructed. Road 3350-230 is currently under a year-round wildlife closure and has a locked gate at the junction with Road 3350-200. A 1.5-acre rotational landslide is adjacent to Road 3300-503 in the headwaters of Salmon Creek; this landslide was reactivated in 1998. One debris flow is in T. 13 S., R. 18 E., Section 13 near the Mill Creek Wilderness trail. The fourth debris flow is in a Harpo Timber Sale unit. The debris flow occurred in 1998. The fluid debris blocked Road 3350-200, flowing across the road and down the slope toward Road 3350-230. The fifth landslide is a road-related rotational slide on Road 2610-050 on the east side of Marks Creek (T. 13 S., R. 19 E., Section 31). The fill has been repaired. The sixth active landslide is on Road 2600-012 (T. 13 S., R. 19 E., Section 16) in the Shamrock area. This landslide terrain reactivated in 1998. The subsequent road failure was repaired in 2001. The draw has active tension cracks, jackstraw trees, and a sag pond. The seventh landslide (3.3 acres) is located in T. 13 S., R. 18 E., Section 13, between Units 119 and 120.

The majority of the project area (87%) is at a low to moderate risk for reactivation by management activities such as road construction or harvest, or by the continued weather pattern of higher precipitation. Eighteen acres are active landslide terrain. Approximately 13 percent of the project area is within mapped dormant landslide terrain. The dormant landslide terrain extends across the length of the project area and is considered to be at moderate risk for reactivation by management activities such as road construction or harvest, or by the continued weather pattern of higher precipitation.

The majority of the dormant landslide originates on Clarno Formation within the project area. Perched ponds and springs are located along the benches nestled within the landslide scarps. When the dormant landslides were more active, they contributed a portion of the existing sediment currently occupying the flood plains of the stream courses. Based on limited stream surveys, there is evidence that the stretches of Jim Elliott and Sears Creeks with greater than 20 percent cutbank erosion are adjacent to the toes of dormant landslides in the upper reaches.

History has shown the land to be responsive to rain-on-snow events, especially below the 4,500-foot elevation. When the landslide debris and the shallow ash soils are saturated, there is potential for an increase in slope movement, which has resulted in debris flows and small rotational landslides within the project area. Above 4,500 feet elevation, the ground is generally still frozen and snow covered. Fewer debris flows and rotational slides occur in this region.

Construction of roads across landslide debris has the potential to compact the debris, creating a dam-like feature, which may collect water upslope, increasing pore water pressure to the point of failure. Minimizing the height of cuts and fills and maintaining adequate drainage help to reduce potential sediment delivery. The construction methods and design criteria which incorporate geotextile, filter rock, reinforced rolling dips, adequately sized pipes, placement frequency, and surface aggregate will reduce the risk of road-related failures. When the unconsolidated landslide debris is saturated, there is a potential for movement with subsurface water flow down slope. Construction of roads and trails on active and dormant landslides may accelerate erosion by changing the subsurface flow patterns, causing increases in pore water pressure, and subsequent reactivation of slope movement. Portions of the existing road system were constructed on dormant and active landslides.

Management activities have the ability to affect the stability of the land. When there is a change in the ground water flow through the unstable terrain, the potential is increased for slope movement. Rapid shallow debris flows and deeper rotational slides can result, altering the vegetation potential and potentially releasing sediment into the stream systems, depending on proximity to the riparian areas. Careful alignment of trails and roads, in addition to streamside protection will help to reduce sedimentation. Changes in precipitation patterns and climate will have their own effects on the erosion rates.

Although central Oregon is no longer affected by the past moist climate, which contributed to the generation of the landslide features shaping the mountains today, there is the potential to reactivate the dormant landslides. Soil compaction due to management activities across landslide debris may change the water flow through the soil pores, potentially affecting the stability of the slope. When the toe slopes of the deep seated landslides abut live streams, they are prone to active erosion. Through time, the landslide debris has reached an equilibrium on the hill slopes. As the stream erodes the toe slopes, the natural balance is upset. Accelerated erosion can occur, causing a decrease in water quality as additional sediment is introduced into the system. The goal is to not increase the pace of mass wasting events beyond the natural background.

Environmental Consequences

Alternative 1

Under this alternative, no timber harvest, road construction, or other activities that would affect dormant and active landslide terrain would occur. The natural process of erosion under the current precipitation pattern would continue. There would be no direct, indirect, or cumulative effects.

Alternative 3

The proposed treatments of precommercial thinning and underburning would have no direct effects on increasing slope instability. Indirectly, the activities would encourage increased growth of the vegetation, which would increase the evapotranspiration and increase slope stability.

Alternatives 2, 4, and 5

The intensity and style of management activity on landslide terrain, in the vicinity of seeps and springs, may potentially change the drainage pattern which increases the risk for instability. Generally, commercial harvest does not measurably alter groundwater movement, except in the vicinity of seeps and springs. Commercial harvest is not expected to substantially reduce the amount of water taken up by the trees through evapotranspiration. Reducing the amount of evapotranspiration would leave more groundwater in the slope, which has the potential to change slope stability.

The acres of dormant and active landslide terrain are spread across the project area. Alternative 2 proposes management on more acres in dormant landslide terrain than Alternatives 4 or 5. Alternative 2 includes 1,423 acres of commercial harvest on dormant landslide terrain. Alternative 4 includes 1,062 acres of commercial harvest on dormant landslide terrain. Alternative 5 proposes the least amount of harvest on dormant landslide terrain; it includes 904 acres. Helicopter and skyline logging systems are less likely to increase instability than a tractor logging system which tends to compact the soil, changing groundwater flow patterns, and potentially altering slope stability.

Units located on the upper slopes of dormant landslide scarps have a slightly increased potential for reactivating the landslide debris on the lower slopes when combined with higher precipitation or a rain-on-snow event like those that occurred in 1997, due to the potential increase flow of groundwater to the lower slopes. Alternative 5 would have slightly less of an effect than Alternative 4 and definitely less than Alternative 2.

There are areas of active landslides on or near Roads 3350-200, 3350-230, 2610-050 and 3300-503. The use of these roads for haul is not expected to increase the potential for mass wasting. Road 3300-503 is expected to self-close, as the landslide scarp retreats into the roadbed. Under all the alternatives, Road 3300-503 and 3350-200 are proposed for reconstruction, which would reduce the potential for future failures by replacing culverts, modifying cross drains, and ensuring proper drainage is maintained.

Cumulative Effects

Potential risk for an increase in sediment transport due to mass wasting is low to moderate for all the action alternatives. There are no past, ongoing, or reasonably foreseeable activities that would reduce slope stability and increase mass wasting.

Visual Quality

Affected Environment

The Forest Plan allocated some areas to visual management, including corridors along U.S. Highway 26, Forest Roads 27, 2630, and 2210, and recreation sites such as Bandit Springs Recreation Area. The Visual Quality Objectives for these areas are retention or partial retention which means that the general emphasis in these areas is to maintain the natural-appearing character of the forest. There is an estimated 7,564 acres in the project area that are included in these visual management allocations. Approximately 5,586 acres are included in the U.S. Highway 26 Scenic Corridor, 1,580 acres in the Bandit Springs Recreation Area, 55 acres in the Forest Road 27 corridor, 292 acres in the Forest Road 2630 corridor, and 51 acres in the Forest Road 2210 corridor.

The existing scenery has a variety of disturbed and undisturbed areas. Human-caused activities have altered the natural-appearing landscape. Diverse vegetation stands and species (with various age, size classes, and health conditions) can be found throughout the project area. These vegetation stands include: ponderosa pine, lodgepole pine, western larch, Douglas-fir, grand fir, white fir, and riparian species. They provide strong diverse lines and textural and color patterns broken up only by occasional filtered-view openings into the foreground landscape.

Although the existing forest conditions may appear natural to a casual visitor, the forest conditions are not natural. Older trees are being suppressed by the densely stocked understory due to the change in fire regime caused by fire exclusion. Densely stocked forest and canopy closure, due to fire exclusion, has led to the loss of the open, park-like ponderosa pine stands historically found within the area. Overstocked and dense stands in parts of the project area have led to serious fire risk. The natural processes can no longer function as they did historically because of these dense stand conditions.

The competition for available space, nutrients, and the encroachment from shade-tolerant understories is prevalent, especially along the travel and scenic corridors (within 0.25 miles). The depth-of-field view deep into the forest is restricted to mostly the immediate foreground area of the landscape due to the high level of vegetation.

Environmental Consequences

Alternative 1

Under this alternative, the existing vegetation within the project area would not be altered or changed by any management activity. Scenery would remain essentially the same during the short-term duration (0-5 years) and may be adversely altered through time (5 years and longer) as multi-strata conditions continue to increase. Encroachment by shade-tolerant species would continue and stand densities would continue to increase. Views of open, park-like stands of older and larger ponderosa pine would become less frequent.

Alternative 2

Approximately 4,576 acres within visual corridors would be treated to enhance long-term scenic quality through commercial thinning, precommercial thinning, and underburning activities. After implementation, the proposed activities within visual management corridors would have short-term (0 to 5 years) effects on scenery. Stumps, slash, and smoke during burning activities would be evident. However, in the long-term, scenery would be enhanced and the vegetation would be moved to more sustainable conditions. Sufficient levels of residual trees would remain on site to meet desired conditions. Table 52 displays the amount of activities within visual corridors for all alternatives.

Management activities would occur within the U.S. Highway 26 Scenic Corridor, Bandit Springs Recreation Area, and travel corridors along Forest Roads 27, 2630, and 2210 within retention and partial retention visual management allocations. Commercial harvest and precommercial thinning would occur within densely stocked stands. Treatments would enhance and maintain scenery by removing understory trees. This would allow the development of more large ponderosa pine and views of large ponderosa pine would become more frequent.

There would be approximately 11.2 miles total of road work within the visual corridors. This includes approximately 3 miles of new road construction and closing the roads after timber hauling and 0.4 miles of new road construction and decommissioning the roads after timber hauling. 1.3 miles of existing roads would be decommissioned and 2.8 miles of existing roads would be closed following timber haul. Newly constructed road beds would be evident in the long run but would eventually become overgrown with vegetation. Decommissioned roads would be scarified, seeded, and water barred after use. However, only 0.2 miles of a newly constructed road would take off directly from the visual corridor on Forest Road 27. This new road would be apparent to the visitor, but it would be decommissioned following commercial harvest activities. The other proposed new roads would not take off directly from the visual corridors so new road construction would not be apparent to the casual visitor.

"Filtered views" deep into the forested landscape, including views into the gentle rolling hills, would be created. This would enhance the existing scenery. Open, park-like stands of older structure ponderosa pine stands would be more readily seen along travel corridors. The "tunnel" effects currently found throughout the project area would be reduced and would become diversified with more openings in treated areas. After the short-term effects of treatment activities (disturbed soil, slash, scorched vegetation) have recovered, the diverse scenic views are expected to enhance a visitor's experience along these corridors.

Forest Plan direction would be met with the retention of residual trees, post-treatment clean up activities, and implementation of design elements. This alternative would better enhance the visual quality than the other alternatives.

Alternative 3

Approximately 4,414 acres within visual corridors would be treated to enhance long-term scenery through precommercial thinning and underburning activities. Under this alternative, the effect on scenery is expected to be less than the other alternatives since only small understory trees would be removed.

Precommercial thinning and underburning would have short term effects on scenery, such as stumps, slash, scorched vegetation, and smoke. However, in the long-term, scenery would be enhanced and the vegetation would be moved toward more sustainable conditions. Sufficient levels of residual trees would remain on site to meet desired conditions.

Management activities would occur within the U.S. Highway 26 Scenic Corridor, Bandit Springs Recreation Area, and travel corridors along Forest Roads 27, 2630, and 2210 within rRetention and partial retention visual management allocations. The long term (20 years and longer) scenic quality within the treatment areas may improve slightly or would remain the same as the existing condition. Less alteration to the scenery would occur due to the removal of smaller, understory trees.

There would be no new road construction.

"Filtered" views would only be created in two-storied stands which do not have a mid-canopy layer. Fewer views of open ponderosa pine would be visible than in the other action alternatives. The retention of green trees following treatment would maintain scenery.

The Forest Plan direction would be met through retention of residual trees, post-treatment clean up activities, and implementation of design elements. This alternative would move less of the area toward the desired future condition for scenic resources than the other action alternatives.

Alternative 4

Approximately 4,657 acres within visual corridors would be managed to enhance long-term scenic quality through commercial thinning, precommercial thinning, and underburning activities. Management activities within the visual corridors would have a short-term effect on scenery due to slash, stumps, blackened vegetation, and smoke. However, in the long-term, scenery would be enhanced and the vegetation would be moved to more sustainable conditions.

Management activities would occur within the U.S. Highway 26 Scenic Corridor, Bandit Springs Recreation Area, and travel corridors along Forest Roads 27, 2630, and 2210 within visual management allocations. Commercial harvest and precommercial thinning would occur within densely stocked stands and would remove understory trees. Treatments would enhance and maintain scenery. This would allow the development of more large ponderosa pine and views of large ponderosa pine would become more frequent.

There would be approximately 8.2 miles total of road work within the visual corridors. This includes approximately 0.8 miles of new road construction and closing the roads after timber hauling and 0.2 miles of new road construction and decommissioning the roads after timber hauling. 1.0 mile of existing roads would be decommissioned and 2.8 miles of existing roads would be closed following timber haul. Newly constructed road beds would be visible in the long run but would eventually become overgrown with vegetation. Decommissioned roads would be scarified, seeded, and water barred after use. One of the proposed new roads would take off directly from the visual corridor along Road 27; this road would be decommissioned following commercial harvest activities and would be apparent to the casual visitor for a period of time.

“Filtered views” deep into the forested landscape, including views into the gentle rolling hills, would be created. This would enhance the existing scenery. Open, park-like stands of older structure ponderosa pine stands would be more readily seen along travel corridors. The “tunnel” effects currently found throughout the project area would be reduced and would become diversified with more openings in treated areas. After the short-term effects of treatment activities (disturbed soil, slash, scorched vegetation) have recovered, the diverse scenic views are expected to enhance a visitor’s experience along these corridors.

Forest Plan direction for scenic resources would be met with the retention of residual trees, post-treatment clean up activities, and implementation of design elements. This alternative would enhance the visual quality of the project area.

Alternative 5

Approximately 4,572 acres within visual corridors would be managed to enhance long-term scenic quality through commercial thinning, precommercial thinning, and underburning activities. Management activities within the visual corridors would have a short-term effect on scenery due to slash, stumps, blackened vegetation, and smoke. However, in the long-term, scenery would be enhanced and the vegetation would be moved to more sustainable conditions.

Management activities would occur within the U.S. Highway 26 Scenic Corridor, Bandit Springs Recreation Area, and travel corridors along Forest Roads 27, 2630, and 2210 within visual management allocations. Commercial harvest and precommercial thinning would occur within densely stocked stands and would remove understory trees. Treatments would enhance and maintain scenery. This would allow the development of more large ponderosa pine and views of large ponderosa pine would become more frequent.

There would be approximately 6.8 miles total of road work within the visual corridors. This includes approximately 1.2 miles of new road construction and closing the roads after timber hauling and 0.2 miles of new road construction and decommissioning the roads after timber hauling. 1.0 mile of existing roads would be decommissioned and 1.2 miles of existing roads would be closed following timber haul. Road beds would be visible in the long run but would eventually become overgrown with vegetation. Decommissioned roads would be scarified, seeded, and water barred after use. One of the proposed new roads would take off directly from the visual corridor along Road 27; this road would be decommissioned following commercial harvest activities and would be apparent to the casual visitor for a period of time.

"Filtered views" deep into the forested landscape, including views into the gentle rolling hills, would be created. This would enhance the existing scenery. Open, park-like stands of older structure ponderosa pine stands would be more readily seen along travel corridors. The "tunnel" effects currently found throughout the project area would be reduced and would become diversified with more openings in treated areas. After the short-term effects of treatment activities (disturbed soil, slash, scorched vegetation) have recovered, the diverse scenic views are expected to enhance a visitor's experience along these corridors.

Forest Plan direction for scenic resources would be met with the retention of residual trees, post-treatment clean up activities, and implementation of design elements.

Table 52. Acres of activities within the visual corridors.

Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Commercial	0	1,539	0	1,379	1,123
Precommercial Thinning	0	1,937	3,217	2,100	2,334
Natural Fuels Underburning	0	981	1,078	1,059	996
Hardwood	0	119	119	119	119
Total	0	4,576	4,414	4,657	4,572

Note: The prescriptions for commercial activities also include precommercial thinning and activity fuels underburning. The prescriptions for precommercial thinning also include activity fuels underburning;

Cumulative Effects

There are no cumulative effects related to visual quality within the project area because there are no planned or reasonable foreseeable activities that would alter the visual quality.

Water Quality

Temperature and 303(d) list

Affected Environment

Marks, Little Hay, and Hamilton Creeks are on the 2004/2006 state 303(d) list of Water Quality Limited Water Bodies for summer water temperature. The 2004/2006 Oregon 303(d) list was approved by EPA on February 26, 2007. Table 53 displays the 7-day average, maximum water temperatures for stations on Marks Creek and its tributaries measured from 1997 through 2006. Water temperatures over threshold are indicated in bold. Water temperatures from 1994 through 1996 are on file at the Lookout Mountain Ranger District. The state standard (Oregon Water Quality Standards (OAR) 340-041-0002(56) and 340-041-0004(5)(a)) indicates the 7-day-average maximum temperature of streams identified as having salmon and trout rearing and migration should not exceed 18.0 degrees C (64.4 degrees F).

U.S. Highway 26 is immediately adjacent to a number of reaches on Marks Creek. The loss of shade and channelization resulting from the highway is a major contributor to higher temperatures in Marks Creek. The 2004/2006 303(d) list references 2002 data from Marks 1 (below Peterson Creek) and Marks 2 (above Little Hay Creek). The 1997 data, shown in Table 53 for Marks 3 (below Buck Creek) and Marks 4 (below Cornez Creek), support the extension of the listing to the upper reaches of this creek. Monitoring indicates that the floating 7-day maximum average water temperatures in most of Marks Creek range from the low to mid 70's. Decreases in base flows due to evaporation from Marks Pond, irrigation withdrawals in lower Marks Creek, and shallow groundwater use by homeowners are probably also contributing to higher summer water temperatures. Maximum 7-day floating average water temperatures in Marks Creek tributaries range from the high 60’s to mid 70’s in Crystal and Peterson Creeks to meeting state and INFISH standards in Hamilton and McGinnis Creeks.

Monitoring of Hamilton Creek started in 2001, the year after the Hash Rock Fire, to evaluate the effects of the fire above the 2600-200 road. By 2003, the water temperatures had fallen back below threshold. Based on recent water temperature monitoring, Hamilton Creek should not be on the 303(d) list because the high temperatures were a temporary effect of the Hash Rock Fire.

Other streams in the project area were monitored that are not on the 2004/2006 303(d) list. The station on McGinnis Creek was established to evaluate the effects of the Hash Rock Fire. The fire intensity in this area was lower than in Hamilton Creek and the water temperatures never exceeded the threshold. However, McGinnis Creek shows the same 3-year water temperature recovery observed on Hamilton Creek. The stations on Salmon Creek were established to evaluate the effects of conifer removal from aspen. The conifer trees have since died from a bark beetle infestation. Salmon Creek appears to be over threshold. The temperature monitoring site on Crystal Creek is between 0.1-0.2 miles above it’s confluence with Marks Creek. Monitoring data indicates it is above threshold. Rush Creek was over threshold in 1997, but only had a 7-day average daily maximum water temperature of 63.83 degrees F in 1996.

Table 53. Marks Creek 7-day average maximum water temperatures for 1997-2006.

Station		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Marks 1	7 Day	**72.94**	**72.53**	**70.02**	**73.02**	**72.45**	**73.72**	**74.23**	**72.09**	--	--
	days>64.4	83	64	57	63	76	39+	91	63	--	--
Marks 2	7 Day	64.25	**69.41**	vandal	vandal	**73.07**	**75.6**	**74.78**	**70.88**	--	--
	days>64.4	0*	43	--	--	74	62+	86	63	--	--
Marks 3	7 Day	**70.62**	--	--	--	--	--	--	--	--	--
	days>64.4	62	--	--	--	--	--	--	--	--	--
Marks 4	7 Day	**72.91**	--	--	--	--	--	--	--	--	--
	days>64.4	69	--	--	--	--	--	--	--	--	--
Salmon 1	7 Day	--	--	--	--	--	--	--	64.17	**69.07**	**67.76**
	days>64.4	--	--	--	--	--	--	--	0	30	47
Salmon 2	7 Day	--	--	--	--	--	--	--	61.33	64.04	**70.59**
	days>64.4	--	--	--	--	--	--	--	**	**	14
Hamilton	7 Day	--	--	--	--	**66.62**	**64.71**	61.94	62.33	--	--
	days>64.4	--	--	--	--	24	3	0	0	--	--
McGinnis	7 Day	--	--	--	--	64.21	63.10	62.26	62.92	--	--
	days>64.4	--	--	--	--	1	0	0	0	--	--
Crystal	7 Day	**70.93**	--	--	--	**68.39**	ND	**71.71**	**72.96**	--	--
	days>64.4	58	--	--	--	17	--	14	41	--	--
Rush	7 Day	**66.51**	--	--	--	--	--	--	--	--	--
	days>64.4	14	--	--	--	--	--	--	--	--	--
Little Hay	7 Day	63.24	61.52	vandal	vandal	60.90	**64.76**	**66.69**	60.54	--	--
	days>64.4	0	0	--	--	0	3	16	0	--	--

ND = No Data (indicates defective temperature probe)
vandal = vandalism (indicates temperature probes were stolen)
* Marks 2 (above Little Hay Creek) – Samples 4/10/97-5/23/97
** Salmon Creek 2 (above aspen stand) is spatially intermittent – data dropped when dry.

No measurable increase in water temperatures, except in accordance with water quality standards, may result from management practices in the Spears project area on streams over the state water temperature standard threshold. The INFISH RMOs indicate there should be no measurable increase in the 7-day maximum average water temperature for the project area. Hamilton Creek water temperatures have recovered from the Hash Rock Fire and fell back below threshold in 2003. Little Hay Creek was under threshold during more than half of the years monitored. The 2003 temperature data does not look consistent with the temperature pattern of earlier and later years. This was probably due to a sampling error. The 2003 data should not have been used for determining impairment. Hamilton and Little Hay Creeks should not be on the 303(d) list based on temperature monitoring data.

Reductions in solar input resulting from shading are a primary factor affecting stream temperature. Shade functions generally occur within 100-200 feet of the channel (Beschta et al. 1987).

The February 12, 2007, Spears Vegetation Project Hydrology Report contains additional information on 303(d) listed streams, stream shading, and temperature.

Environmental Consequences

Alternative 1

There would be no activities within the RHCAs for streams on the 303(d) list. No reduction in shading would result from this alternative. There would be no increase in water temperatures. The temperature of streams that are on the 303(d) list as described above would not change.

Alternative 2

There would be about 147 acres of commercial harvest in Class I, II, and III RHCAs. These activities would not reduce shade on fish-bearing streams or non-fish-bearing perennial streams. The only commercial harvest within an RHCA on a 303(d) listed stream is in Unit 841 along Marks Creek. Commercial harvest in this unit would be accomplished using a helicopter logging system. Commercial harvest would only occur in the outer 100 feet of the 300-foot RHCA and would not reduce shade on Marks Creek.

There would be about 723 acres of precommercial and hardwood thinning in Class I, II, and III RHCAs. Precommercial thinning within RHCAs occurs in RHCAs for 303(d) listed streams. In the Hamilton Creek RHCA, precommercial thinning would occur in Units 708 and 873. In the Little Hay Creek RHCA, thinning would occur in Unit 402 which is an aspen unit. In the Marks Creek RHCA, precommercial thinning would occur in Units 567, 840, and 841, and hardwood thinning would occur in Units 502 and 507. The height of trees, at various slopes and distances that provide shade during the period when peak temperatures occur, were calculated. Only trees less than this height would be thinned from units along perennial streams. Shade was not a consideration along intermittent streams since they should not affect peak water temperatures; however, some shade would be maintained in Class IV RHCAs to contribute toward meeting Riparian Management Objectives (RMOs). Shade monitoring of precommercial thinning within Class I and II RHCAs in 1998 found less than a one (1) percent change in shade readings when compared to shade readings taken prior to thinning (Fontaine 1998). Precommercial thinning would not reduce shade on streams, including 303(d) listed streams. There is a risk of conifer thinning in aspen stands reducing shade for a short time (up to 6 months); however, water temperatures would still meet state standards.

There is a risk of prescribed fire reducing shade for a short time (up to 6 months); however, water temperatures would still meet state standards. Short-term increases in temperature (up to 6 months) are allowed even on streams over threshold during activities designed to restore riparian vegetation (OAR 340-041-002(56) and 340-041-0004(5)(a)). Prescribed burning would occur within the RHCAs for 303(d) listed streams. Along Hamilton Creek, burning would occur in Units 708 and 873. Along Little Hay Creek, burning would occur in Units 861, 862, and 867. Along Marks Creek, burning would occur in Units 567, 832, 833, 838, 840, 841, 842, 901, 921, and 922. Burning would be accomplished when moisture conditions favor a low-intensity burn which would result in a mosaic of burned and unburned vegetation. Prescribed fire would not be ignited within 50 feet of stream channels, although fire would be allowed to burn within this 50-foot buffer. Approximately 38 percent of the RHCAs on fish-bearing streams and 38 percent on perennial non-fish bearing streams are in units with prescribed fire. It is estimated that 20 percent of the area in the RHCA would burn with most of this being at low intensity and further away from the stream. There would not be any measurable increase in water temperatures on perennial streams. There is a potential to increase water temperature in intermittent non-fish bearing streams (Class IV) when they are flowing, but this should not result in a violation of state water quality standards because these streams go dry before peak water temperatures occur in the project area.

There would be no measurable temperature change on any of the Class I-III streams, including 303(d) listed streams, in the project area under any of the alternatives in the next 10 years. Activities proposed in RHCAs, including RHCAs for 303(d) listed streams, are designed to promote attainment of RMOs over time. Thinning conifers would increase the growth rates of residual conifers and hardwood and broadleaf species such as aspen, cottonwood, alder, and willow. Hardwood and broadleaf species are expected to increase in vigor and would provide additional shade. Increasing the growth rates of residual conifers would promote development of large trees that would become future large wood. As the amount of large woody material in streams increases over time, it would result in more pools which would help lower water temperatures.

Alternative 3

There would be 675 acres of precommercial thinning in Class I, II, and III RHCAs in this alternative. Precommercial thinning within RHCAs occurs in RHCAs for 303(d) listed streams. In the Hamilton Creek RHCA, precommercial thinning would occur in Units 708 and 873. In the Little Hay Creek RHCA, thinning would occur in Unit 402 which is an aspen unit. In the Marks Creek RHCA, precommercial thinning would occur in Units 567, 840, and 841, and hardwood thinning would occur in Units 502 and 507. The height of trees, at various slopes and distances that provide shade during the period when peak temperatures occur, were calculated. Only trees less than this height would be thinned from units along perennial streams. This would not reduce shading on fish-bearing streams or non-fish bearing perennial streams. Shade was not a consideration along intermittent streams since they should not affect peak water temperatures; however, some shade would be maintained in Class IV RHCAs to contribute toward meeting RMOs. Precommercial thinning would not reduce shade on streams, including 303(d) listed streams, based on monitoring that showed this activity resulted in a change of less than one (1) percent (Fontaine 1998). There is a risk of conifer thinning in aspen and cottonwood stands reducing shade for a short time (up to 6 months); however, water temperatures would still meet state standards.

There is a risk of prescribed fire reducing shade for a short time (up to 6 months); however, water temperatures would still meet state standards. Prescribed burning would occur within the RHCAs for 303(d) listed streams. Along Hamilton Creek, burning would occur in Units 708 and 873. Along Little Hay Creek, burning would occur in Units 861, 862, and 867. Along Marks Creek, burning would occur in Units 567, 832, 833, 838, 840, 841, 842, 901, 921, and 922. Burning would be accomplished when moisture conditions favor a low-intensity burn which would result in a mosaic of burned and unburned vegetation. Prescribed fire would not be ignited within 50 feet of stream channels, although fire would be allowed to burn within this 50-foot buffer. Approximately 36 percent of the RHCAs on fish-bearing streams and 33 percent on perennial non-fish bearing streams are in units with prescribed fire. It is estimated that between 20 percent of the area in the RHCA would burn with most of this being at low intensity and further away from the stream. There should not be any measurable increase in water temperatures on perennial streams. There is a potential to increase water temperature in intermittent non-fish bearing streams (Class IV) when they are flowing, but this should not result in a violation of state water quality standards because these streams go dry before peak water temperatures occur in the project area.

There would be no measurable temperature change on any of the Class I-III streams in the project area under any of the alternatives in the next 10 years. Activities proposed in RHCAs, including RHCAs for 303(d) listed streams, are designed to promote attainment of RMOs over time. Thinning conifers would increase the growth rates of residual conifers and hardwood and broadleaf species such as aspen, cottonwood, alder, and willow. Hardwood and broadleaf species are expected to increase in vigor and would provide additional shade. Increasing the growth rates of residual conifers would promote development of large trees that would become future large wood. As the amount of large woody material in streams increases over time, it would result in more pools which would help lower water temperatures.

Alternative 4

There would be about 127 acres of commercial harvest in Class I, II, and III RHCAs. This would not reduce shading on fish-bearing streams or non-fish-bearing perennial streams. The only commercial harvest within an RHCA on a 303(d) listed stream is in Unit 841 along Marks Creek. Commercial harvest in this unit would be accomplished using a helicopter logging system. Commercial harvest would only occur in the outer 100 feet of the 300-foot RHCA and would not reduce shade on Marks Creek.

There will be about 675 acres of precommercial thinning in Class I, II, and III RHCAs. In the Hamilton Creek RHCA, precommercial thinning would occur in Units 708 and 873. In the Little Hay Creek RHCA, thinning would occur in Unit 402 which is an aspen unit. In the Marks Creek RHCA, precommercial thinning would occur in Units 505, 567, 840, and 841, and hardwood thinning would occur in Units 502 and 507. The height of trees, at various slopes and distances that provide shade during the period when peak temperatures occur, were calculated. Only trees less than this height would be thinned from units along perennial streams. Shade was not a consideration along intermittent streams since they should not affect peak water temperatures; however, some shade would be maintained in Class IV RHCAs to contribute toward meeting RMOs. Precommercial thinning would not reduce shade on streams, including 303(d) listed streams, based on monitoring that showed this activity resulted in a change of less than one (1) percent (Fontaine 1998). There is a risk of conifer thinning in aspen and cottonwood stands reducing shade for a short time (up to 6 months); however, water temperatures would still meet state standards.

There is a risk of prescribed fire reducing shade for a short time (up to 6 months); however, water temperatures would still meet state standards. Short-term increases in temperature (up to 6 months) are allowed even on streams over threshold during activities designed to restore riparian vegetation. Prescribed burning would occur within the RHCAs for 303(d) listed streams. Along Hamilton Creek, burning would occur in Units 708 and 873. Along Little Hay Creek, burning would occur in Units 861, 862, and 867. Along Marks Creek, burning would occur in Units 567, 832, 833, 838, 840, 841, 842, 901, 921, and 922. Burning would be accomplished when moisture conditions favor a low-intensity burn which would result in a mosaic of burned and unburned vegetation. Prescribed fire would not be ignited within 50 feet of stream channels, although fire would be allowed to burn within this 50-foot buffer. Approximately 38 percent of the RHCAs on fish-bearing streams and 38 percent on perennial non-fish-bearing streams are in units with prescribed fire. It is estimated that 20 percent of the area in the RHCA would burn with most of this being at low intensity and further away from the stream. There would not be any measurable increase in water temperatures on perennial streams. There is a potential to increase water temperature in intermittent non-fish bearing streams (Class IV) when they are flowing, but this should not result in a violation of state water quality standards because these streams go dry before peak water temperatures occur in the project area.

There would be no measurable temperature change on any of the Class I-III streams in the project area under any of the alternatives in the next 10 years. Activities proposed in RHCAs, including RHCAs for 303(d) listed streams, are designed to promote attainment of RMOs over time. Thinning conifers would increase the growth rates of residual conifers and hardwood and broadleaf species such as aspen, cottonwood, alder, and willow. Hardwood and broadleaf species are expected to increase in vigor and would provide additional shade. Increasing the growth rates of residual conifers would promote development of large trees that would become future large wood. As the amount of large woody material in streams increases over time, it would result in more pools which would help lower water temperatures.

Alternative 5

There would be about 94 acres of commercial harvest in Class I, II, and III RHCAs. This would not reduce shading on fish-bearing streams or non-fish-bearing perennial streams. The only commercial harvest within an RHCA on a 303(d) listed stream is in Unit 841 along Marks Creek. Commercial harvest in this unit would be accomplished using a helicopter logging system. Commercial harvest would only occur in the outer 100 feet of the 300-foot RHCA and would not reduce shade on Marks Creek.

There would be about 732 acres of precommercial thinning in Class I, II, and III RHCAs. In the Hamilton Creek RHCA, precommercial thinning would occur in Units 708 and 873. In the Little Hay Creek RHCA, thinning would occur in Unit 402 which is an aspen unit. In the Marks Creek RHCA, precommercial thinning would occur in Units 505, 567, 832, 833, 840, and 841, and hardwood thinning would occur in Units 502 and 507. The height of trees, at various slopes and distances that provide shade during the period when peak temperatures occur, were calculated. Only trees less than this height would be thinned from units along perennial streams. Shade was not a consideration along intermittent streams since they should not affect peak water temperatures; however, some shade would be maintained in Class IV RHCAs to contribute toward meeting RMOs. Precommercial thinning would not reduce shade on streams, including 303(d) listed streams, based on monitoring that showed this activity resulted in a change of less than one (1) percent (Fontaine 1998). There is a risk of conifer thinning in aspen and cottonwood stands reducing shade for a short time (up to 6 months); however, water temperatures would still meet state standards.

There is a risk of prescribed fire reducing shade for a short term; however, water temperatures would still meet state standards. There is a risk of prescribed fire reducing shade for a short time (up to 6 months); however, water temperatures would still meet state standards. Short-term increases in temperature (up to 6 months) are allowed even on streams over threshold during activities designed to restore riparian vegetation. Prescribed burning would occur within the RHCAs for 303(d) listed streams. Along Hamilton Creek, burning would occur in Units 708 and 873. Along Little Hay Creek, burning would occur in Units 861, 862, and 867. Along Marks Creek, burning would occur in Units 567, 832, 833, 838, 840, 841, 842, 901, 921, and 922. Burning would be accomplished when moisture conditions favor a low-intensity burn which would result in a mosaic of burned and unburned vegetation. Prescribed fire would not be ignited within 50 feet of stream channels, although fire would be allowed to burn within this 50-foot buffer. Approximately 36 percent of the RHCAs on fish-bearing streams and 35 percent on perennial non-fish-bearing streams are in units with prescribed fire. It is estimated that 20 percent of the area in the RHCA would burn with most of this being at low intensity and further away from the stream. There would not be any measurable increase in water temperatures on perennial streams. There is a potential to increase water temperature in intermittent non-fish bearing streams (Class IV) when they are flowing, but this should not result in a violation of state water quality standards because these streams go dry before peak water temperatures occur in the project area.

There would be no measurable temperature change on any of the Class I-III streams in the project area under any of the alternatives in the next 10 years. Activities proposed in RHCAs, including RHCAs for 303(d) listed streams, are designed to promote attainment of RMOs over time. Thinning conifers would increase the growth rates of residual conifers and hardwood and broadleaf species such as aspen, cottonwood, alder, and willow. Hardwood and broadleaf species are expected to increase in vigor and would provide additional shade. Increasing the growth rates of residual conifers would promote development of large trees that would become future large wood. As the amount of large woody material in streams increases over time, it would result in more pools which would help lower water temperatures.

Cumulative Effects

The Hash Rock Fire in 2000 resulted in measurable increases in water temperature in Hamilton and McGinnis Creeks and may have resulted in increases in Cornez and Reilly Creeks. Shade should have recovered in low-intensity burn areas, but it may take up to 20 years to fully recover in the high-intensity burn areas. Monitoring on Hamilton and McGinnis Creeks show water temperatures returned to below threshold values in 2003. The streams in the Upper Marks Creek subwatershed on the northwest side of U.S. Highway 26 are below the state water temperature standard threshold.

Past logging, road construction, and grazing have reduced shading in the project area. This has been offset in some drainages by increased shading from dense overstocked stands of conifers. No reduction of shading on fish bearing and perennial non-fish-bearing streams is expected as a result of the proposed timber harvest or precommercial thinning based on design criteria. Possible short term reductions in shade resulting from conifer thinning in aspen and cottonwood stands and prescribed fire are not expected to produce any measurable increases in temperature.

Past deciduous riparian plantings outside of exclosures in Crystal and Little Hay Creeks are being heavily browsed by livestock and wildlife. The allotment management plans for the Crystal Springs and Burn Allotment will be analyzed over the next 2 years with the Marks Creek and Wildcat Allotments scheduled to start in 2009. The updates to these allotments will not be completed until after the decision is made on the Spears Project. It is reasonably foreseeable that changes in livestock grazing will result in improved channel condition because of activities such as moving water troughs out of riparian zones, fencing or enlarging exclosures at spring source areas of water developments, and developing more water sources in the uplands. Changing livestock management is outside the scope of this document; however, it is reasonably foreseeable that there will be an improvement in riparian condition due to changes in the range utilization standards in the Grazing Implementation Monitoring Module (IIT 2000). Studies in the intermountain region (Clary 1999) indicate that the height of grasses and forbs that are to be left in key riparian areas indicate a level of grazing that allows a corresponding recovery of palatable woody vegetation. Bank stability and channel geometry interact with vegetation but may respond differently, depending on the extent of continued mechanical disturbance in the channel and the current channel condition.

None of the alternatives are expected to produce measurable increases in the maximum water temperature. All alternatives meet state and INFISH water quality temperature standards. State Water Quality Rules also indicated that recurring activities, including rotating grazing pastures, are not to be considered new or increased discharges which would trigger an anti-degradation review as long as they do not increase in frequency, intensity, duration, or geographic extent (OAR 340-041-0004(4)(a)).

There are no reasonably foreseeable activities that would affect stream shade.

Sediment and Turbidity

Affected Environment

It is estimated that between 60 and 75 percent of the sediment in the streams in the Marks Creek Watershed and Veazie Creek Subwatershed is coming from in-channel erosion such as bank erosion, head cuts, and channel scour. Channel destabilization can result from changes in peak flows, sediment load, roads, and livestock impacts. Potential increases from in-channel sources resulting from harvest and natural disturbance induced increases in runoff are analyzed by the Equivalent Harvest Area (EHA) model.

In the late summer of 2000, the Hash Rock Fire burned approximately 4,594 acres in the Marks Creek Watershed, predominately in the Mill Creek Wilderness. Turbidity and suspended sediment samples were collected in Marks Creek above the Little Hay Bridge between 1998 and 2005. Samples collected since the fire were compared to samples collected prior to the Hash Rock Fire to see if projected increases occurred. Because of the low snow pack and lack of severe rainstorms the first few years after the fire, erosion, and sediment delivery to streams was less than expected. Peak flows were also substantially less than average. Analysis indicates that turbidity in 2001 and 2002 was higher than in samples prior to the fire with that in 2002 being lower than that in 2001. However, when the post-fire turbidity for Marks Creek was compared with that from Ochoco Creek, which was not affected by the fire, the ratio was found to be within the normal range of fluctuation that existed prior to the fire. Dredging in Marks Pond by home owners in the spring of 2002 appears to have affected some water quality samples. Adequate moisture in the spring and summer of 2001 and the spring of 2002 allowed substantial recovery of grasses and forbs in the low to moderate-intensity burn areas and some high-intensity burn areas. Needle fall in the high-intensity burn areas without crown fire also continued to increase effective ground cover. This combined with the lack of rilling during the first 2 years after the fire reduced the risk of higher sediment rates during the remainder of the recovery.

While the Hash Rock Fire is still affecting flows in the most severely burned drainages, surface erosion has returned to pre-fire levels. Fire lines were hydrologically closed and seeded in 2000 and should also have recovered. There is still a risk of sediment delivery from landslides occurring in the high-intensity burn areas on dormant landslide terrain, especially in Hamilton Creek, the West Fork Cornez Creek, and McGinnis Creek. Total reinforcement from live and dead roots reaches the low point 7 years after the fire (2007) and recovers as live root reinforcement increases (Ziemer 1981). These landslides should be fairly small and localized due to the drier climate in the project area.

State water quality standards direct that turbidity levels should not exceed background levels by more than 10 percent. The Forest Plan indicates that this will be accomplished by maintaining stream bank stability and implementing Best Management Practices (BMPs).

Turbidity is the degree to which suspended material in the water impedes light penetration. There is normally a close correlation between turbidity and suspended sediment in a given stream, but this correlation can change as organic material increases over the summer or if the percent of sediment from different sources in the drainage changes. Turbidity does not measure the amount of sediment being transported as bedload.

From field observations, it can be seen that the further a sediment source is from a stream, the smaller the percentage that gets delivered to the channel. This is due to infiltration of the water carrying the sediment, deposition at slope breaks, and deposition in depressions, behind surface debris, and in vegetation. Delivery bands derived from Leven (1978) were used for this analysis.

Sediment from the uplands, direct and cumulative effects to water quality from accelerated sediment delivery related to timber harvest practices, fire, and road construction and use were evaluated by comparing the relative erosion and sediment delivery rates of the alternatives based on the Relative Erosion Rate (RER) model.

The RER procedure evaluates sediment delivery. It evaluates direct changes to sediment load from current management practices and average rates that reflect previous practices and recovery rates. Only management activities within 600 feet of mapped streams are evaluated. Soil erosivity is based on the Forest Soil Resource Inventory; slopes are derived from the GIS Digital Elevation Model; delivery potential is calculated from a technique derived from PSWHA I (Leven 1978); and potential sediment yield and recovery are calculated using the "Guide for Producing Sediment Yield from Forested Watersheds" (Forest Service 1981), and WATSED (Forest Service 1992). Based on the low average annual precipitation in the project area, low volume per acre, and not operating in the rainy season, haul delivered sediment should be low (less than 10 percent of the road delivered sediment). Because of the amount and period of haul on individual roads, annual precipitation, and the low sediment delivery, haul delivered sediment was not calculated because of the low level. The RER does not calculate the actual sediment load but calculates a Relative Erosion Rate that is used to compare alternatives.

The RER depicts potential sediment delivery based on the amount and type of ground disturbance, slope/erosion class (based on soil erosivity and slope), and distance to stream channels. The actual sediment delivery may be higher or lower than predicted depending on the amount of vegetative recovery before storm events and storm intensity. Elevated sediment delivery may occur even if no additional activities are accomplished if a large runoff event occurs such as that in January 1997. The first timber sale is to be offered in 2007. RER calculations assume all harvest activities, in Alternatives 2, 4, and 5, will take place between 2008 and 2011. In the project area, a sixth of the harvest is assumed to occur in 2008, a third in 2009 and 2010, and a sixth in 2011. Precommercial and hardwood thinning activities are assumed to be completed by 2013. Fuels treatments were modeled as being finished in 2015.

Environmental Consequences

Alternative 1

Sediment and turbidity levels would not change. Over time, without disturbance, fuel loading in stands would continue to progress toward Condition Class 3, which has a higher risk of high-intensity fire. In the long term, there is a potential for indirect effects associated with fuel loading that would carry high-intensity wildfire. If a large-scale, high-intensity fire was to occur, there is a high probability of increased sediment delivery resulting in adverse effects to aquatic habitats. It is difficult to predict the time or the scale and intensity at which such an event might occur, but it is highly probable that it would be larger and more intense than what happened historically due to increased ladder fuels and higher fuel loadings. Roads in the stream influence zone would not be inactivated (closed) or decommissioned.

Alternative 2

Alternative 2 proposes harvest on 16.7 percent of the project area (14.4% tractor, 0.2% skyline, and 2.1% helicopter). It is estimated that 90 percent of the sediment delivered to streams from surface erosion comes from within 400 feet of the channel. This alternative proposes harvest on approximately 11.3 percent (1,421 acres) of total NFS lands in the project area within 400 feet of streams (8.3% tractor, 0.3% skyline, and 2.7% helicopter). Approximately 1,051 acres of tractor harvest, 38 acres of skyline harvest, and 332 acres of helicopter harvest are proposed within 400 feet of streams. Megahan (1980) found that tractor harvest produced about 30 percent less sediment than clearcutting. Skyline harvest produces about half of that caused by tractor logging, and helicopter less than a fifth. Tractor harvest units within 200 feet of streams that have the highest potential sediment delivery are shown in Table 54. The RER analysis indicates that about 46 percent of the potential new sediment originates from timber harvest. It is estimated more than 25 percent of this logging generated sediment would come from five tractor harvest units: 108, 139, 148, 163, and 776. Reshin et al. (2006) in a study with samples in both eastern and western Washington found that a 10-meter (32.8 foot) setback of felling and yarding activities prevented sediment delivery to streams from about 95 percent of harvest-related

Table 54. Tractor harvest unit areas of concern within 200 feet of streams.

Unit[1]	**20-35% Erosive Soils (acres)**	**>35% Slope (acres)**	**Soil and Slope Concern (% Unit within 200 feet of stream)**	**RHCA**[2]
108	8.9	0.7	36	Y
111	1.2	--	23	Y
112[3]	--	0.6	25	N
125[3]	5.0	1.0	74	Y
129	--	<0.1	19	N
139	2.8	1.2	12	Y
160	1.1	0.8	38	Y
163	3.2	0.6	18	Y
166	1.5	1.0	67	Y
174	--	<0.1	100	N
191[3]	--	1.1	27	Y
193	--	2.0	41	Y
198	--	0.1	5	N
199	--	0.8	22	N
200	--	0.4	4	Y
201[3]	--	4.2	46	Y
515	0.1	--	36	N
550[3]	0.4	--	28	N
559	0.2	--	10	Y
563	--	<0.1	<1	N
570	--	<0.1	2	N
704[3]	--	<0.1	2	N
711	--	0.2	<1	N
776	2.0	0.1	12	Y
806	2.6	0.7	32	N
810	--	0.5	11	N
846	1.4	0.2	37	Y
879	0.3	--	5	N

[1]Units in bold have a risk of delivering sediment to streams.
[2] Units with harvest in RHCA where soil erosivity or slope concern extends into the RHCA.
[3] There is no harvest in Class IV RHCAs in these units.

erosion features and said a wider setback may be advisable on portions of units where steep inner gorges extend beyond 10 meters. Lynch et al. (1985) determined that a 30 meter (98.4 foot) buffer from logging operations removed an average of 75-80 percent of the suspended sediment in storm water. This is consistent with post-harvest observations by the project hydrologist on the Ochoco National Forest, but suspended sediment delivery appears to be lower because of the lower precipitation rates east of the Cascades and higher infiltration rates in the project area.

This alternative includes underburn activities on 40 percent (5,047 acres) of the project area within 400 feet of streams. Planned ignitions are designed to produce a mosaic burn. About 20 percent of the units within RHCAs are expected to burn. Burning would not be accomplished all at one time, but is expected to take up to 10 years to complete depending on when thinning activities occur and when suitable weather conditions for fire ignition occur. Commercial harvest and precommercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Commercial harvest, precommercial thinning, and fuels treatments overlay about 50 percent of the forested plant associations in the project area. Fuels treatments would be accomplished on about 51 percent of the area in forested plant associations outside the Mill Creek Wilderness. The reduction of surface and ladder fuels would reduce the amount of area susceptible to high-intensity wildfire. About 2,937 acres of activities (harvest and PCT) and 2,111 acres of natural fuels treatments are proposed within 400 feet of streams. About 28 percent of the new potential sediment originates from fuels treatments.

This alternative constructs 3.3 mile of road within 400 feet of streams (0.16 mi/mi^2). New and reopened roads would be closed or decommissioned after use. Stream crossings are a major sediment delivery site. Under this alternative, there would be two crossings on Class II streams, four crossings on Class III streams, and 28 crossings on Class IV streams. Road construction would result in 10 new crossings, one on a Class II and the other nine on Class IV streams. They can concentrate runoff and transport sediment down ditch lines, down the surface of the road, and can generate sediment on the approaches and at the crossing. Several miles of road (7.3 miles) within 400 feet of streams would be decommissioned after use. In addition, this alternative would close 3.9 miles of road within 400 feet of streams after completion of the sale. The RER analysis indicates that about 28 percent of the potential new sediment originates from roads. Most sediment delivered to streams would come from stream crossings, road drainage close to streams, and harvest and fuels treatments adjacent to Class IV streams.

Field observation and monitoring of the Trout Creek timber sale and the Hash Rock Fire have shown that intact RHCAs are effective at filtering sediment. Design elements prevent mechanical disturbance of stream channels and generally preclude placing landings and using ground-based equipment in RHCAs (see Chapter 2 for exceptions). This alternative proposes 48 acres or about 4 miles of tractor harvest in Class 4 RHCAs (Class IV streams) by pulling cable from outside the RHCA. Based on past monitoring, design elements to protect stream channels from mechanical disturbance and maintain filtering in fuels units, and delayed burning in RHCAs with precommercial thinning slash, this alternative has a moderate risk of sediment delivery, but would still meet state water quality turbidity standards because filtering vegetation would be maintained in RHCAs.

Alternative 3

No timber harvest or road work is proposed in this alternative. All new potential sediment originates from fuels treatments.

This alternative includes underburning activities on 37 percent (4,628 acres) of the project area within 400 feet of streams. Planned ignitions are designed to produce a mosaic burn. About 20 percent of RHCAs are expected to burn. Burning would not be accomplished all at one time, but may take up to 10 years to complete. Precommercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Precommercial thinning and fuels treatments overlay about 46 percent of the forested plant associations in the project area. Fuels treatments would be accomplished on about 47 percent of the area in forested plant associations outside the Mill Creek Wilderness. The reduction of surface and ladder fuels would reduce the amount of area susceptible to high-intensity wildfire. About 10 percent less new potential sediment originates from fuels treatments in this alternative than in Alternative 2. Most sediment delivered by this alternative to streams would come from fuels treatments adjacent to Class IV streams. The RER analysis indicates that Alternative 3 generates 74 percent less potential new sediment than Alternative 2.

Based on the lack of mechanical disturbance in RHCAs and design elements to maintain filtration in RHCAs, Alternative 3 would meet state water quality turbidity standards.

Alternative 4

Alternative 4 proposes harvest on 13.4 percent of the project area (11.2% tractor and 2.2% helicopter). It is estimated that 90 percent of the sediment delivered to streams from surface erosion comes from within 400 feet of the channel. This alternative proposes harvest on approximately 9.6 percent (1,201 acres) of the NFS lands in the project area within 400 feet of streams (7.0% tractor & 2.6% helicopter). Approximately 879 acres of tractor harvest and 322 acres of helicopter harvest are proposed within 400 feet of streams under this alternative. Tractor harvest units within 200 feet of streams that have higher potential sediment delivery are shown in Table 55. About 19 percent less new potential sediment originates from harvest treatments in this alternative than in Alternative 2. It is estimated more than 25 percent of logging generated sediment would come from four tractor harvest units: 108, 148, 163, and 776.

This alternative proposes underburn activities on 40 percent (4,982 acres) of the project area within 400 feet of streams. Planned ignitions are designed to produce a mosaic burn. Only about 20 percent of the units within RHCAs are expected to burn. Burning would not be accomplished all at one time, but may take up to 10 years to complete. Commercial harvest and precommercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Commercial harvest, precommercial thinning, and fuels treatments overlay about 49 percent of the forested plant associations in the project area. Fuels treatments would be accomplished on about 50 percent of the area in forested plant associations outside the Mill Creek Wilderness. The reduction of surface and ladder fuels would reduce the amount of area susceptible to high-intensity wildfire. New potential sediment originating from fuels treatments in this alternative are about the same as those in Alternative 2.

Table 55. Tractor harvest unit areas of concern within 200 feet of streams.

Unit[1]	20-35% Erosive Soils (acres)	>35% Slope (acres)	Soil and Slope Concern (% Unit within 200 feet of stream)	RHCA[2]
108	8.9	0.7	36	Y
111	1.2	--	23	Y
112[3]	--	0.6	25	N
125[3]	3.6	0.1	64	N
129		<0.1	19	N
139	0.2	<0.1	85	Y
163	2.8	0.5	18	Y
166	1.5	1.0	67	Y
174	--	<0.1	100	N
191[3]	--	1.1	27	Y
193	--	2.0	41	Y
198	--	0.1	5	N
199	--	0.8	22	N
200	--	0.4	4	Y
201[3]	--	4.2	46	Y
515	0.1	--	36	N
550[3]	0.4	--	28	N
559	0.2	--	7	Y
563	--	<0.1	<1	N
570	--	<0.1	2	N
704[3]	--	<0.1	2	N
711	--	0.2	3	N
776	2.0	0.1	12	Y
810	--	0.5	11	N
879	0.3	--	5	N

[1]Units in bold have a risk of delivering sediment to streams.
[2] Units with harvest in RHCA where soil erosivity or slope concern extends into the RHCA.
[3] There is no harvest in Class IV RHCAs in these units.

This alternative constructs 1.3 mile of road within 400 feet of streams (0.07 mi/mi²). New and reopened roads would be closed ore decommissioned after use. Several miles of road (6.5 miles) within 400 feet of streams, would be decommissioned. In addition, 3.8 miles of road within 400 feet of streams would be closed after completion of commercial timber harvest. Stream crossings are a major sediment delivery site. Under this alternative, there would be one crossing on a Class II stream, four crossings on Class III streams, and 23 crossings on Class IV streams. Road construction would result in five new crossings on Class IV streams. They can concentrate runoff and transport sediment down ditch lines, down the road surface, and can generate sediment on the approaches and at the crossing. About 62 percent less new potential sediment originates from roads in this alternative than in Alternative 2.

Most sediment delivered to streams would come from stream crossings, road drainage close to streams, and harvest and fuels treatments adjacent to Class IV streams. The RER analysis indicates that Alternative 4 generates 24 percent less potential new sediment than Alternative 2.

Field observation and monitoring of the Trout Creek timber sale and the Hash Rock Fire have shown that intact RHCAs are effective at filtering sediment. Design elements prevent mechanical disturbance of stream channels and generally preclude placing landings and using tractor harvest in RHCAs (see Chapter 2 for exceptions). This alternative proposes 36 acres or about 3 miles of tractor harvest in Class IV RHCAs by pulling cable from outside the RHCA. Based on past monitoring, design elements to protect stream channels from mechanical disturbance, maintain filtering in fuels units, and delayed burning in RHCAs with precommercial thinning slash, this alternative would meet state water quality turbidity standards.

Alternative 5

Alternative 5 proposes harvest on 10.7 percent of the project area (8.9% tractor and 1.8% helicopter). This alternative proposes harvest on approximately 7.4 percent (931 acres) of the NFS lands in the project area within 400 feet of streams (5.5% tractor and 1.9% helicopter). Approximately 703 acres of tractor harvest and 228 acres of helicopter harvest are proposed within 400 feet of streams. Tractor harvest units within 200 feet of streams that have higher potential sediment delivery are shown in Table 56. The RER analysis indicates that this alternative generates 33 percent less potential new harvest generated sediment than Alternative 2. Three tractor units (108, 139, and 163) account for more than 20 percent of the projected harvest generated sediment delivery in Alternative 5.

This alternative proposes underburn activities on 37 percent (4,685 acres) of the project area within 400 feet of streams. Planned ignitions are designed to produce a mosaic burn. About 20 percent of the area within units in RHCAs are expected to burn. Burning would not be accomplished all at one time, but may take up to 10 years to complete. Commercial harvest and precommercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Commercial harvest, precommercial thinning, and fuels treatments overlay about 47 percent of the forested plant associations in the project area. Fuels treatments would be accomplished on about 48 percent of the area in forested plant associations outside the Mill Creek Wilderness. The reduction of surface and ladder fuels would reduce the amount of area susceptible to high-intensity wildfire. About 7 percent less new potential sediment originates from fuels treatments in this alternative than in Alternative 2.

This alternative constructs 1.3 mile of road within 400 feet of streams (0.07 mi/mi^2). New and reopened roads would be closed or decommissioned after use. Nearly 6 miles of road within 400 feet of streams would be decommissioned. This alternative would close 2.4 miles of open road within 400 feet of streams. Stream crossings are a major sediment delivery site. Under this alternative, there would be one crossing on a Class II stream, three crossings on Class III streams, and 21 crossings on Class IV streams. Road construction would result in six new crossings on Class IV streams. They can concentrate runoff and transport sediment down ditch lines, down the surface and can generate sediment on the approaches and at the crossing. The

RER analysis indicates that this alternative generates 67 percent less potential new road delivered sediment than Alternative 2.

Table 56. Tractor harvest unit areas of concern within 200 feet of streams.

Unit[1]	20-35% Erosive Soils (acres)	>35% Slope (acres)	Soil and Slope Concern (% Unit within 200 feet of stream)	RHCA[2]
108	8.9	0.7	36	Y
111	1.2	--	23	Y
112[3]	--	0.6	25	N
125[3]	5.0	1.0	74	N
139	0.2	<0.1	85	Y
163	2.6	0.6	51	Y
166	0.5	1.0	66	Y
174	--	<0.1	100	N
191[3]	--	1.1	27	N
193	--	0.4	29	Y
198	--	0.1	5	N
199	--	0.8	22	N
200	--	0.4	4	Y
201[3]	--	4.2	46	Y
515	0.1	--	36	N
559	0.2	--	7	Y
563	--	<0.1	<1	N
570	--	<0.1	2	N
704[3]	--	<0.1	2	N
776	2.0	0.1	12	Y
810	--	0.5	11	N
879	0.3	--	5	N

[1]Units in bold have a risk of delivering sediment to streams. [2] Units with harvest in RHCA where soil erosivity or slope concern extends into the RHCA.
[3] There is no harvest in Class IV RHCAs in these units.

Most sediment delivered to streams would come from stream crossings, road drainage close to streams, and harvest and fuels treatments adjacent to Class IV streams. The RER analysis indicates that Alternative 5 generates 35 percent less potential new sediment than Alternative 2.

Field observation and monitoring of the Trout Creek Timber Sale and the Hash Rock Fire have shown that intact RHCAs are effective at filtering sediment. Design elements prevent mechanical disturbance of stream channels and generally preclude placing landings and using tractor yarding in RHCAs (exceptions are listed in Chapter 2, Design Elements). This alternative proposes 29 acres or about 2.4 miles of tractor harvest in Class IV RHCAs by pulling cable from outside the RHCA. Based on monitoring, design elements to protect stream channels from mechanical disturbance, maintain filtering in fuels units, and delayed burning in RHCAs with precommercial thinning slash, this alternative would meet state water quality turbidity standards.

Reshin et al. (2006) in a study with samples in both eastern and western Washington found that a 10-meter (32.8 foot) setback of felling and yarding activities prevented sediment delivery to streams from about 95 percent of harvest related erosion features and said a wider setback may be advisable on portions of units where steep inner gorges extend beyond 10 meters. Lynch et al. (1985) determined that a 30 meter (98.4 foot) buffer from logging operations removed an average of 75-80 percent of the suspended sediment in storm water. This is consistent with post-harvest observations by the project hydrologist on the Ochoco National Forest, but suspended sediment delivery appears to be lower because of the lower precipitation rates east of the Cascades and higher infiltration rates in the project area.

Cumulative Effects

The Bottom Line Survey indicates that about 3 percent of the stream reaches in the project area have greater than 20 percent cutbank and about 17 percent have between 10 and 20 percent cutbank. Road alignment on U.S. Highway 26 has resulted in channelization of reaches 2, 3 and 6 of Marks Creek. After the Hash Rock Fire, headcut work and riparian planting were completed on McGinnis Creek and undersized culverts were replaced on Hamilton, Cornez, Reilly, and McGinnis Creeks. Headcuts were treated in Little Hay Creek in 2001 and McGinnis Creek in 2002 which reduced sediment delivery. Riparian planting and exclosure fencing were also accomplished on Little Hay Creek in 2002 and 2003. Headcuts were treated and channel restoration work accomplished in Marks Creek on private property below the National Forest boundary by the Crooked River Watershed Council between 2002 and 2005. Increases in flow and loss of stream bank vegetation due to high-intensity burn on the Hash Rock Fire may still be resulting in bank erosion and channel widening in the more severely impacted drainages impacted by the fire, especially in Hamilton Creek, the unnamed tributary to the west of Hamilton Creek, and the west fork of Cornez Creek.

Ground disturbance associated with trails, off highway ehicle (OHV) use, dispersed recreation, and firewood gathering may cause localized sediment delivery but is small on a watershed scale and was not included in the analysis. Sediment from routine road maintenance, which is included in the model, was overestimated because the model assumes annual maintenance on open roads. It is estimated that most of management derived sediment delivered to streams by surface erosion on NFS lands in the project area is coming from roads. Open road densities within 400 feet of stream channels, the source area of an estimated 90 percent of surface sediment delivered sediment, are shown in Table 57. Proposed road closure and decommissioning would reduce the cumulative sediment delivery in the long run but ground disturbance from ripping and installing drainage structures would increase sediment the first year or two.

While livestock can affect sediment delivery, in the Spears project area their primary impact appears to be on riparian vegetation and channel condition. Degraded channel conditions in the headwaters of many streams and in spring areas in the project area have resulted from livestock concentration. Changing livestock management is outside the scope of this document; however, it is reasonably foreseeable that cattle will continue grazing in the allotments. Special grazing restrictions implemented in the Viewpoint Pasture after the Hash Rock Fire were successful based on monitoring. These special grazing restrictions have been lifted. The allotment

Table 57. Open road densities within 400 feet of streams.

Subwatershed	Alternatives 1 and 3	Alternative 2	Alternative 4	Alternative 5
Upper Marks Creek	3.48 mi/mi²	3.16 mi/mi²	3.16 mi/mi²	3.26 mi/mi²
	36.2 miles	32.9 miles	32.9 miles	33.9 miles
Lower Marks Creek	3.82 mi/mi²	3.61 mi/mi²	3.62 mi/mi²	3.71 mi/mi²
	34.6 miles	32.7 miles	32.8 miles	33.6 miles
Veazie Creek	0 mi/mi²	0 mi/mi²	0 mi/mi²	0 mi/mi²
	0 miles	0 miles	0 miles	0 miles

management plans for the Crystal Springs and Burn Allotments will be analyzed over the next 2 years, with the Marks Creek and Wildcat Allotments scheduled to start in 2009. The updates to these allotments will not be completed until after the decision is made on the Spears project area. It is reasonably foreseeable that changes will result in improved channel condition. Upward trends in riparian condition are expected to continue due to changes in the range utilization standards in the Grazing Implementation Monitoring Module (IIT 2000). These utilization standards are used to determine when livestock are to be removed from pastures. Studies in the intermountain region (Clary 1999) indicate that the height of grasses and forbs that are to be left in key riparian areas indicate a level of grazing that allows a corresponding recovery of palatable woody vegetation. Bank stability and channel geometry interact with vegetation but may respond differently, depending on the extent of continued mechanical disturbance in the channel and the current channel condition. State Water Quality Rules indicated that recurring activities, including rotating grazing pastures, are not to be considered new or increasing discharges which would trigger an anti degradation review as long as they do not increase in frequency, intensity, duration, or geographic extent (OAR 340-041-0004(4)(a)).

Equivalent Harvest Area (EHA)

Affected Environment

Peak annual flows resulting from snowmelt normally occur in March through April in the project area. However, peak annual flows resulting from rain-on-snow events in early winter have produced some of the highest flows in the project area over the last 50 years. High flows can result from intensive convective thunderstorms that cause flash floods during the spring and summer. Flash flooding is not a major factor in the Marks Creek Watershed due to vegetation, ground cover, and the buffering affect of the forest canopy. Peak flows are probably earlier and higher than historically due to loss of floodplain storage due to entrenched channels and soil loss, compaction, timber harvest, and road construction which cause flashier responses. This has been offset somewhat by increased understory canopy cover.

The Hash Rock Fire burned approximately 4,594 acres in the Marks Creek Watershed in 2000. More than half of this was low intensity resulting in less than 10 percent mortality. Since at least 15 percent of the canopy needs to be removed to increase water yield, the primary effect from the fire should result from the 4.2 percent of the watershed that burned at moderate to high intensity with most of this coming from the 2.7 percent that burned at high intensity. Less than 1 percent of the watershed had crown fire. The fire occurred above 4,500 feet primarily in the Mill Creek

Wilderness on steeper ground. Due to the elevation of the area that burned, there was only a small effect on peak flows resulting from rain-on-snow events in early winter. The fire affected peak flows associated with spring snow melt but, due to the small increase in EHA from the fire, are only observable in those drainages directly affected by it. Increased peak flows in Hamilton Creek, the unnamed tributary to the west, and the west fork of Cornez Creek, the most severely affected drainages, are expected to last for at least 25 to 30 years. Peak flow increases in the other drainages directly affected by the fire should be within the normal range of variability.

Base flows were probably higher prior to alterations which have occurred over the last 100 years. Stream entrenchment has reduced storage potential in alluvial aquifers. Upland storage has been lost due to road construction, erosion, and compaction. Prior to European settlement, frequent fires maintained lower evapotranspiration and interception rates and water storage in wetlands and beaver ponds contributed to base flows. Increases in base flow due to removing trees tend to be short term (5 to 10 years) and return to pre-disturbance levels as other vegetation utilizes the increase.

The Hash Rock Fire caused increases in base flows in the drainages directly affected by the fire. The increases are most pronounced in Hamilton Creek and the next tributary to the west and to a lesser extent in the west fork of Cornez Creek, and upper McGinnis Creek. Increases in Reilly Creek, Buck Creek and the main stem of Marks Creek were small and within normal annual fluctuations. Increases in the base flow are expected to last for 15 to 20 years after tree re-establishment in high-intenstiy burn areas.

Stream surveys have identified a number of headcuts on tributaries to Marks Creek in the project area making these streams susceptible to increased flows. Headcuts were treated and channel restoration work accomplished in Marks Creek on private property below the National Forest boundary by the Crooked River Watershed Council between 2002 and 2005. The Forest Service accomplished headcut work and riparian planting on McGinnis Creek and replaced undersized culverts on Hamilton, Cornez, Reilly, and McGinnis Creeks following the Hash Rock Fire. Headcut repair, riparian planting, and exclosure fencing were accomplished on Little Hay Creek in 2002 and 2003.

EHA is used to evaluate the risk to water quality and stream bank stability. The Forest Plan assigned an EHA threshold of 30 percent to the Marks Creek and Lower Ochoco Creek Watersheds (Veazie Creek Subwatershed). The Marks Creek Watershed Analysis (1998) recommended the EHA be reduced to 25 percent based on watershed condition and sensitivity. The EHA threshold should not be interpreted as a point above which detrimental impacts will occur but as a point above which detrimental impacts may occur, should a 10-year or greater storm or melt event take place (Anderson 1989).

The February 12, 2007, Spears Vegetation Project Hydrology Report contains additional information on EHA.

Environmental Consequences

EHA calculations assume all harvest activities in Alternatives 2, 4, and 5, will take place between 2008 and 2011. Within the project area, a sixth of the harvest is assumed to occur in 2008, a third in 2009 and 2010, and a sixth in 2011. Precommercial and hardwood thinning activities would be completed by 2013. The analysis assumed that fuels reduction activities do not remove enough canopy to produce a measurable increase in water yield. Table 58 shows the expected EHA values from 2007 through 2015.

Alternative 1

There would be no direct effects from this alternative. EHA would continue to recover from past harvest and the Hash Rock Fire. Increased peak flows in Hamilton Creek, the unnamed tributary to the west, and the west fork of Cornez Creek, the drainages most severely affected by the Hash Rock Fire, would persist for several years. Table 58 displays the expected EHA values over time.

The majority of the project area is in Fire Regimes I and III, and fuel loadings have moved into Condition Classes 2 and 3. Over time, without disturbance, fuel loading would continue the progression toward Condition Class 3, which has the highest risk of high-intensity fire. In the long term, there is potential for indirect effects associated with fuel loading that would carry a high-intensity wildfire. If a large-scale, high-intensity fire did occur, there would be an increase in EHA commensurate with the size and intensity of the fire. It is difficult to predict the time, or the scale and intensity at which such an event might occur, but it is probable that it would be larger and more intense than what happened historically due to increased ladder fuels and higher fuel loadings.

Effects common to Alternatives 2, 3, 4, and 5

The EHA would continue to recover from past harvest and the Hash Rock Fire. Increased peak flows in Hamilton Creek, the unnamed tributary to the west, and the west fork of Cornez Creek would persist during the period covered by this analysis. Timber harvest and precommercial thinning in the action alternatives would reduce interception and evapotranspiration, increase snow accumulation, and change snow melt rate and timing. The percentage of commercial timber harvest ranges from 16.7 percent of the project area in Alternative 2, to 13.4 percent in Alternative 4, to 10.7 percent in Alternative 5. There is no commercial harvest in Alternative 3. Fire would reduce interception by burning fuels and vegetation; reduce evapotranspiration by killing or burning back grasses, shrubs and small trees; and change the timing and rate of snowmelt. These increases would be partially offset by an increased uptake of water by the remaining trees and vegetation. The reduction in interception and evapotranspiration and rate of snow melt resulting from prescribed spring and fall burning should not result in any measurable increase in flows from areas being treated due to the low intensity of the burn.

The 196 acres of thinning activities to improve cottonwood and aspen would help improve bank stability in stands adjacent to streams in the long term (starting within 5 to 10 years).

The EHA model does not measure direct effects but is based on the principal that reduced canopy closure would reduce interception and evapotranspiration and would increase snow accumulation. Standing dead trees no longer transpire but still would affect interception and snow accumulation. In addition based on the aspect and elevation of the project area, reducing stand density would accelerate snowmelt. Restated, there would be more snow pack and it probably would come off faster. However, the EHA values for all of the alternatives are below the Forest Plan threshold of 30 percent and the recommended threshold of 25 percent in the watershed analysis.

The probability of an event (flood) occurring can be increased by increasing the runoff efficiency of a drainage by road construction, increasing the snow pack through unit size and distribution, increasing snow melt rate by reducing canopy closure, or increasing the amount of water available by removing vegetation. Measurable increases in flow should start showing up when the EHA reaches about 20 percent (Hibbert 1965) and should be roughly proportional to the percentage of the area above that value. None of the alternatives would have a measurable increase on stream flows because the EHA value is below 20 percent in all alternatives.

Table 58. EHA on National Forest System lands.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Marks Creek Watershed									
Alternative 1	14.44	13.68	13.11	12.71	12.33	11.92	11.42	10.45	9.62
Alternative 2		15.00	16.86	18.87	19.71	19.34	18.81	17.59	16.48
Alternative 3		14.03	13.80	13.73	13.66	13.55	13.31	12.23	11.27
Alternative 4		14.79	16.23	17.82	18.48	18.16	17.70	16.50	15.43
Alternative 5		14.69	15.86	17.18	17.74	17.46	17.04	15.86	14.80
Upper Marks Creek Subwatershed									
Alternative 1	16.58	15.96	15.40	14.96	14.54	14.04	13.36	11.85	11.58
Alternative 2		16.92	18.07	19.31	19.78	19.35	18.69	16.99	15.52
Alternative 3		16.26	15.99	15.82	15.66	15.41	14.95	13.35	11.98
Alternative 4		16.85	17.88	19.00	19.42	19.01	18.37	16.67	15.21
Alternative 5		16.77	17.58	18.48	18.80	18.42	17.82	16.14	14.69
Lower Marks Creek Subwatershed									
Alternative 1	11.79	10.85	10.27	9.93	9.60	9.31	9.02	8.73	8.43
Alternative 2		12.62	15.36	18.31	19.62	19.32	18.95	18.33	17.67
Alternative 3		11.27	11.09	11.15	11.19	11.25	11.27	10.84	10.40
Alternative 4		12.25	14.19	16.35	17.32	17.12	16.87	16.30	15.70
Alternative 5		12.11	13.74	15.58	16.42	16.28	16.07	15.52	14.93
Veazie Creek Subwatershed (Lower Ochoco Creek Watershed)									
Alternative 1	2.17	2.07	1.99	1.92	1.84	1.74	1.69	1.59	1.51
Alternative 2		9.74	17.34	18.13	18.72	19.26	18.64	17.88	17.08
Alternative 3		3.15	4.14	5.09	5.98	6.83	6.47	6.04	5.60
Alternative 4		8.80	15.42	16.29	16.98	17.62	17.06	16.34	15.60
Alternative 5		8.29	14.40	15.27	15.93	16.60	16.06	15.37	14.68

Alternative 2

Commercial harvest and precommercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Commercial harvest, precommercial thinning, and fuels treatments overlay about 50 percent of the forested plant associations in the project area. Fuels treatments would be accomplished on about 51 percent of the area in forested plant associations outside the Mill Creek Wilderness.

The EHA is below the Forest Plan threshold of 30 percent and the recommended threshold of 25 percent in the watershed analysis. Harvest and precommercial thinning under Alternative 2 would not produce any measurable increases in flow (EHA < 20%) in the Marks Creek Watershed or the Upper Marks, Lower Marks, and Veazie Creek Subwatersheds.

Alternative 3

Precommercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Precommercial thinning and fuels treatments overlay about 46 percent of the forested plant associations in the project area. Fuels treatments would be accomplished on about 47 percent of the area in forested plant associations outside the Mill Creek Wilderness.

Precommercial thinning proposed under Alternative 3 would not result in measurable increases in flow in the Marks Creek Watershed or the Upper Marks, Lower Marks, and Veazie Creek Subwatersheds.

Alternative 4

Commercial treatments and precommercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Commercial harvest, precommercial thinning, and fuels treatments overlay about 49 percent of the forested plant associations in the project area. Fuels treatments would be accomplished on about 50 percent of the area in forested plant associations outside the Mill Creek Wilderness.

The EHA is below the Forest Plan threshold of 30 percent and the recommended threshold of 25 percent in the watershed analysis. Harvest and precommercial thinning under Alternative 4 would not produce any measurable increases in flow (EHA < 20%) in the Marks Creek Watershed or the Upper Marks, Lower Marks, and Veazie Creek Subwatersheds.

Alternative 5

Commercial harvest and precommercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Commercial harvest, precommercial thinning, and fuels treatments overlay about 47 percent of the forested plant associations in the project area. Fuels treatments would be accomplished on about 48 percent of the area in forest plant associations outside the Mill Creek Wilderness.

The EHA is below the Forest Plan threshold of 30 percent and the recommended threshold of 25 percent in the watershed analysis. Harvest and precommercial thinning under Alternative 5 would not produce any measurable increases in flow (EHA < 20%) in the Marks Creek Watershed or the Upper Marks, Lower Marks, and Veazie Creek Subwatersheds.

Cumulative Effects

The level of mortality due to the Hash Rock Fire is not expected to produce a measurable effect on peak flows at the watershed or subwatershed level, but it is expected to still be affecting flows in Hamilton Creek, the unnamed tributary to the west, and the west fork of Cornez Creek. Flows in Buck Creek, the east fork and main stem of Cornez Creek, Reilly Creek, and McGinnis Creek are within the normal range of variability.

The EHA model evaluated water yield effects of past and proposed harvest, precommercial thinning, and underburning in the project area. It is estimated that about 90 percent of the forested land outside the wilderness and research natural area has been at least lightly harvested in the past. The model evaluated all timber harvest over the last 30 years plus the Marks Creek Fire (1968) and the Hash Rock Fire (2000). Overstory removal and regeneration harvest prior to the last 30 years is still affecting water yield, but has substantially recovered. Roads can reduce canopy and leaf area index but the area is small. The Forest Plan maximum recommended open road density of 3 miles per square mile results in less than a 1 percent EHA. This is less than the accuracy of the model and if roads were included only sections that were in forested plant associations may be evaluated. The primary effect of roads is increased runoff efficiency resulting from extension of the drainage system and erosion from the road surface and cut and fill slopes. Natural fuels underburning primarily kills seedlings and saplings and without connected precommercial thinning, does not remove enough of the canopy to affect the EHA. Insect, disease, and wind throw can reduce canopy but the concentration and area impacted are small and dispersed in the project and were not included in the model. The number and spacing of the downed trees removed in Pickup Salvage (2001) and beetle kill trees removed in Cougar Salvage and TC Salvage (2006) were so few and far apart that they did not affect EHA. Other management activities that remove trees that should not affect EHA are: removing safety trees from developed campgrounds, removing safety trees adjacent to system roads, removing conifers from aspen stands, juniper thinning in low precipitation zones, and the Christmas tree program.

Harvest treatments on private lands below the National Forest boundary have been similar to those on the National Forest. There is currently no logging occurring on private lands in the project area. Based on species composition and past harvest activities, any future logging on private lands would probably be selective harvest. Since private land only accounts for about 5 percent of the area in the project area, potential future timber harvest on private lands would have a minimal affect on water yield in the project area.

Livestock grazing is not expected to affect peak or base flows. Livestock have little effect on EHA; their primary influence is on bank conditions which is one of the factors that determine what the channel response will be to changes in flow. Upward trends in riparian condition are expected to continue due to changes in the range utilization standards in the Grazing Implementation Monitoring Module (IIT 2000).

Wildlife

Goshawk

Affected Environment

Goshawks utilize a variety of forest conditions within their territories, but tend to favor stands with patches of moderate to high overstory canopy closure, interlocking crowns, mature to old structure, presence of canopy gaps and flyways below the overstory, and proximity to water for nesting areas (Schommer and Silovsky 1994, Crocker-Bedford 1990, Bull and Hohmann 1992, Reich et al. 2004, and Reynolds et al. 1992).

There are 22,896 acres of primary nesting habitat within the project area. This figure is based on the abundance of forested stands with medium to large size trees (size class 4 and 5) in all seral stages (E, M and L) in grand fir and Douglas-fir PAGs, and in the late seral (L) stage in ponderosa pine. There are six known goshawk territories within the project area. Each of these territories include a variety of habitats and forest conditions. Post-fledging areas (PFAs) have been mapped around or adjacent to known goshawk nesting sites. PFAs are generally mapped in the best available forested stands (moderate to high canopy closure with medium and large sized trees common) around or adjacent to known nest areas. Nesting sites are also mapped within each territory. There is one nest site mapped where all known alternate nests can be reasonably accommodated within one nest site. If alternate nests are in separate locations, then additional nest sites are mapped. In this project area, five of the PFAs are associated with a single mapped nest site and one is associated with two separate nest sites. The January 29, 2007, Spears Wildlife Report contains additional information on goshawk.

Environmental Consequences

Alternative 1

This alternative would not treat forest stands within PFAs or 30-acre nest sites. This alternative would not result in modification of existing habitat conditions. It is estimated that the project area would retain habitat suitability in the short term, but potentially be exposed to subsequent long-term risk of high intensity disturbance and loss of overstory trees due to continued competition for moisture and the presence or development of ladder fuels over time.

Alternative 1 would result in short-term retention of the existing amount and distribution of goshawk habitat at the landscape scale. There are 22,896 acres of primary nesting habitat within the project area. This alternative would also retain existing amounts and structural conditions within all six PFAs in the project area, at least in the short term. Goshawks are expected to continue to utilize the PFAs and other suitable habitat.

Direct and Indirect Effects Common to Alternatives 2, 3, 4, and 5

Acres outside the nest areas and within the PFAs that would be treated under any action alternative would be thinned from below. These activities are intended to improve forest condition by removing understory trees, with the result of enhancing longevity of dominant trees and growth of retained co-dominant trees. These activities would result in more open space for flight below the overstory canopy which would improve foraging habitat, but would reduce nesting and post-fledging hiding cover. All existing snags would be left that are not deemed to be a safety hazard.

Precommercial thinning would be limited to small trees less than 12 inches dbh. However, the majority of trees to be cut during precommercial thinning would be less than 9 inches dbh.

All action alternatives would implement underburning of natural fuels outside of thinning units within PFAs. This would occur in three PFAs, but the majority would be in the Crystal Springs PFA. Underburning activities within the PFAs would be designed to protect large overstory trees and, to the extent practical, snags and large down wood. However, it is predicted that snags and down wood that are in advanced stages of decay would be consumed by fire. This would be partially offset by the creation of snags and down wood due to fire-killed trees. However, the effect of fire on snag retention would likely result in a higher number of hard snags, with a concurrent reduction in soft and hollow snag habitat. Burning has the potential to remove large snags where they are present prior to treatment, while increasing the relative abundance of smaller snags that result from the fire. Prescribed burning would also stimulate production of herbaceous vegetation for several years after the fire, and shrubby vegetation 3-15 years after the fire. These changes in conditions would provide foraging habitat for some species that would be prey for goshawk (such as song birds), while potentially altering nesting habitat for some species (such as woodpeckers), which are also prey for goshawk.

The amount of suitable primary nesting habitat for goshawks within the project area predicted to be present after implementation (based on seral structural stage and PAG) is displayed in Table 59. The rate of development of future habitat can also be accelerated by thinning activities. Over time, as canopy closure recovers and trees in the stand attain diameter growth, primary nesting habitat would develop or be regained in treated areas, and would develop in other areas as well. All alternatives result in goshawk habitat remaining within the HRV both immediately after treatment and after 50 years of development post-treatment.

Table 59. Primary reproductive habitat for goshawks post-treatment and after 50 years.

	Post-Treatment	50 Yr Projection	Low End HRV	High End HRV
Alternative 1	22,896	25,552	20,819	34,599
Alternative 2	23,272	26,474	20,819	34,599
Alternative 3	23,243	26,530	20,819	34,599
Alternative 4	23,243	26,508	20,819	34,599
Alternative 5	23,350	26,531	20,819	34,599

Alternative 2

This alternative would commercially harvest timber on 421 acres and precommercial thin trees on 115 acres within PFAs. This alternative would implement underburning of natural fuels outside of harvest units within PFAs on approximately 144 acres. No units are within 30-acre nest sites. This alternative would result in modification of existing habitat conditions on a total of 678 acres within PFAs. It is estimated that commercially harvested areas and a portion of underburned areas within PFAs would have a short-term reduction in habitat suitability, but potentially subsequent long-term improvement through overstory maintenance and reduced risk of high-intensity disturbance. The remainder of the treated area within PFAs (understory thinning and some underburned areas) would likely retain existing habitat suitability or may be improved through opening up of understory canopy conditions (more flight paths and improved prey visibility). Acres of treatment within each PFA are displayed in Table 60.

Table 60. Alternative 2 acres of activities within PFAs.

Post-fledging Area	Commercial harvest +	Precommercial +	Fuels Activity Only	Total Acres Treated
PFA 2497 Claypool Spring	64	0	72	136
PFA 0246 Crystal Glade	107	19	60	186
PFA 1151 Jim Elliot Creek	48	51	0	99
PFA 1169 Little Hay Creek	119	18	4	141
PFA 9902 Nature Creek	0	0	2	2
PFA # 9903 Reilly Creek	83	27	6	116

This alternative would result in a 376-acre net increase in the amount of goshawk habitat at the landscape scale after all activities are complete which would result in 23,272 acres of primary nesting habitat within the project area. This alternative would also accelerate the development of future habitat, based on forest development projections, leading to a 922-acre net increase in 50 years compared to no action. This alternative would alter existing amounts and structural conditions within all six PFAs in the project area, on a total of 680 acres. Treatments would range from less than 1 percent to 47 percent of each PFA. Goshawks may be disturbed by activities outside of the nesting season or outside of seasonally restricted areas during operations. However, because (1) less than 50 percent of any PFA would be treated, (2) no activities would occur within known nest sites, (3) activities are limited to thinning from below and prescribed burning, and (4) seasonal restrictions would be applied during the nesting season, all PFAs are expected to remain suitable for occupancy by nesting goshawks and their young.

Alternative 3

This alternative would thin small trees on 265 acres in PFAs. Alternative 3 would implement underburning of natural fuels outside of thinning units within PFAs on approximately 234 acres. No activities are proposed within the 30-acre nest sites. This alternative would result in modification of existing habitat conditions on a total of 499 acres within PFAs. It is anticipated that this alternative would retain habitat suitability in the short term, with a long-term improvement through overstory maintenance and reduced risk of high-intensity disturbance, though the protection from risk of future loss of habitat may be less than that achieved under the more aggressive prescriptions under some of the other alternatives. Acres of treatment within each PFA are displayed in Table 61.

Table 61. Alternative 3 acres of activities within PFAs.

Post-fledging Area	Commercial harvest +	Precommercial +	Fuels Activity Only	Total Acres Treated
PFA 2497 Claypool Spring	0	46	90	136
PFA 0246 Crystal Glade	0	80	106	186
PFA 1151 Jim Elliot Creek	0	99	0	99
PFA 1169 Little Hay Creek	0	0	32	32
PFA 9902 Nature Creek	0	0	2	2
PFA 9903 Reilly Creek	0	38	6	44

This alternative would result in a 347-acre net increase in the amount of goshawk habitat at the landscape scale after all activities are complete which would result in 23,243 acres of primary nesting habitat within the project area. This alternative would also accelerate the development of future habitat, based on forest development projections, leading to a 978-acre net increase in 50 years compared to no action. This alternative would alter existing amounts and structural conditions within all six PFAs in the project area, on a total of 499 acres. Activities would range from less than 1 percent to 47 percent of each PFA. Goshawks may be disturbed by activities outside of the nesting season or outside of seasonally restricted areas during operations. Because (1) less than 50 percent of any PFA would be treated, (2) no treatments would occur within known nest sites, (3) activities are limited to precomercial thinning and prescribed burning, and (4) seasonal restrictions would be applied during the nesting season, all PFAs are expected to remain suitable for occupancy by nesting goshawks and their young.

Alternative 4

This alternative would commercially harvest timber on 245 acres and precommercially thin young trees on 218 acres in PFAs. Alternative 4 would implement underburning of natural fuels outside of thinning units within PFAs on approximately 144 acres. No units are within the 30-acre nest sites. This alternative would result in modification of existing habitat conditions on a total of 607 acres within PFAs. It is estimated that commercially harvested areas and a portion of underburned areas within PFAs would have a short-term reduction in habitat suitability, but potentially subsequent long-term improvement through overstory maintenance and reduced risk of high-intensity disturbance. The remainder of the treated area within PFAs (understory thinning and some underburned areas) would likely retain existing habitat suitability or may be improved through opening up of understory canopy conditions (more flight paths and improved prey visibility). Acres of treatment within each PFA are displayed in Table 62.

Table 62. Alternative 4 acres of activities within PFAs.

Post-fledging Area	**Commercial harvest +**	**Precommercial +**	**Fuels Activity Only**	**Total Acres Treated**
PFA 2497 Claypool Spring	62	0	72	134
PFA 0246 Crystal Glade	46	80	60	186
PFA 1151 Jim Elliot Creek	6	93	0	99
PFA 1169 Little Hay Creek	48	18	4	70
PFA 9902 Nature Creek	0	0	2	2
PFA 9903 Reilly Creek	83	27	6	116

This alternative would result in a 347-acre net increase in the amount of goshawk habitat at the landscape scale after all activities are complete which would result in 23,243 acres of primary nesting habitat within the project area. This alternative would also accelerate the development of future habitat, based on forest development projections, leading to a 956-acre net increase in 50 years compared to no action. This alternative would alter existing amounts and structural conditions within all six PFAs in the project area, on a total of 607 acres. Activities would range from less than 1 percent to 47 percent of each PFA. Goshawks may be disturbed by activities outside of the nesting season or outside of seasonally restricted areas during operations. Because (1) less than 50 percent of any PFA would be treated, (2) no activities would occur within known nest sites, (3) activities are limited to thinning from below and prescribed burning, and (4) seasonal restrictions would be applied during the nesting season, all PFAs are expected to remain suitable for occupancy by nesting goshawks and their young.

Alternative 5

This alternative would commercially harvest timber on 111 acres and precommercial thin young trees on 326 acres in PFAs. A few harvest units overlap mapped PFAs: 306 and 858 in the Little Hay Creek PFA and 302 and 303 in the Claypool Spring PFA. Within these areas, harvest would retain clumpy distribution of dominant and co-dominant trees and variable thinning density in the understory, with the intent of promoting horizontal diversity in the stand and a high degree of interlocking crown structure as described in Management Recommendation for the Northern Goshawk in the Southwestern United States (Reynolds et al. 1992). Alternative 5 would implement underburning of natural fuels outside of harvest units within PFAs on approximately 215 acres. No units are within 30-acre nest sites. This alternative would result in modification of existing habitat conditions on a total of 652 acres within PFAs. It is anticipated that the modified prescription included in this alternative would retain habitat suitability in the short-term, with a long-term improvement through overstory maintenance and reduced risk of high-intensity disturbance, though the protection from risk of future loss of habitat may be less than that achieved under the more aggressive prescriptions under some of the other alternatives. Acres of treatment within each PFA are displayed in Table 63.

Table 63. Alternative 5 acres of activities within PFAs.

Post-fledging Area	Commercial harvest +	Precommercial +	Fuels Activity Only	Total Acres Treated
PFA 2497 Claypool Spring	44	20	72	136
PFA 0246 Crystal Glade	0	126	60	186
PFA 1151 Jim Elliot Creek	0	99	0	99
PFA 1169 Little Hay Creek	67	43	3	113
PFA 9902 Nature Creek	0	0	2	2
PFA 9903 Reilly Creek	0	38	78	116

This alternative would result in a 454-acre net increase in the amount of goshawk habitat at the landscape scale post-treatment, 23,350 acres of primary nesting habitat within the project area. This alternative would also accelerate the development of future habitat, based on projections, leading to a 979-acre net increase in 50 years compared to no action. This alternative would alter existing amounts and structural conditions within all six PFAs in the project area, on a total of 652 acres. Activities would range from less than 1 percent to 47 percent of each PFA. Goshawks may be disturbed by activities outside of the nesting season or outside of seasonally restricted areas during operations. Because (1) less than 50 percent of any PFA would be treated, (2) no activities would occur within known nest sites, (3) activities are limited to thinning from below and prescribed burning, (4) seasonal restrictions would be applied during the nesting season, and (5) the prescription includes measures to promote stand diversity, all PFAs are expected to remain suitable for occupancy by nesting goshawks and their young.

Cumulative Effects

Past harvest activities have occurred on 7,563 acres in the project area in the last 30-35 years. The majority of these harvest activities removed most or all of the overstory trees and goshawk habitat. These harvest activities occurred on approximately 3,260 acres in Lower Marks Creek, 2,800 acres in Upper Marks Creek, and 7 acres in Veazie Creek. Some of these areas received harvest prescriptions that retained varied levels of abundance of large overstory trees. Prescriptions that retain approximately four to six live overstory trees would provide for some future large snag and log habitat as the younger stand develops into a mature stand, but would have largely eliminated goshawk habitat in the short term. These activities occurred on approximately 220 acres in Lower Marks Creek and 300 acres in Upper Marks Creek. Shelterwood harvests generally did not retain enough overstory trees to provide goshawk habitat in the short term. However, such stands do retain structure that may contribute to both the overstory and the snag and down wood components in the future as the stand develops around them. Shelterwood harvests occurred on approximately 260 acres in Lower Marks Creek and 560 acres in Upper Marks Creek. Thinning, which has occurred on approximately 150 acres in the project area would have retained a portion of the overstory and may remain suitable for goshawks after treatment depending on residual canopy closure and stand structural diversity. The Hash Rock Fire burned approximately 4,594 acres in the Marks Creek Watershed, removing foraging and PFA habitat within one goshawk territory (Reilly Creek PFA 9903). The PFA has been remapped to include the best available remaining habitat around the nest and historic use area. Riparian planting and aspen restoration that has been completed in the project area has improved habitat by enhancing habitat for prey (primarily birds), or is likely to contribute to improved habitat conditions in the future. At the same time, continued utilization by both big game and livestock have likely impacted the development of riparian hardwood habitat and habitat for shrub-nesting birds, which may provide prey for goshawks. The removal of snags for firewood, for hazard abatement, or under salvage sales (e.g. Cougar Salvage) may have reduced habitat for woodpeckers, which also represent prey for goshawks. Road closures that have been implemented have reduced the likelihood of snag removal and disturbance to nesting goshawks, though continued uncontrolled recreational use by off highway vehicles (OHV) has likely contributed to disturbance at one known nest site. Though past management activities have altered the amount, quality, and distribution of suitable goshawk habitat, or habitat components that contribute to habitat for their prey, the amount of reproductive habitat available to goshawks at the landscape scale is within the HRV as shown in Table 59.

Ongoing and reasonably foreseeable activities would continue to interact with goshawks and their habitat as described above. Ongoing firewood cutting, grazing, recreational use, riparian improvement and exclosure maintenance activities are not expected to result in altering habitat suitability. All six known PFAs are expected to remain suitable for occupancy by nesting goshawks and their young.

Management Indicator Species

The Forest Plan identified Management Indicator Species (MIS) to determine the effects of management activities on fish and wildlife habitat. Management indicator species are species whose presence in a certain location or situation at a given population level indicates a particular environmental condition. Population changes are believed to indicate effects of management activities on a number of other species.

Pileated woodpecker was identified as an indicator for species that require mature forest and old-growth habitat. Primary cavity excavators and the common (northern) flicker were identified to represent species that utilize snags and old-growth juniper habitat.

Pileated Woodpecker

Affected Environment

Pileated woodpeckers are an indicator species for dense and more mesic late and old structure (LOS) forests. They typically select for multi-strata mixed conifer LOS. LOS stands described in relation to wildlife habitat include forest stands that are at least 5 acres in size and that contain sufficient numbers of large trees and total stand density to meet established criteria used to describe LOS forest habitat. There are two patch size criteria which are relevant to analysis of wildlife habitat. The 5-acre minimum patch size distinguishes groups of large trees of sufficient size to provide a LOS forested habitat patch. When LOS stands are described in this document, it refers to areas that were determined to meet or exceed the 5-acre patch size, based on nearest neighbor analysis in GIS. The other relevant patch size is 100 acres, which responds to LOS forest habitat emphasis in the Eastside Screens and triggers the identification of connective corridor described in the connective corridor section of this document. The previous section on LOS applies to analysis for HRV comparison, and looks at large trees within pixels (1/6 acre), regardless of stand size. The acres of LOS stands described in the wildlife section refer to treatments within forested environments a minimum of 5 acres in size and meeting the following criteria for large tree abundance (trees per acre greater than or equal to 21 inches dbh) and total stand density (basal area in square feet per acre): grand fir at least 15 trees per acre, and 60 square feet of basal area; Douglas-fir at least 12 trees per acre and 40 square feet of basal area; mesic pine at least 10 trees per acre and 40 square feet of basal area; xeric pine at least 10 trees per acre and 30 square feet of basal area; juniper woodland at least 5 trees per acre and 12 square feet of basal area.

Pileated woodpecker habitat associates prefer dense forest conditions; they include Townsend's warbler, hermit thrush, and red-breasted nuthatch. As dense mixed-conifer stands often contain a high density of dead or dying trees, habitat for this species also represents habitat for the black-backed woodpecker, which is attracted to stands with abundant snags and activity by bark beetles and wood boring beetles. The best pileated feeding habitat is within stands dominated by large (>20 inch dbh) fir. Current conditions in the project area favor the pileated woodpecker, with multi-strata late and old structure forests being within or above the historical range of variability in moist and dry grand-fir, and Douglas-fir PAGs. The existing condition for pileated woodpecker reproductive habitat within the project area is within the HRV as shown in Table 65.

Forest Plan designated Old Growth Management Areas (OGMAs) are generally to provide reproductive habitat areas, and pileated feeding habitat has been mapped outside of the designated old growth. There are three OGMAs in the project area. Two of these have feeding habitat designated around them. Though the Jim Elliot Creek OGMA is within 2 miles of the Hash Rock Fire perimeter, the fire did not affect the areas designated for management of pileated woodpeckers. The third is contained within the Research Natural Area, which provides sufficient feeding habitat (exceeds the minimum requirements specified in the Forest Plan) for pileated woodpeckers. The pileated woodpecker prefers closed canopy, late to old growth fir-dominated habitat. They prefer stands with old growth, grand fir, abundant snags, abundant down logs, and canopy closure of at least 60 percent. Pileated woodpeckers use other species in proportion to their availability as foraging substrate. They use snags of ponderosa pine, Douglas-fir, and western larch, and snags at least 15 inches dbh were preferred for foraging. Pileated woodpeckers forage on down logs, but avoid lodgepole pine. These birds have been observed to glean insects from live Douglas-fir and grand fir in June and July (late instar budworms) and from live western larch from November to January (carpenter ants). Pileated woodpeckers select large, live, grand fir trees for night roosting, though they will use live larch and snags of ponderosa pine, grand fir, and larch (average 28 inches dbh). Hollow interiors of trees or snags resulting from decay rather than excavation, and the presence of Indian paint fungus conks are prevalent in roost trees (Bull et al. 1992). Breeding bird survey data show no significant change in population for this species in the western states (Marshall et al. 1997).

Within the project area, evidence of foraging by pileated woodpeckers has been observed on recently dead grand fir and potential roost holes were noted in large diameter, dead topped grand fir trees. Probable nest entrances have been observed in large diameter pine snags. The January 29, 2007, Spears Wildlife Report includes more information on pileated woodpecker.

Environmental Consequences

Alternative 1

This alternative would not treat LOS stands or forest stands within pileated feeding habitat or OGMAs. This alternative would maintain the existing acres of fir-dominated understory and canopy closure, at least in the short term. Of the approximately 1,400 acres of LOS stands that have been identified in the project area, 34 percent is in moist grand fir or Douglas-fir PAGs. These relatively more mesic areas are the most likely sites to sustain multi-strata LOS stands in the long term. Lack of treatment of the understory in these stands would perpetuate development of fir understory conditions which would increase pileated woodpecker habitat abundance and quality in the short term. Overtime, however, high stand densities may lead to mortality due to insects, disease, or high-intensity fire. The effect of such disturbances on pileated woodpecker habitat in the long term is dependent on the type, severity, and extent of the event(s). Extensive areas of high mortality that may potentially result from future, large-scale disturbance which would likely limit the amount of suitable nesting habitat in affected areas, whereas events resulting in mosaics including moderate and low intensity disturbance may continue to provide nesting habitat over time.

This alternative would maintain the suitability of existing habitat for pileated woodpeckers in the short term. Over time, the suitability for nesting is expected to decline on sites that cannot sustain high densities of conifers. As trees on such sites succumb to insect invasion they would provide a foraging substrate for a variety of woodpeckers, including the pileated. If the mortality becomes extensive and live canopy closure is lost in large areas of severe insect infestations or fire intensity, then affected areas would become less suitable for this species. If the mortality remains moderate and patchy, then the affected areas may remain suitable for this species. This is most likely to be sustainable on the more mesic PAGs, especially grand fir sites. Projections indicate that pileated woodpecker habitat would be above the HRV in 50 years under this alternative in the absence of large scale disturbance.

Direct and Indirect Effects Common to Alternatives 2, 3, 4, and 5

Within pileated feeding habitat, Alternatives 2 and 4 would reduce canopy closure, which would likely reduce the suitability of these areas as foraging habitat for pileated woodpeckers. However, within the treatment units that overlap pileated feeding habitat, prescriptions were modified to ensure that grand fir and Douglas-fir remain in these stands, while reducing stand density so that the development of large trees would be promoted. The reduction in canopy closure is a trade-off for the long-term benefit of providing a greater abundance of large structure trees, snags, and logs in the future. At the same time, snags would not be marked for removal; although hazard trees (tress that pose a danger to workers within work areas) would be cut down. Under Alternatives 3 and 5, stand density would be reduced in stands treated within pileated feeding habitat, but to a lesser extent than would occur under Alternatives 2 and 4. Suitability of habitat would be retained as the understory thinning is not expected to substantially alter canopy closure or the potential for future development of stem rot, and thus future nest/roost sites.

Underburning of natural fuels can result in varied effects to pileated woodpecker habitat. When fire burns under relatively cool conditions with higher fuel moisture the fire may creep around leaving unburned and lightly burned patches, and much of the larger woody debris would be retained. Some individual trees may be weakened, giving advantage to insects or pathogens that result in foraging opportunities for woodpeckers and which set individual trees on a path toward developing stem rot that would ultimately make them suitable substrate for the excavation of future nest cavities. Burning under this type of scenario would retain sufficient canopy closure to maintain habitat for pileated woodpeckers while providing for the development of foraging, roosting, and nesting habitat over time. On the other hand, if the burning occurs under warmer conditions with lower fuel moisture, the combustion of woody debris (including snags) may be more complete, canopy closure may be reduced, crown base height may be substantially raised, and resulting tree mortality may be immediate rather than prolonged (less time for development of stem rot). Burning under this type of scenario, may reduce suitability for use by pileated woodpeckers due to reduced cover and nesting/roosting sites, though a pulse of foraging substrate may result immediately after the treatment. Often a prescribed fire will burn under a combination of conditions due to variation in aspect, elevation, fuel types, and changing weather conditions. The end result is usually a mosaic of post-fire conditions that lead to a variable habitat quality for a range of species.

Thinning of small diameter trees within the Stewart Springs OGMA would release selected large diameter trees from understory competition. Resultant slash would be pulled away from the base of the trees, hand piled, and burned. This activity would improve the longevity of the selected large trees by reducing competitive stress and the development of ladder fuels. Because these activities are limited to the drier portions of the OGMA (south and west facing slopes in Douglas-fir and dry grand fir PAGs), the areas of the OGMA with the highest potential for sustaining pileated woodpecker nesting habitat (north and east facing slopes in moist grand fir PAGS) would remain untreated. The low intensity thinning activity would occur in patches where large live ponderosa pine and larch trees exist. Unthinned patches would be retained where large trees are absent, or where they occur less abundantly. Much of the area would remain suitable as foraging habitat for pileated woodpeckers.

Alternative 2

This alternative would commercially thin timber on 253 acres in pileated feeding habitat. Because the canopy may be reduced to less than 60 percent crown closure after treatment, this alternative would reduce the suitability of these stands as foraging or nesting habitat for pileated woodpeckers, at least in the short term. Canopy closure is expected to recover to some extent, as the retained trees expand their crowns in diameter and depth in response to the release from competition that results from thinning. Thinning of mid-story trees would promote the development of large structure trees in the future, ultimately providing a source of recruitment for large snags and down logs. Thus, this alternative would facilitate the development of higher quality nesting and roosting habitat in the long term. The prescription calls for preferential retention of ponderosa pine and larch, but grand fir and Douglas-fir would also be retained as individuals or clumps within these stands. In patches where moderate or higher levels of mistletoe occur in one species, understory trees of another species would be retained. This should promote within stand diversity and limit the impact of mistletoe on stand development.

Precommercial thinning outside of harvest areas would occur on 67 acres of pileated feeding habitat. Thinning of these small trees would help to promote the development of larger trees in the stand. Thus, this treatment would facilitate the development of higher quality foraging habitat in the long term. The prescription calls for preferential retention of ponderosa pine and larch, but grand fir and Douglas-fir would also be retained as individuals or clumps scattered within these stands, especially on north and east facing slopes and in draws.

Under burning (outside of thinning units) within pileated feeding habitat would occur on 94 acres. This activity may reduce habitat suitability by reducing canopy closure and by altering the timing of mortality in grand fir and Douglas-fir. Fire is likely to result in an abundance of fire killed fir trees soon after the activity, providing a flush of foraging substrate, but later within stand mortality is expected to decline and foraging opportunities would also decline.

No harvest or natural fuels burning would occur within OGMAs. Thinning of small diameter trees to release selected individual large trees would be conducted within portions of one OGMA (Stewart Springs) on approximately 70 acres.

This alternative is expected to reduce the quality of pileated woodpecker feeding habitat on 414 acres. Alternative 2 is expected to reduce the quantity of primary nesting habitat on 1,182 acres (26% of existing) within the project area in the short term. This alternative would result in about 20 percent less primary nesting habitat for pileated woodpeckers in 50 years compared to no action, assuming that large-scale, high-intensity disturbances does not occur. Projections indicate that pileated woodpecker habitat would be within the HRV in 50 years under this alternative. Pileated woodpeckers generally would not be expected to nest within areas that are commercially harvested under this alternative for a period of 25-30 years on more mesic sites (grand fir and Douglas-fir PAGs). Precommercial thinning stands on such sites may remain suitable after treatment, depending on residual stocking. On xeric sites (ponderosa pine and juniper PAGs) primary nesting habitat would not occur whether treated or not.

Alternative 3

Alternative 3 has no commercial harvest in pileated feeding habitat. It includes precommercial thinning on 125 acres. Thinning of these small trees would promote the development of larger trees in the stand. This activity would facilitate the development of higher quality foraging habitat in the long term with minimal impact on foraging habitat in the short term. The prescription calls for preferential retention of ponderosa pine and larch, but grand fir and

Douglas-fir would be retained as individuals within these stands, especially on north and east facing slopes and in draws.

Prescribed natural fuels burning within pileated feeding habitat would occur on 125 acres. This activity may reduce habitat suitability by reducing canopy closure and by altering the timing of mortality in grand fir and Douglas-fir. Fire is likely to result in an abundance of fire killed fir trees soon after the treatment, providing a flush of foraging substrate, but later within stand mortality is expected to decline and thus foraging opportunities would also decline.

No harvest or natural fuels burning would occur within OGMAs. Thinning of small diameter trees to release selected individual large trees would be conducted within portions of one OGMA (Stewart Springs) on approximately 70 acres.

This alternative is expected to alter forest structure on 250 acres of pileated woodpecker feeding habitat, but retain suitability within those acres. This alternative has potential to reduce quantity at least in the short term on these acres. The amount of primary nesting habitat would be reduced by 190 acres (4% of existing) within the project area in the short term. This alternative would result in about 4 percent less primary nesting habitat for pileated woodpeckers in 50 years compared to no action, assuming that large-scale, high-intensity disturbances do not occur. Projections indicate that pileated woodpecker habitat would be above the HRV in 50 years under this alternative. Precommercial thinned stands on mesic sites may remain suitable for nesting after treatment, depending on residual stocking and degree of crown scorch. On xeric sites (ponderosa pine and juniper PAGs) primary nesting habitat would not occur whether treated or not.

Alternative 4

This alternative would commercially thin timber on 131 acres in pileated feeding habitat. Because the canopy may be reduced to less than 60 percent crown closure after harvest, this alternative would reduce the suitability of these stands as foraging habitat for pileated woodpeckers, at least in the short term. Canopy closure is expected to recover to some extent, as the retained trees expand their crowns in diameter and depth in response to the release from competition that results from the thinning. Thinning of mid-story trees would promote the development of large structure trees in the future, ultimately providing a source of recruitment for large snags and down logs. Thus, this activity may facilitate the development of higher quality nesting and roosting habitat in the long term. The prescription calls for preferential retention of ponderosa pine and larch, but grand fir and Douglas-fir would also be retained as individuals or clumps within these stands. In patches where moderate or higher levels of mistletoe occur in one species, understory trees of another species would be retained. This would promote within stand diversity and limit the impact of mistletoe on stand development.

Precommercial thinning outside of harvest areas would occur on 155 acres. Thinning of these small trees would help to promote the development of larger trees in the stand. Thus, this treatment would facilitate the development of higher quality foraging habitat in the long term. The prescription calls for preferential retention of ponderosa pine and larch, but grand fir and

Douglas-fir would also be retained as individuals or clumps scattered within these stands, especially on north and east facing slopes and in draws.

Prescribed natural fuels burning (outside of thinning units) within pileated feeding habitat would occur on 74 acres. This activity may reduce habitat suitability by reducing canopy closure and by altering the timing of mortality in grand fir and Douglas-fir. Fire is likely to result in an abundance of fire killed fir trees soon after the treatment, providing a flush of foraging substrate, but later within stand mortality is expected to decline and thus foraging opportunities would also decline.

No harvest or natural fuels burning would occur within OGMAs. Thinning of small diameter trees to release selected individual large trees would be conducted within portions of one OGMA (Stewart Springs) on approximately 70 acres.

Alternative 4 is expected to reduce the quality of pileated woodpecker feeding habitat on 360 acres. This alternative is expected to reduce quantity of primary nesting habitat on 996 acres (22% of existing) within the project area in the short term. This alternative would result in about 17 percent less primary nesting habitat for pileated woodpeckers in 50 years compared to no action, assuming that large-scale, high-intensity disturbances do not occur. Projections indicate that pileated woodpecker habitat would be within the HRV in 50 years under this alternative Pileated woodpeckers generally would not be expected to nest within areas that are commercially harvested under this alternative for a period of 25-30 years on more mesic sites (grand fir and Douglas-fir PAGs). Precommercial thinned stands on such sites may remain suitable after treatment, depending on residual stocking and degree of crown scorch. Primary nesting habitat would not occur on xeric sites (ponderosa pine and juniper PAGs).

Alternative 5

This alternative would not commercially harvest timber in pileated feeding habitat. The suitability of these stands as foraging habitat for pileated woodpeckers, at least in the short term would be retained. Development of large structure trees in the future would continue at a slower pace than might occur if the stands were thinned.

Precommercial thinning outside of harvest areas would occur on 264 acres. Thinning of these small trees would promote the development of larger trees in the stand. The prescription would include retention of dense patches throughout treated stands in order to provide cover and foraging substrate. This activity would facilitate the development of higher quality foraging habitat in the long term with minimal impact on foraging habitat in the short term. The prescription calls for preferential retention of ponderosa pine and larch, but grand fir and Douglas-fir would be retained as individuals or clumps scattered within these stands, especially on north and east facing slopes and in draws. This activity may reduce habitat suitability by reducing canopy closure and by altering the timing of mortality in grand fir and Douglas-fir.

Prescribed natural fuels burning within pileated feeding habitat would occur on 57 acres. Fire is likely to result in an abundance of fire killed fir trees soon after the activity, providing a flush of foraging substrate, but later within stand mortality is expected to decline and thus foraging opportunities would also decline.

No harvest or natural fuels burning would occur within OGMAs. Thinning of small diameter trees to release selected individual large trees would be conducted within portions of one OGMA (Stewart Springs) on approximately 70 acres.

Alternative 5 is expected to alter quality of pileated woodpecker feeding habitat on 320 acres, but retain suitability on those acres. This alternative is expected to reduce quantity of primary nesting habitat on 1,048 acres (23% of existing) within the project area in the short term. This alternative would result in about 18 percent less primary nesting habitat for pileated woodpeckers in 50 years compared to no action, assuming that large-scale, high-intensity disturbances do not occur. Projections indicate that pileated woodpecker habitat would be within the HRV in 50 years under this alternative. Outside of areas with modified prescriptions, pileated woodpeckers generally would not be expected to nest within areas that are commercially harvested under this alternative for a period of 25-30 years on more mesic sites (grand fir and Douglas-fir PAGs). Within areas with modified prescriptions (connective corridors, goshawk post-fledging areas, pileated feeding habitat, satisfactory cover, etc.) and within precommercial thinned stands on such sites habitat may remain suitable after treatment.

Table 64. Acres of treatment in pileated woodpecker feeding habitat.

	Commercial Harvest	**Precommercial Thinning**	**Underburn Natural Fuels**	**Total Treatment**
Alternative 1	0	0	0	0
Alternative 2	254	67	94	414
Alternative 3	0	125	125	250
Alternative 4	131	155	74	360
Alternative 5	0	264	57	320

Table 65. Amount of pileated woodpecker habitat over time compared to HRV (acres).

	Existing Habitat	**Habitat after activities**	**Habitat after 50 Years**	**Low HRV**	**High HRV**
Alternative 1	4,617	4,617	7,788	3,073	6,584
Alternative 2	4,617	3,435	6,258		
Alternative 3	4,617	4,427	7,466		
Alternative 4	4,617	3,621	6,450		
Alternative 5	4,617	3,569	6,380		

***S**haded cells represent amounts outside the HRV.

Cumulative Effects

Harvest activities have occurred on 7,563 acres in the project area. Pileated feeding habitats are generally delineated outside of previously harvested areas, though some acres within pileated feeding habitat have received some level of hazard tree removal, salvage harvest, or woodcutting in the past. The majority of the previous harvest resulted in removal of most or all of the overstory trees rendering these areas unsuitable for pileated woodpeckers. This intensity of treatment occurred on approximately 3,263 acres in Lower Marks Creek, 2,799 acres in Upper Marks Creek, and 7 acres in Veazie Creek. Prescriptions that retained approximately 4-6 live overstory trees would provide for some future large snag and log habitat as the younger stand develops into a mature stand, but would have removed pileated woodpecker habitat. This type of treatment occurred on approximately 220 acres in Lower Marks Creek and 298 acres in Upper Marks Creek. Shelterwood harvests would not have retained enough overstory trees to provide pileated woodpecker habitat. However, such stands do retain structure that may contribute to both the overstory and the snag and down wood components in the future as the stand develops around them. Shelterwood harvests occurred on approximately 261 acres in Lower Marks Creek and 562 acres in Upper Marks Creek. Removal of snags for firewood, for hazard abatement, or under salvage sales (e.g. Cougar Salvage) would have reduced habitat for woodpeckers. At the same time that pileated woodpecker habitat was being reduced within timber harvest units, fire suppression activities were being implemented across all plant associations. As a result of this fire exclusion, grand fir developed in the understory of many stands that were previously dominated by ponderosa pine and larch. In these stands, pileated woodpecker habitat has increased compared to historic conditions.

Implementation of Viable Ecosystems and efforts to reduce hazardous fuel accumulations at the watershed and Forest level will continue to remove fir from many forested stands, resulting in increased domination of pine and larch, more open forest conditions and single stratum stand structure on more acres than is currently present. This will reduce the quality of pileated woodpecker habitat in the long term on these areas. At the same time, stands that have developed densities and species compositions that are not sustainable due to site capability, would be brought closer to a sustainable level. At the watershed scale, the abundance and distribution of pileated woodpecker habitat would be closer to the historic level. Habitat for pileated woodpeckers would be concentrated on sites that are more likely to sustain such stand densities and species distributions, and would be eliminated from sites that are less likely to sustain it in the long term.

Ongoing and reasonably foreseeable activities would continue to interact with pileated woodpeckers and their habitat. Ongoing grazing, recreational use, and exclosure maintenance activities are not expected to result in effects to this species when combined with effects of this project. However, ongoing firewood cutting may combine with this project to further reduce habitat for pileated woodpeckers. When implemented within the rules established by the firewood synopsis, there should be no net cumulative effect. However, people continue to remove large snags illegally, accessing them cross country or on old timber harvest access routes. This project proposes to harvest up to 5,366 acres with ground-based equipment and proposes to construct/reconstruct up to 30 miles of road. Though all new roads are scheduled to be closed and additional existing roads are planned to be closed after project activities are completed, some people are likely to utilize these road beds for a period of time before closures are implemented (some people may breach closures after they are implemented) in order to access firewood. This project may contribute to increased accessibility and thus additional area vulnerable to illegal snag removal which would reduce potential nesting habitat for this species and other primary cavity excavators.

Primary Cavity Excavators

Primary cavity excavators are Management Indicator Species (MIS) listed in the Ochoco Forest Plan (FEIS p. 3-21) as wildlife species that consistently excavate their own cavities.

The primary cavity excavators that occur on Ochoco National Forest are Lewis' woodpecker, red-naped sapsucker, Williamson's sapsucker, hairy woodpecker, downy woodpecker, white-headed woodpecker, black-backed woodpecker, three-toed woodpecker, pileated woodpecker and northern flicker. These species excavate cavities in wood that they use to nest in, and which may subsequently be used by other species (secondary cavity nesters). Two other groups of species, the nuthatches and chickadees sometimes excavate their own cavities and sometimes use existing cavities as secondary nesters. In this analysis, the black-capped chickadee and red-breasted nuthatch are represented by primary cavity excavators that use dense forest or riparian woodlands, while the mountain chickadee, pygmy nuthatch, and white-breasted nuthatch are represented by primary cavity excavators that use xeric open forest habitats.

The existing condition of habitat for primary excavators in conifer forest focuses on three species, the white-headed woodpecker, the pileated woodpecker, and the northern flicker. These three species represent the range of forest conditions from open, single-story dry forest to dense multiple-story mesic forest. These species are indicators for the range of habitat conditions utilized by conifer forest-dwelling primary cavity excavators that would be present in the project area. The white-headed and pileated woodpeckers also have higher requirements than the other species of primary cavity excavators either in terms of snag numbers, size, or both. White-headed woodpeckers are an indicator for open forest conditions in pine stands, while pileated woodpeckers are an indicator for dense forest conditions on more mesic sites. Though the northern flicker is a habitat generalist, it was chosen as a species to represent availability of snag habitat in old-growth juniper woodlands. The discussion on northern flicker has an emphasis placed on the discussion of old-growth juniper, though total habitat for the species can occur across all forest types within the project area, and the preferred nesting habitat within this project area is represented by the white-headed woodpecker. Species that select for special habitats such as aspen or that are listed as focal species for priority habitats in the Partners in Flight Northern Rocky Mountains Bird Conservation Plan are discussed in the section on neotropical birds. These include Lewis' woodpecker and red-naped sapsucker. The aspen loving red-naped sapsucker is an indicator of two other primary cavity excavators that select for riparian woodlands: Williamson's sapsucker and black-capped chickadee. The black-backed woodpecker is discussed in the neotropical birds section, because it is associated with a priority habitat listed there. The analysis of management indicator species and the neotropical birds section combined represent the needs and effects to all of the primary cavity excavators found on the Ochoco National Forest. The January 29, 2007, Spears Wildlife Report includes more information on primary cavity excavators.

White-headed Woodpecker

Affected Environment

The white-headed woodpecker prefers ponderosa pine habitat that has more open stand conditions with large pine for foraging and large snags for nesting habitat. The white-headed woodpecker is an indicator of more xeric LOS forests. They typically select for single-strata ponderosa pine dominated LOS forests. Its habitat associates are generally called the pine birds, including the pygmy and white-breasted nuthatches and the flammulated owl. This habitat type is also a preferred habitat for the northern flicker in the Blue Mountains of Oregon (Marshall et al. 2003). This habitat is used by all of the other primary cavity excavators with the exception of the pileated woodpecker, red-breasted nuthatch, and three-toed woodpecker, which prefer mixed conifer habitat with a fir component, and downy woodpecker and black-capped chickadee which are largely restricted to riparian woodlands. Open forest conditions are also preferred by Lewis' woodpecker, northern flicker, Williamson's sapsucker, pygmy and white-breasted nuthatches, and mountain chickadee. Current conditions in the Spears project area are limiting for white-headed woodpecker, with single-strata LOS forests being below the HRV in dry grand fir, Douglas-fir, and ponderosa pine PAGs. The existing condition is currently deficient in white-headed woodpecker habitat within the project area when compared to the HRV as shown in Table 66.

Table 66. Amount of white-headed woodpecker habitat over time compared to HRV (acres).

	Existing Habitat	**Habitat after activities**	**Habitat after 50 Years**	**Low HRV**	**High HRV**
Alternative 1	13,716	13,716	8,510	14,589	27,943
Alternative 2	13,716	17,176	10,938		
Alternative 3	13,716	14,800	9,400		
Alternative 4	13,716	16,848	10,720		
Alternative 5	13,716	16,936	10,829		

*Shaded cells represent amounts outside the HRV.

The white-headed woodpecker prefers open canopy, late to old growth pine-dominated habitat. They prefer stands with live old ponderosa pine, abundant snags, and relatively open understory conditions. White-headed woodpeckers favor live ponderosa pine as foraging substrate, but have been observed in lodgepole pine, sugar pine, Engelmann spruce, and other species. They concentrate their foraging activities on live ponderosa pine, but they may also glean insects from other tree species. They generally select large diameter ponderosa pine snags as nest sites, though they are not always in tall snags (Dixon 1995 and Marshall 1997). Though the population has been reported as increasing across the western states (Wisdom et al. 2000), there have been local population declines in the Blue Mountains (Csuti et al. 1997) and on Deschutes and Winema National Forests (Marshall et al. 1997). Breeding bird survey data show no significant change in population for this species in the western states (Marshall et al. 1997).

Within the project area, white-headed woodpeckers have been observed foraging in open forested areas, and potential nest holes have been noted in medium to large diameter pine snags and hollow live trees.

Environmental Consequences

Alternative 1

The current trends in snag and large wood abundance would continue to occur. The amount of existing snags present within the project area would not be altered by implementation of this alternative, though continued competitive stress would likely result in mortality of trees and thus recruitment of snags and down wood. Concurrently, the build up of fuels and canopy conditions that favor crown fires and high fire intensity may ultimately facilitate a stand replacing disturbance event. Such events yield an abundance of snags in the short term, but may result in large areas devoid of snags in 50 to 100 years afterwards (after the majority of the initial pulse of snags has fallen down). Large snag recruitment would begin again after the new stand matures enough to provide such structure. This may take 150 years or more.

This alternative would maintain the existing acres of fir-dominated understories and the trend toward fir dominated habitats. The no action alternative would favor the species that utilize fir-dominated habitats, by maintaining this habitat within the HRV. There would be a continued decline in white-headed woodpecker habitat which prefers open, pine dominated stands. This alternative would not move towards the HRV for the white-headed woodpecker and its associates. The trend of decreasing open forest and single-strata LOS would continue in the short term as understory trees fill in from below. Of the approximately 1,400 acres of LOS forests that have been identified in the project area, 66 percent is in dry grand fir or ponderosa pine plant associations. These relatively more xeric areas are the least likely to be able to sustain multi-strata LOS in the long term. Mortality due to stand densities being above sustainable levels would result in loss of foraging habitat for white-headed woodpeckers (live pine) as the overstory pine trees succumb to stress from competition in overstocked stands.

This alternative would not restore habitat for white-headed woodpeckers. This habitat type would remain below HRV. Over time, stand conditions area expected to decline on sites that cannot sustain high densities of conifers. As trees on such sites succumb to insect invasion they would stop producing seeds, sap, and invertebrates associated with foliage. These are listed as important food resources for this species (Marshall et al. 2003). If the mortality becomes extensive and live canopy closure is lost in large areas of severe insect infestations or fire intensity, then affected areas would become less suitable for this species. If the mortality remains moderate and patchy, then the affected areas may become more suitable for this species which prefers relatively open forest conditions. Projections indicate that white-headed woodpecker habitat would remain below the HRV in 50 years in the absence of large scale disturbance.

Direct and Indirect Effects Common to Alternatives 2, 3, 4, and 5

All existing snags would be left that are not deemed to be a safety hazard. The amount of existing snags present within the project area should not be substantially altered by implementation of any of the alternatives. Thus, the percent tolerance for species evaluated under DecAID would not be affected in the short term. However, the alternatives do set treated stands on different courses for rate of large tree development. Snags and down wood may be consumed by prescribed fire. This would be partially offset by the creation of down wood due to fire-killed trees. The effect of fire on snag retention would likely result in a higher number of hard snags, with a concurrent reduction in soft and hollow snag habitat. Because of anticipated low-fire intensity, it is also likely that while large existing snags may be consumed by fire, the snags created by fire would tend to be in smaller size classes due to the vulnerability to fire mortality of smaller, thin barked trees.

Reduction of understory tree density within treated areas would reduce the abundance of dense, fir-dominated understory conditions, and increase the abundance of more open stand structure with ponderosa pine contributing a relatively larger percentage of the species composition. This would result in reduced abundance of habitat for species that select for dense multi-layered forests, such as the pileated woodpecker and red-breasted nuthatch, while providing an increased abundance of habitat for species that prefer more open pine dominated stands, such as the white-headed woodpecker and white-breasted nuthatch.

Alternative 2

This alternative would treat 6,172 acres with commercial harvest. In these units all existing snags would be left that are not deemed to be a safety hazard during timber operations. The intent is to have at least the number and sizes of snags and down wood as prescribed in the Regional Forester's Plan Amendment 2. All existing snags and down logs (>12 inches small end) are to be retained (with the exception of safety hazards).

Underburning would occur on 5,511 acres outside of harvest and thinning units and on 9,953 acres within harvest and thinning units.

This alternative would help restore white-headed woodpecker habitat on most of the commercial harvest area. Where precommercial thinning occurs in two-storied stands with a component of large live ponderosa pine and suitable snags for nesting, this activity would help restore white-headed woodpecker habitat. Precommercial thinning in young stands promotes the development of large pine in the future, and thus habitat for white-headed woodpecker. This alternative treats 11,356 acres by precommercial or hardwood restoration thinning. This alternative is expected to restore white-headed woodpecker habitat on 3,460 acres. This alternative would reduce the understory fir component on acres dominated by ponderosa pine and western larch.

Alternative 2 is expected to restore white-headed woodpecker habitat on 3,460 acres moving this habitat type into HRV post-treatment. This alternative would result in about 29 percent more primary nesting habitat for white-headed woodpeckers in 50 years compared to no action. Projections indicate that white-headed woodpecker habitat would be below the HRV in 50 years under this alternative, unless maintained in the future. White-headed woodpeckers would be expected to nest within commercially harvested areas for up to 15 years on mesic sites (grand fir and Douglas-fir PAGs), or up to 30 years on more xeric sites (ponderosa pine PAGs). Precommercial thinned stands on such sites may be suitable after treatment, depending on residual stocking and degree of crown scorch.

Alternative 3

Alternative 3 has no commercial harvest, but would still treat forest stands on 9,899 acres with precommercial or hardwood restoration thinning. Small trees up to 12 inches dbh would be subject to precommercial thinning. Prescribed underburning would occur on 5,603 acres outside of thinning units and on 8,323 acres in precommercial thinning units.

The effects of this alternative would reduce the amount of overstocked stands by thinning understory trees. This alternative would not create the open habitats preferred by the pine birds except on acres dominated by trees less than 12 inches dbh trees and in two storied stands with dense small tree cover under the large tree overstory. It would not reduce fir dominated mid and understories as much as the commercial harvest alternatives, as many of these trees are larger than 12 inches dbh.

Where precommercial thinning occurs in two-storied stands with a component of large live ponderosa pine and suitable snags for nesting, this activity would help restore white-headed woodpecker habitat. However, this activity would not be as effective in multi-storied stands as commercial harvest, where the mid-story trees are thinned more aggressively. Thinning of young stands would promote development of future white-headed woodpecker habitat on pine sites. This alternative would have the least effect of the action alternatives on white-headed woodpecker habitat, because treated stands would likely retain a higher canopy closure and true fir component than would be present in commercially harvested stands of the other alternatives. This alternative is expected to restore white-headed woodpecker habitat on 1,084 acres.

This alternative is expected to alter forest structure sufficiently enough to restore habitat for white-headed woodpeckers on 1,084 acres moving this habitat type into HRV post-treatment. This alternative would result in about 10 percent more primary nesting habitat for white-headed woodpeckers in 50 years compared to no action. Projections indicate that white-headed woodpecker habitat would be below the HRV in 50 years under this alternative. Stands may be suitable for nesting after treatment on mesic sites (grand fir and Douglas-fir PAGs) for up to 15 years, or up to 30 years on xeric sites (ponderosa pine PAGs) depending on residual stocking and degree of crown scorch.

Alternative 4

This alternative treats 4,935 acres with commercial harvest. In these units all existing snags would be left that are not deemed to be a safety hazard. The intent is to have at least the number and sizes of snags and down wood as prescribed by the Eastside Screens. All existing snags and down logs (>12 inch diameter small end) are to be retained.

This alternative would help restore white-headed woodpecker habitat on most of the commercial harvest area. Where precommercial thinning occurs in two-storied stands with a component of large live ponderosa pine and suitable snags for nesting, this treatment would help restore white-headed woodpecker habitat. Precommercial thinning in young stands promotes the development of large pine in the future, and thus habitat for white-headed woodpecker. This alternative treats 11,131 acres by precommercial or hardwood restoration thinning. Underburning would occur on 5,338 acres outside of thinning units and 9,824 acres within thinning units. This alternative is expected to restore white-headed woodpecker habitat on 3,132 acres. The effects of this alternative would reduce acres of overstocked stands and reduce the understory fir component on acres dominated by ponderosa pine and western larch.

This alternative is expected to restore white-headed woodpecker habitat on 3,132 acres moving this habitat type into HRV post-treatment. This alternative would result in about 26 percent more primary nesting habitat for white-headed woodpeckers in 50 years compared to no action. Projections indicate that white-headed woodpecker habitat would be below the HRV in 50 years under this alternative, unless maintained in the future. White-headed woodpeckers would be expected to nest within areas that are treated for up to 15 years on mesic sites (grand fir and Douglas-fir PAGS), or up to 30 years on more xeric sites (ponderosa pine PAGs). Precommercial thinned stands on such sites may be suitable after treatment, depending on residual stocking and degree of crown scorch.

Alternative 5

This alternative treats 3,942 acres with commercial harvest. In these units all existing snags would be left that are not deemed to be a safety hazard. The intent is to have at least the number and sizes of snags and down wood as prescribed by the Regional Forester's Plan Amendment 2. All existing snags and down logs (>12 inch diameter small end) are to be retained (with the exception of safety hazards).

This alternative would help restore white-headed woodpecker habitat on commercial harvest units that are not within goshawk PFAs, connective corridors, satisfactory elk cover in winter range, or in mesic north or east facing swales. In harvest units within these habitats, the harvest prescription is less aggressive, so would not do as well at promoting habitat suitability for white-headed woodpeckers, as the more intensive treatments elsewhere under this alternative or under Alternatives 2 or 4. Where precommercial thinning occurs in two-storied stands with a component of large live ponderosa pine and suitable snags for nesting, this treatment would help restore white-headed woodpecker habitat. Precommercial thinning in young stands promotes the development of large pine in the future, and thus habitat for white-headed woodpecker. This alternative treats 11,270 acres by precommercial or hardwood thinning. Underburning would occur on 4,702 acres outside of harvest and thinning units and on 9,503 acres within harvest and thinning units. This alternative is expected to restore white-headed woodpecker habitat on 3,220 acres. The effects of this alternative would reduce acres of overstocked stands and reduce the understory fir component on acres dominated by ponderosa pine and western larch.

This alternative is expected to restore white-headed woodpecker habitat on 3,220 acres post-treatment. This alternative would result in about 29 percent more primary nesting habitat for white-headed woodpeckers in 50 years compared to no action. Projections indicate that white-headed woodpecker habitat would be below the HRV in 50 years under this alternative, unless maintained in the future. White-headed woodpeckers would be expected to nest within areas that are commercially harvested under this alternative for up to 15 years on mesic sites (grand fir and Douglas-fir PAGs), or up to 30 years on more xeric sites (ponderosa pine PAGs). Precommercial thinned stands on such sites may be suitable after treatment, depending on residual stocking and degree of crown scorch.

Cumulative Effects

Harvest activities have occurred on 7,563 acres in the project area. The majority of the previously harvested areas received harvest prescriptions which removed most or all of the overstory trees limiting both nesting and foraging habitat in these areas for white-headed woodpeckers. This intensity of treatment occurred on approximately 3,263 acres in Lower Marks Creek, 2,799 acres in Upper Marks Creek, and 7 acres in Veazie Creek. Prescriptions that retain 4-6 live overstory trees may provide suitable habitat for white-headed woodpeckers as long as live ponderosa pine and at least 2.25 large snags per acres are present (Thomas et al. 1979). This intensity of treatment occurred on approximately 220 acres in Lower Marks Creek and 298 acres in Upper Marks Creek. Shelterwood harvests may retain enough overstory trees to provide suitable white-headed woodpecker nesting habitat. Stands with at least 12 trees per acre greater than 21 inches dbh may be comparable to stands that are known to have been used successfully by nesting white-headed woodpeckers (Marshall et al. 2003). Such stands provide live large tree structure currently and may contribute to both the overstory and the snag and down wood components in the future. Shelterwood harvests occurred on approximately 261 acres in Lower Marks Creek and 562 acres in Upper Marks Creek. Removal of snags for firewood, as hazard abatement, or under salvage sales (e.g. Cougar Salvage) would have reduced habitat for white-headed woodpeckers (Wisdom et al. 2000). Fire exclusion has resulted in grand fir developing in the understory of many stands that were previously dominated by ponderosa pine and larch. This has contributed to loss of open forest conditions and potential increases in predation (Marshall et al. 2003). As a result of past management practices, white-headed woodpecker habitat has decreased compared to historic conditions.

Implementation of Viable Ecosystems and efforts to reduce hazardous fuel accumulations at the watershed and Forest level would continue to restore more open forest conditions in many forested stands, resulting in increased dominance of pine and larch and single stratum structure on more acres than is currently present. This would improve the quality of white-headed woodpecker habitat on these areas. At the watershed scale, the abundance and distribution of white-headed woodpecker habitat would become within the historic level in the short-term under all action alternatives. Keeping white-headed woodpecker habitat within HRV in the long term would require future maintenance.

Ongoing and reasonably foreseeable activities would continue to interact with white-headed woodpeckers and their habitat. Ongoing grazing, recreational use, and exclosure maintenance activities are not expected to result in effects to this species when combined with effects of this project. However, ongoing firewood cutting may combine with this project to further reduce habitat for white-headed woodpeckers. When implemented within the rules established by the firewood synopsis, there should be no net cumulative effect. However, people continue to remove large snags illegally, accessing them cross country or on old timber harvest access routes. This project proposes to harvest up to 5,366 acres with ground-based equipment and proposes to construct/reconstruct up to 30 miles of road. Though all new roads are scheduled to be closed and additional existing roads are planned to be closed after project activities are completed, some people are likely to utilize these road beds for a period of time before closures are implemented (some people may breach closures after they are implemented) in order to access firewood. As described above for pileated woodpeckers, this project may contribute to increased accessibility and thus additional areas vulnerable to illegal snag removal, which would reduce potential nesting habitat for this species and other primary cavity excavators.

Northern (Common) Flicker

Affected Environment

Northern flicker prefers open forests and forest edges, though they can be found in a wide variety of terrestrial habitats in Oregon. They tend to avoid very dense forested areas. They will nest in a variety of tree species with decay in them. In the Blue Mountains, they are known to nest in ponderosa pine, Douglas-fir, western larch, and lodgepole pine. In central Oregon, flickers were found to select old-growth juniper over mid-successional juniper (Marshall et al. 2003). The most preferred habitat conditions for this species is provided for in open condition ponderosa pine and Douglas-fir PAGs which are analyzed above in the section on white-headed woodpeckers. The direct, indirect, and cumulative effects described for white-headed woodpeckers best represent the effects to northern flickers in the project area. The following discussion applies to the old-growth juniper habitat type and the role it may play in providing for the northern flicker within the project area, even though it is not necessarily the primary preferred habitat for the species within this project area.

Of the approximately 1,400 acres of LOS stands that have been identified in the project area, a negligible amount were in western juniper PAG. However, juniper also occurs in the early-seral stages of the ponderosa pine and Douglas-fir PAGs, so individual old-growth juniper trees may occur in these sites as well as in the western juniper PAG.

Environmental Consequences

Alternative 1

The current trends in snag and large wood abundance would continue to occur. The amount of existing juniper snags and live juniper with hollow spaces present within the project area would not be altered by this alternative. The build up of fuels and canopy conditions would continue, and would ultimately favor stand replacing fire events. This would not be an atypical fire regime in this habitat type. Such events yield an abundance of snags of varying heights and diameters. Juniper snags may tend to stand for many years following fire unless they are in a location that can be easily accessed by firewood cutters. Snag and cavity tree recruitment would begin again after the new stand matures enough to provide such structure. Development of snags and trees with stem rot (decay that allows excavation to be possible) of sufficient size to accommodate nesting flickers may take 200 years or more after a stand-replacing fire.

This alternative would maintain the existing acres of juniper stands and dense developing understory conditions. This alternative would not move juniper woodland and juniper steppe PAGs towards the HRV for open stands of large structure juniper trees, and would not reduce the potential for stand replacing fire events. The trend of decreasing open woodland juniper LOS would continue in the short term as understory trees fill in from below. This alternative would not remove juniper from the understory of pine, Douglas-fir, or grand fir sites, so potential replacement trees for juniper LOS would not be reduced. The growth rate of potential replacement trees would not be improved under this alternative. Because old-growth juniper is not a an extensive habitat feature within this project area, and because northern flickers are expected to select for more favorable nest sites such as large diameter pine, fir, or larch where they are available, the effect of this alternative on old-growth juniper is expected to have a negligible effect on northern flickers.

Alternatives 2, 3, 4, and 5

Under the action alternatives, no old-growth juniper would be removed, except incidentally such as in clearing for road construction or landings. Some individual old-growth trees may be killed by prescribed burning if ground and ladder fuels are sufficient to carry the fire into them. However, the old-growth juniper trees are often on rocky areas that do not sustain fire spread. That is why the juniper has developed into old growth on those sites. The amount of existing juniper snags and large, live juniper with hollow spaces present within the project area would not be altered by implementation of the action alternatives. However, the number of potential replacement trees would be reduced, as young and small diameter juniper trees would be targeted for removal to achieve stand density objectives. The trees that are retained during thinning operations, whether juniper or other species, would benefit from the density reduction in both growth rate and reduction of risk of loss to high intensity disturbance (fire, insects, and disease). Thus, though there may be fewer small juniper trees retained under the action alternatives, most of the larger and older juniper trees would be retained.

These alternatives would maintain the majority of the existing old-growth juniper trees, but would reduce the acres in dense developing understory conditions (including juniper). This alternative would move juniper woodland and juniper steppe PAGs towards the HRV for open stands of large structure juniper trees, and would reduce the potential for stand replacing fire events. The trend of decreasing open woodland juniper LOS would be slowed in treated stands as young trees are thinned from below. These alternatives would remove juniper from the understory of pine, Douglas-fir ,or grand fir sites, so potential future juniper tree density would be reduced, however the growth rate of retained trees (including potential replacement LOS) would be improved under these alternatives. Because old-growth juniper is not a an extensive habitat feature within this project area, and because northern flickers are expected to select for more favorable nest sites such as large diameter pine, fir, or larch where they are available, the effect of these alternatives on old-growth juniper is expected to have a negligible effect on northern flickers in this project area.

Cumulative Effects

There are no present or reasonably foreseeable future activities that would alter old-growth juniper habitats within the project area. Therefore, there are no cumulative effects related to old-growth juniper habitat.

Snags and Down Wood

The Eastside Screens provide direction on dead wood retention, including both snags and logs. The Interim Wildlife Standard, Scenario A, specifies that all sale activities will maintain snags and green replacement trees greater than or equal to 21 inches dbh (or the representative overstory tree dbh if less than 21 inches), at the 100 percent potential population levels of primary cavity excavators. The Eastside Screens state that this should be determined using the best available science on species requirements as applied through current snag models or other documented procedures.

Recently, the Decayed Wood Advisor (DecAID) (Mellen et al. 2002) has become available for use. This work is an advisory tool to help land managers evaluate effects of forest conditions and existing or proposed management activities on organisms that use snags, down wood, and other wood decay elements. In this publication, it is possible to relate the abundance of dead wood habitat, both snags and logs, to the frequency of occurrence of various wildlife species that require dead wood habitat for some part of their life cycle. DecAID shows levels based upon "percentage of tolerance." This tolerance can be viewed as representation of levels of "assurance" or confidence of providing habitat for a particular species. However, the data displayed in DecAID is merely a summary of the conditions present in research plots that have been studied and is dependent on available research data (within each habitat type and for each species). DecAID does provide data on snag abundance and distribution in unharvested study areas that can be used as a basis of comparison for reference conditions within various habitat types. It also provides data on wildlife use observed in studies that have been conducted which can be used to help predict species responses to varying snag and down wood levels in various habitat types.

Affected Environment

The Hash Rock Fire burned approximately 4,600 acres within the Marks Creek Watershed in the fall of 2000. The majority of these acres were impacted by low-intensity fire that tended to thin young trees from the understory and consume some of the large wood on the forest floor. The fire did burn moderate to hot in three locations in the Hamilton, Reilly, and McGinnis Creek drainages. In these locations, there were 20 to 30-acre hotspots that killed most of the overstory trees. Following the Hash Rock Fire increased mortality began to occur in all diameter classes of ponderosa pine. Initially, the mortality occurred within the perimeter of the Hash Rock fire although additional mortality began to show up outside the fire perimeter. As a result of the increase in snags within the watershed, habitat for primary cavity excavators and other species that depend on dead would habitat was increasing.

Dead wood (standing or down) plays an important role in overall ecosystem health, soil productivity, and numerous species' habitat. Many wildlife species depend on snags and downed wood for roosting, denning, or feeding. In the Blue Mountains of Oregon and Washington, 62 species of birds and mammals use snags in some portion of their life functions (Thomas 1979). Snags come in all sizes and start as standing hard snags and through time begin to break down and eventually decay into soil nutrients. Various species utilize snags at various stages throughout the decay process. The goal is to manage for a variety of snag sizes, in various stages of decay and at various densities across the landscape to maintain viable populations of the variety of species that depend on them. Currently, the Ochoco National Forest is using the

Viable Ecosystems Management Guide or 2.25 snags per acres (Thomas 1979) to determine the number of snags to retain. The minimum number is 2.25 snags per acres, as described in Thomas (1979). The Viable Ecosystems Management Guide describes a range of snag densities that could historically exist across the landscape in different PAGs.

Snag management guidelines were developed for the Marks Creek Watershed using a variety of information including scientific literature, standards and guidelines in the Forest Plan, local knowledge of the area, and information contained in the DecAID advisory tool.

Snag and down wood levels are best analyzed at scales of subwatersheds or 20 square miles (Mellen et al. 2002). Wisdom et al. (1999) recommends a subwatershed scale for sampling snags. The recent (2004) Cougar Salvage Project analysis collected information on size, density, and distribution for the approximately 38,800-acre Marks Creek Watershed. No information was collected for the non-forest portion of the watershed or the juniper woodlands portion.

The following methods were used to determine existing snag densities for the Marks Creek Watershed (from Cougar Salvage analysis). The desire was to conduct a total count of snags for the watershed using a conservative method that would not over estimate existing snag densities. Comparing survey data with information that was collected on the ground from the same locations and considering the survey techniques, indications are that the survey underestimated current snag levels by approximately 25 percent.

First, low-level helicopter flights were flown over the entire watershed. Recently dead trees were counted. Recently dead was defined as having the majority of the crown with red needles. In general, individual trees were not inventoried and snags with no red needles were also not inventoried. Snags were recorded as greater than 20 inches dbh and less than 20 inches dbh. Species were recorded for fir and pine. Smaller groups of dead trees were recorded as points and when larger areas of scattered dead trees or larger groups of dead trees were surveyed, they were recorded as polygons. A district wildlife biologist and the forest wildlife biologist conducted the surveys. Ground truthing on selected sites indicated that aerial surveys under estimated snag densities when numbers of snags exceeded approximately 50.

Second, snag densities were obtained from the district silviculturist for that portion of the Hash Rock fire that occurred within the Marks Creek Watershed. Snag density estimates for the burn area was obtained using stand exam information; CVS plot data, and burn intensities within the fire. Even though some survey data points from the helicopter survey occurred within the Hash Rock fire perimeter, the survey concentrated outside the Hash Rock fire perimeter. Observations that were made during the 2004 helicopter survey indicated that a large amount of mortality has occurred in stands within the Hash Rock fire perimeter and on the edges of the perimeter that was not initially dead following the fire.

Finally, in an attempt to capture a portion of the dead trees existing prior to the 2004 helicopter survey, data from the Insect and Disease survey, conducted annually by the USDA Forest Service and the Oregon Department of Forestry was included. Information was included from the years 1999 through 2003. Information from the 2004 insect and disease survey that did not overlap with the 2004 helicopter survey was also included.

The combined survey data provided snag information: (1) to evaluate existing conditions for the Marks Creek Watershed,(2) to develop retention guidelines for salvage areas, and (3) for comparison of direct and indirect effects of alternatives. Snags will be addressed as they relate to size, density, and distribution.

Tables 67 and 68 summarize all information collected for dead trees within the approximately 38,800 acre Marks Creek Watershed by PAG. The tables also display the VEMG guidelines and the prescribed retention levels by PAG. No information was collected for the juniper woodland community and non-forest portion of the project area.

Table 67. Surveys and retention levels for snags less than 20 inches dbh.

PAG	Existing Snags <20"dbh	Watershed Acres	Snags/Acre <20"dbh	VEMG Range	Prescribed Retention Levels
Moist grand fir	5,960	1,403	4.2	4.4 - 10.0	10/ac.
Dry grand fir	87,496	19,633	4.5	3.2 - 7.1	5.8/ac.
Douglas-fir	2,824	8,219	0.3	1.3 - 3.1	3.1/ac.
Mesic pine	563	2,155	0.3	1.2 - 2.7	2.7/ac.
Xeric pine	640	2,600	0.25	0 - 0.3	0.3/ac.
		34,010			

Table 68. Surveys and retention levels for snags greater than 20 inches dbh.

PAG	Existing Snags >20"dbh	Watershed Acres	Snags/Acre >20"dbh	VEMG Range	Prescribed Retention Levels
Moist grand fir	1,170	1,403	0.8	1.5 - 4.9	4.9/ac.
Dry grand fir	17,060	19,633	0.9	1.0 - 3.3	3.3/ac.
Douglas-fir	738	8,219	0.1	0.2 - 1.6	1.6/ac.
Mesic pine	152	2,155	0.1	0.2 - 1.6	1.6/ac.
Xeric pine	83	2,600	0.03	0.1 - 0.7	0.7/ac.
		34,010			

Survey data (Tables 67 and 68) indicate that on the watershed scale the project area is currently below the low end of the range for snag density in both size classes in the moist grand fir, Douglas-fir, and moist pine PAGs. In the dry grand fir PAG, and in less than 20 inch dbh trees, the project area is slightly above the low end of the range for snag density, but slightly below the range for snag density in snags greater than or equal to 20 inches dbh. In dry pine PAGs, existing snag density is within the VEMG range in both size classes. The purpose of the watershed scale look at snag densities is to provide guidance for the management of snags at the project or unit scale. As a result of current levels being below or at the low end of the range, the prescription within treatment areas is to manage at the higher end of the range.

Information obtained from DecAID was used to compare how snags may have been historically distributed across the landscape with the distribution that currently exists. Table 69 displays distribution data from unharvested plots in DecAID for the ponderosa pine/Douglas-fir habitat type. The ponderosa pine/Douglas-fir habitat type best describes the moist pine, Douglas-fir, and dry grand fir PAGs used in this analysis. Data for the moist grand fir PAG was also included. The moist grand fir PAG occurs on approximately 1,400 acres within the project area. Information is displayed for all snags greater than 10 inches dbh. Alternative 1 displays information for the project area. Acres are not included for the non-forest and juniper woodland portions of the project area.

Table 69. Distribution data for unharvested plots in DecAID for ponderosa pine/Douglas-fir habitat types (snags per acre).

snags/acre	No snags	0-4 snags	4-8 snags	8-12 snags	>12 snags
Unharvested Plots (DecAid)	54%	24%	7%	10%	4%
Existing Condition	65%	24%	1%	0.07%	10%

DecAID predicts the following species will use ponderosa pine/Douglas-fir large tree vegetation: black-backed woodpecker, flammulated owl, northern flicker, white-headed woodpecker, pileated woodpecker, pygmy nuthatch, red-naped sapsucker, and Williamson's sapsucker. Available information in DecAID on snag densities by species is limited and shown in Tables 70 and 71 for the white-headed woodpecker and pileated woodpecker. Refer to the Primary Cavity Excavator section above for more information on white-headed and pileated woodpeckers.

In this project area, the large snags in stands that are included in the dry grand fir PAG provide habitat consistent with large snags in the ponderosa pine/Douglas-fir habitat type described in DecAID because these stands are relatively dry and tend to have natural fire regimes that favor retention of early and mid seral fire tolerant species rather than late seral fire intolerant species. On the dry grand fir sites, the largest trees and snags are usually a mix of ponderosa pine, Douglas-fir, and larch, while the grand fir on these sites is more commonly present in the understory and mid-story layers as small or medium sized trees and snags. For this reason, the

Table 70. Tolerance levels in ponderosa pine and Douglas-fir large tree (>10"snags).

Tolerance Levels	Pileated Woodpecker	White-headed Woodpecker
30% Snag Density (#/acre)	--	0.3
30% Sample size	0	149
30% # of studies	0	1
50% Snag Density (#/acre)	30.4	1.7
50% Sample size	105	149
50% # of studies	1	1
80% Snag Density (#/acre)	--	3.7
80% Sample size	0	149
80% # of studies	0	1

Table 71. Tolerance levels in ponderosa pine and Douglas-fir large tree (>20"snags).

Tolerance Levels	Pileated Woodpecker	White-headed Woodpecker
30% Snag Density (#/acre)	--	0.5
30% Sample size	0	75
30% # of studies	0	1

50% Snag Density (#/acre)	7.6	1.8
50% Sample size	105	75
50% # of studies	1	1
80% Snag Density (#/acre)	--	3.8
80% Sample size	0	75
80% # of studies	0	1

snag counts for snags greater than 20 inches dbh in the dry grand fir PAG listed in Table 68 is included in the count for existing snag density in the ponderosa pine/Douglas-fir habitat type. The difference between the snag count in Tables 67 and 68 in the dry grand fir PAG is applied toward the count for existing snag density in the East Side Mixed Conifer habitat type. The tolerance levels for snags greater than 10 inches dbh includes both snags less than 20 inches dbh and snags greater than 20inches dbh.

Using the rationale and methods stated, it has been determined that the existing condition is providing habitat at the 50 percent tolerance level in snags greater than 10 inches dbh for the white-headed woodpecker. For snags greater than 20 inches dbh, habitat is being provided at the 30 percent tolerance level.

For the pileated woodpecker in the ponderosa pine/Douglas-fir habitat type large tree structure DecAID data shows a needed snag density of 30.4 snags per acre for the 50 percent tolerance level for all snags over 10inches dbh or at 7.6 snags per acre in the greater than 20 inches dbh size class. Within this project area neither of these snag densities currently exist, so habitat is not being provided at the 50 percent tolerance level. Data is not available in DecAID for a 30 percent tolerance level for this species within this habitat type. DecAID advises that the data for the pileated woodpecker includes plots on mixed conifer sites.

DecAID predicts the following species would use snags among live eastside mixed conifer vegetation: American marten, long-legged myotis, pileated woodpecker, silver-haired bat, and white-headed woodpecker. DecAID also predicts that the following species would use snags in ponderosa pine/Douglas-fir large tree vegetation type: black-backed woodpecker, flammulated owl, northern flicker, white-headed woodpecker, pileated woodpecker, pygmy nuthatch, red-naped sapsucker, and Williamson's sapsucker. The range of small snag densities used varied from a low of 0.3 snags per acre greater than or equal to 9.85 inches dbh at the 30 percent tolerance level for the white-headed woodpecker to a high of 56.4 snags per acre greater than or equal to 9.85 inches dbh at the 50 percent tolerance level for the silver-haired bat. The range of large snag densities used varied from a low of 0.0 snags per acre greater than or equal to 19.7 inches at the 30 percent tolerance level for the white-headed woodpecker to a high of 16.8 snags per acre greater than or equal to 19.7 inches dbh at the 50 percent tolerance level for the silver-haired bat (USDA 2006).

The Forest Plan standards and guidelines for snags specify that across the Ochoco National Forest, snags must meet an average of 47 percent of biological potential. The Eastside Screens amendment requires managing snags at 100 percent of maximum potential for primary cavity excavators, which is a minimum of 2.25 snags per acre (Thomas 1979). Viable Ecosystem Management Guide levels for snags were agreed upon with the Regional Office to meet the amendment standards and guidelines, except that snags would not be managed below a minimum of 2.25 snags per acre (USDA Forest Service 1997). The work by Thomas has been challenged by Bull and others. Bull et al. (1997) states current direction for providing wildlife habitat on public forest lands does not reflect the new information available which suggests that to fully meet the needs of wildlife, additional snags and habitat are required for foraging, denning, nesting, and roosting. Rose et al. (2001) stated that several major lessons have been learned in the period 1979 to 1999 that have tested critical assumptions of earlier management advisory models, including some assumptions used to develop Forest Plan standards and guidelines. Some assumptions include: (1) calculation of numbers of snags required by woodpeckers based on assessing their “biological (population) potential” is a flawed technique, (2) empirical studies are suggesting that snag numbers in areas used and selected by some wildlife species are far higher than those calculated by this technique, and (3) numbers and sizes (inches dbh) of snags used and selected by secondary cavity nesters often exceed those of primary excavators (Rose et al. 2001).

This suggests that managing for 100 percent population levels of primary excavators may not represent the most current knowledge of managing for cavity nesters and that these snag levels, under certain conditions, may not be adequate for some species. In addition, the current direction provides recommendations for green stands only when studies show that cavity-nesting birds require higher snag densities in post-fire conditions versus green stands for nesting and productivity. This is likely due to cavity nesting birds requiring more snags for foraging, cover, and protection from predators in post-fire environments.

The use of DecAID is a culmination of the most recent science and data available. As stated by Rose et al. (2001), DecAID is based on a thorough review of the literature, available research and inventory data, and expert judgment. Information in DecAID will be compared to the Viable Ecosystem Management Guide guidelines for this project.

Other research regarding historical snag densities were reviewed to compare with information found within DecAID and prescribed retention levels. Harrod et al. (1998) estimated historical snag densities in ponderosa pine dominated dry forests. Estimated snag densities greater than 6 inches dbh ranged from 5.9 to 14.1 per acre in pre-European settlement landscapes. Agee (2002) estimated lower snag densities than Harrod et al. for the ponderosa pine/Douglas-fir forest series by estimating number of trees in 0.1 hectare clumps of 16 age classes and assuming that the oldest patch is killed by insects every 25 years. Agee (2002) assumed fire helped to decompose snag patches and after 5 fires at 10-year intervals, snags would be completely consumed. As a result, historical snag density was estimated at 2 snags per acre. Results from regional studies in eastern Washington and Oregon (all ownerships) by Ohmann and Waddell (2002) suggest there are currently 2.025 total snags per acre greater than 10 inches dbh of which 0.405 snags were greater than 20 inches dbh.

Snag densities reported by Harrod et al. are within the 80% tolerance level range, and Agee are within the 50% tolerance level range for the wildlife data and below the 30% tolerance level for inventory data of those reported in DecAID for ponderosa pine/Douglas-fir habitat types for large trees.

Retention levels were also compared with the Region 6 Interim Old Growth Definitions to determine if old-growth characteristics would be retained following harvest. The standard for meeting old-growth conditions in this document for the ponderosa pine series was that there needed to be 3 snags per acre greater than 14 inches dbh and/or 10 percent of the live trees in the stand containing "spire tops" (partially dead tops). For the Douglas-fir series, the standard was 1 snag per acre 12 inches or greater dbh.

Logs are an important component on the landscape. They provide organic and inorganic nutrients in soil development, provide microhabitats for invertebrates, plants, amphibians, and other small vertebrates, and provide structure for riparian associated species in streams and ponds. It has been shown that size, distribution, and orientation may be more important than tonnage or volume. Small logs provide escape cover or shelter for small species. It is still unknown what levels of down woody material are needed to provide quality habitat for associated species. Larger sized logs are also used more and by more species than smaller logs. (Bull et al. 1997). Log levels are prescribed in the Eastside Screens and are presented in Table 72.

Table 72. Log levels prescribed in the Eastside Screens.

Species	Pieces Per Acre	Diameter Small End	Piece Length and Total Lineal Length
Ponderosa Pine	3-6	12 inches	> 6 ft. 20-40 ft.
Mixed Conifer	15-20	12 inches	>6 ft. 100-140 ft.

The project area has had a long history of activities that resulted in the removal of snags and logs. Primarily, past timber harvest and firewood cutting have resulted in lower numbers of downed logs than what is desired. No specific data was collected for down wood, although knowledge of the area indicates that downed wood levels are beginning to increase as a result of snags beginning to fall both within and outside the Hash Rock fire perimeter.

Environmental Consequences

Alternative 1

The no action alternative would retain all existing snags in the project area except those that would be removed by ongoing programs of work such and recreational site and highway maintenance operations. At the watershed scale, snags would be retained at the levels shown in Tables 67 and 68.

Alternatives 2, 4, and 5

No dead trees would be removed, with the exception of those that are deemed to be hazard trees. This project does not propose to harvest snags, so the amount of snags present within the project area should not be substantially altered by commercial harvest. Prescribed burning may alter snag abundance as described above, but fire effects are not expected to alter snag densities enough to affect the percent tolerance for species evaluated under DecAID. The project is not expected to reduce the habitat tolerance level for any species for which habitat is currently being provided due to use of Design Elements (see Chapter 2) intended to minimize loss of snags during burning operations. At the watershed scale, the percent of the area with no snags will not change (Table 69). There would be a negligible reduction in the percent of the area that contains greater than 0 snags per acre. This reduction would occur as a result of hazard reduction in areas such as around landings and equipment fueling areas.

No removal of existing down logs are proposed under the action alternatives. However, there is potential for incidental effects to species that use down logs, especially in units that are harvested with ground-based equipment, have grapple piling, include road construction, or include underburning. Individual logs may be moved or broken during harvest or road construction activities or may be consumed during prescribed burning operations. Existing levels are expected to increase in the future across the project area as standing trees and existing snags fall. Within the areas proposed for harvest (up to 6,172 acres), green trees would be removed that could have otherwise potentially fallen and become downed wood. This has the potential of affecting accumulations of down wood in the future, although the prescribed retention levels would retain sufficient numbers of trees to provide down wood recruitment in the future (Table 73). Precommercial thinning would promote the development of larger trees and thus the potential for long-term recruitment of large down wood.

Alternative 3

No dead trees or down logs would be removed, with the exception of those trees that are deemed to be hazard trees. This project does not propose to cut snags, so the amount of snags present within the project area should not be substantially altered. There would be no commercial harvest operations or road construction, so there would be no direct effects to species that use down wood. Prescribed burning may alter snag abundance as described above, but fire effects are not expected to alter snag densities enough to affect the percent tolerance for species evaluated under DecAID. The project is not expected to reduce the habitat tolerance level for any species for which habitat is currently being provided due to use of Design Elements (see Chapter 2) intended to minimize loss of snags during burning operations.

Cumulative Effects

Refer the cumulative effects discussion for Primary Cavity Excavators for more detailed information on past, present, and reasonably foreseeable activities that may affect or continue to have effects on species associated with snag habitat. Recently, the Cougar Salvage was implemented in the Marks Creek Watershed. That project removed approximately 595 dead trees in scattered patches on a total of 52 acres. These patches occurred in 37 locations and ranged from 1 to 5 acres each. Snag retention was applied as described above and displayed in Table 73.

Table 73. Cougar Salvage prescription for snags by PAG.

Plant Association Group	Snags/Acre <20"dbh Retention Levels	Snags/Acre>20"dbh Retention Levels
Dry grand fir	5.8	3.3
Douglas-fir	3.1	1.6

Moist pine	2.7	1.6

Actual retention levels varied within harvest locations although all locations met or exceeded prescribed retention levels. No retention levels are described for moist grand fir and xeric pine PAGs because there was no harvest proposed under the Cougar Salvage Project. The largest harvest area is 5 acres with the majority of locations being less than 1 acre. The Forest Plan direction of providing snag habitat on a 40-acre area was met on this project. The Spears project when considered along with past, present, and reasonably foreseeable actions (including Cougar Salvage) meets Forest Plan standards for snags and down wood retention.

There are not any other timber sales planned for the project area. Firewood gathering is expected to continue to reduce snag and downed wood levels in close proximity to open roads. Prescribed burning, ground-based timber operations, and grapple piling in the action alternatives may combine to increase accessibility for cross country travel which could exacerbate the loss of snags to firewood cutting, and may alter the abundance and distribution of down wood.

Connective Corridors

Affected Environment

Connective corridors have been identified to meet the requirements of the Regional Forester's Plan Amendment 2 (see Map 17). There are at least two connective corridors between all allocated old-growth areas and LOS stands larger than 100 acres. Connective corridors also link to allocated old-growth areas or LOS stands in adjacent watersheds. The connections from east to west through the project area cross U.S. Highway 26.

Alternative 1

This alternative would not treat within mapped connective corridors. The structural complexity and canopy closure within mapped connective corridors would be retained. On mesic sites, the abundance of snags and down logs and the development of multiple canopy layers would continue on the current trend. On drier sites, large structure ponderosa pine and larch would decline in vigor due to competition from the developing understory, resulting in a gradual loss of large live tree habitat and an increase in large snag habitat.

This alternative treats 0 acres in connective corridors. This alternative retains existing structural character, visual cover, and climatic moderation at least in the short term.

Alternative 2

This alternative includes 787 acres of commercial harvest and 535 acres of precommercial thinning within connective corridors. Prescribed burning of natural fuels outside of thinning units would occur within connective corridors on 645 acres. Within these areas, the structural complexity and canopy closure within mapped connective corridors would be reduced in the short term. It is anticipated that the level of retention post treatment would still provide adequate cover and structure to facilitate travel by most species that would use these corridors. Some species that select for open forest conditions may find the habitat more favorable after treatment. However, treated habitat within the corridors may be less desirable for species that have limited mobility, that are vulnerable to predation, or that are sensitive to climatic conditions, at least in the short term. Where these activities occur within young stands, thinning designed to promote development of large trees would likely improve habitat conditions within the corridors in the long term.

This alternative treats 1,966 acres in connective corridors. This alternative alters existing structural character and canopy cover, but improves resilience on 56 percent of the area within mapped connective corridors in the project area.

Alternative 3

This alternative includes 1,026 acres of precommercial thinning within connective corridors. Prescribed burning of natural fuels outside of thinning units would occur within connective corridors on 610 acres. Within these units the canopy closure within mapped connective corridors would be reduced in the short term. The level of retention post treatment would still provide adequate cover and structure to facilitate travel by most species that would use these corridors. These activities occur within young stands or understory trees only. Thinning designed to promote development of large trees would likely improve habitat conditions within the corridors in the long term.

This alternative treats 1,636 acres in connective corridors. This alternative alters existing structural character and canopy cover, but improves resilience on 47 percent of the area within connective corridors in the project area.

Alternative 4

This alternative includes 700 acres of commercial harvest and 611 acres of precommercial thinning within connective corridors. Prescribed burning of natural fuels outside of thinning units would occur within connective corridors on 618 acres. Within these areas the structural complexity and canopy closure within mapped connective corridors would be reduced in the short term. It is anticipated that the level of retention post treatment would still provide adequate cover and structure to facilitate travel by most species that would use these corridors. Some species that select for open forest conditions may find the habitat more favorable after treatment. However, treated habitat within the corridors may be less desirable for species that have limited mobility, that are vulnerable to predation, or that are sensitive to climatic conditions, at least in the short term. Where these treatments occur within young stands, thinning designed to promote development of large trees would likely improve habitat conditions within the corridors in the long term.

This alternative treats 1,929 acres in connective corridors. This alternative alters existing structural character, visual cover, and climatic moderation, but improves resilience on 25 percent of existing LOS stands and on 55 percent of the area within mapped connective corridors in the project area.

Alternative 5

This alternative includes 382 acres of commercial harvest and 883 acres of precommercial thinning within connective corridors. Prescribed burning of natural fuels outside of thinning units would occur within connective corridors on 320 acres. Due to the modified prescription included in this alternative for units within mapped connective corridors it is expected that although canopy closure would be reduced in the short term, the level of retention post treatment should still provide adequate cover and structure to facilitate travel by most species that would use these corridors. These treatments occur within young stands or understory trees only. Thinning designed to promote development of large trees would likely improve habitat conditions within the corridors in the long term.

This alternative treats 1,585 acres in connective corridors. This alternative alters existing structural character and reduces canopy cover, but improves resilience on 45 percent of the connective corridors in the project area.

Cumulative Effects

There are no ongoing or reasonable foreseeable activities within the project area that would alter connective corridors. The effects of past harvest and other activities were considered when identifying connective corridors.

Neotropical Birds

Affected Environment

This section addresses the effects of the alternatives on neotropical migratory birds described in the Partners In Flight - Northern Rocky Mountains Bird Conservation Plan. This conservation plan identifies priority habitats and focal species by subprovince. The Ochoco National Forest is within the Blue Mountains Subprovince. Table 74 lists the habitats and species for the Blue Mountains Subprovince. The existing condition for neotropical birds is addressed by looking at focal species that represent communities of birds that occupy priority habitats. Current conditions are described in comparison to estimates of the historic abundance of habitat.

Table 74. Blue Mountains Subprovince priority habitats and focal species.

Priority Habitats	Focal Species for the Blue Mountains Subprovince
Dry Forest	White-headed woodpecker, flammulated owl, chipping sparrow, Lewis' woodpecker
Mesic Mixed Conifer	Townsend's warbler, Vaux's swift, varied thrush, MacGillivray's warbler, olive-sided flycatcher
Riparian Woodland	Lewis' woodpecker, red-eyed vireo, veery
Riparian Shrub	Willow flycatcher
Subalpine Forest	Hermit thrush
Montane Meadows	Upland sandpiper
Steppe Shrublands	Vesper sparrow
Aspen	Red-naped sapsucker

Alpine	Gray-crowned rosy finch

Nine of the seventeen species listed were analyzed using the data derived from the Viable Ecosystems Model. White-headed woodpecker was analyzed and is described above in the Primary Cavity Excavators section. In addition, gray flycatcher was analyzed as a surrogate for steppe shrublands (in lieu of vesper sparrow), and black-backed woodpecker was analyzed as an indicator for mature true fir forest conditions in Mesic Mixed Conifer priority habitat. The existing amount of priority habitat has been compared to the desired range of habitat identified as the HRV. This allows a comparison between what exists today compared to the balance of conditions that may have existed historically. Of the ten species discussed in this section, seven are currently above the minimum amount of habitat abundance and three are below. Generally, there is a relative shortage of habitat for those species associated with open forest conditions. These trends are primarily the result of past management practices and fire suppression activities. Table 75 displays the habitat amounts in the project area. Species whose habitat is currently below historic abundance are: chipping sparrow, olive-sided flycatcher, and gray flycatcher. Species whose habitat is currently within historic abundance are: flammulated owl, Lewis' woodpecker, varied thrush, MacGillivray's warbler, hermit thrush, and black-backed woodpecker. A species with habitat currently above the historic range is the Townsend's warbler, which favors dense forest conditions with an abundance of fir.

Species that require specialized habitats such as riparian vegetation, meadows, hollow trees, aspen, or alpine cannot be analyzed this way (based on forest structural/seral stages). None of the alternatives include reducing shrub or meadow habitat. The action alternatives include restoration activities for aspen stands and prescribed burning may result in restoration or alteration of upland shrub and grassland habitats.

Table 75. Comparison of existing habitat to HRV.

Species	HRV Low (acres)	HRV Low (acres)	Existing (acres)	Status
Flammulated owl	23,520	40,799	25,883	Within range
Chipping sparrow	14,808	28,778	13,638	Below range
Lewis' woodpecker	10,253	18,012	10,414	Within range
Varied thrush	3,421	9,508	5,019	Within range
MacGillivray's warbler	260	782	284	Within range
Olive-sided flycatcher	14,695	28,044	14,040	Below range
Townsend's warbler	781	1,667	1,908	Above range
Hermit thrush	2,122	3,908	3,525	Within range
Gray flycatcher	1,933	4,254	1,208	Below range
Black-backed woodpecker	11,395	22,218	16,339	Within range

Environmental Consequences

Alternative 1

This alternative would continue to perpetuate the abundance of wildlife species associated with dense forests having true fir and Douglas-fir understories. The no action alternative would not directly change the existing acres of habitat. Under this alternative there would be a continued decline in habitat abundance for all species that select open forest and early seral conditions as denser, mid to late seral conditions continue to develop. In the long-term, Alternative 1 results in the least amount of habitat for species that select for open forest or early seral conditions. In the long-term, this alternative would result in the most habitat of all the alternatives for these species associated with denser, mid to late seral conditions. This alternative does not propose any treatments that would directly modify the existing amount of habitat therefore post treatment acres equals existing acres. Habitat would compare to HRV as described above and displayed in Table 75 in the short term.

The red-eyed vireo, veery, and willow flycatcher are associated with riparian woodland and shrub plant communities. These habitats exist within the project area, but are small in size and fragmented. These species may be present and utilizing the habitats as available. The no action alternative would retain the current trends in displacement of riparian vegetation due to encroachment by young conifers. The red-naped sapsucker is a bird that uses aspen dominated vegetation and riparian woodlands almost similar to the vireo, veery, and willow flycatcher. The no action alternative does not propose aspen restoration activities involving thinning of conifers which are competing with aspen.

This alternative maintains habitat for species that select for dense forest conditions and continues the decline in habitat conditions for species that use open forest conditions until one or more disturbance events (insects or fire) create open conditions in the future.

Direct and Indirect Effects Common to Alternatives 2, 3, 4, and 5

Of the remaining species listed in Table 74, the upland sandpiper is discussed below in the threatened, endangered, and sensitive species section of this report. This Region 6 Regional Forester's Sensitive Species and its habitat are not affected by the project proposals as they occupy expansive wetland habitats which do not occur in the project area. The vesper sparrow inhabits steppe shrublands found at lower elevations and are not present within forested habitats or in the project area. The gray-crowned rosy finch inhabits alpine habitats that do not occur within this project area. Therefore, the proposed activities would have no effect to these species or their habitats.

Measures prescribed to restrict activities within nesting seasons for goshawk and other raptors would result in reduced disturbance to nesting birds where their home ranges overlap with these areas. Some of the harvest, thinning and burning activities would be scheduled outside of the nesting season and would not result in disturbance to nesting birds. However, a portion of the project work would occur during the nesting season and some individuals would likely be impacted by management activities. Since most migratory birds occupy relatively small nesting season home ranges and are present in relatively large numbers, it is expected that suitable habitat outside of active treatment units will provide alternate cover for birds that are displaced during activities. The area outside of active treatment units will also provide source populations for reoccupation of areas after treatment activities are completed. Birds that are disturbed early in the nesting season may move out of the treatment area during operations and may re-nest later, or outside of the area of activity. In some cases, habitat outside of the unit may be limiting or fully occupied, in which case the displaced birds may become non-reproductive during the year of operation. These are short-term impacts to individual birds or pairs of birds. This is a trade-off under the action alternatives for (1) the long term benefits of increasing the amount of habitat for the focal species (and the communities they represent) that are currently below the HRV, (2) the restoration of habitat for species that utilize herbaceous and shrubby vegetation, and (3) the protection of habitat against risk of future large scale or high intensity disturbance. The project also proposes treatments to promote the longevity, vigor, and extent of riparian hardwood habitats and the development or retention of stands of large diameter live pine. These treatments are consistent with the goals and objectives for these habitats as listed in the Partners In Flight, Landbird Conservation Strategy for the Northern Rocky Mountains (Altman 2000).

Alternative 2

This alternative would treat 16,942 acres. Some of this treatment would occur in habitat for neotropical birds during the nesting season and potentially impact nesting birds. This alternative results in increases in habitat for species that select for open forest and early seral conditions due to stand density reduction and the favoring of early seral species. The amount of habitat relative to HRV changes to within the historic range for chipping sparrow, olive-sided flycatcher, and Townsend's warbler due to increases in open forest and decreases in dense forest conditions. However, the amount of habitat moves to below the minimum for MacGillivray's warblers, due to thinning of understory vegetation in moist grand fir sites. This effect on MacGillivray's warblers should be short term as thick patches of understory vegetation should recover relatively quickly on these mesic sites, especially in riparian areas and other seasonally moist areas.

Habitat for gray flycatcher moves further below the low end of the HRV, primarily due to reduction in small tree and tall shrub structure on ponderosa pine and western juniper sites. The extent and duration of impacts on gray flycatcher nesting habitat will depend on how thoroughly small tree and shrub structure (ground fuels) are removed from potential habitat and subsequent maintenance treatments, such as repeated underburning. Past experience indicates that approximately 40-70 percent of the surface area within prescribed fire units is burned. As shrub cover may be reduced by scorch as well as consumption, it is expected that upland shrub habitat will be reduced on more than 40-70 percent of the area treated with prescribed burning, at least in the short term. There is potential for treatments to promote the development of gray flycatcher habitat where upland shrub regeneration is promoted and tall shrubs are allowed to develop after the initial treatments on xeric sites (dry pine and western juniper PAGs). In the long-term, Alternative 2 results in the greatest amount of habitat for all open forest and upland shrub species, as well as those that select for large tree size. Activities would cause a reduction in the amount of habitat for species that select for denser forests or late-seral conditions.

Table 76. Habitat acres for Alternative 2.

Species	Low HRV (acres)	High HRV (acres)	Post Treatment (acres)	HRV
Flammulated owl	23,520	40,799	27,000	Within range
Chipping sparrow	14,808	28,778	17,249	Within range
Lewis' woodpecker	10,253	18,012	14,329	Within range
Varied thrush	3,421	9,508	3,633	Within range
MacGillivray's warbler	260	782	248	Below range
Olive-sided flycatcher	14,695	28,044	17,470	Within range
Townsend's warbler	781	1,667	1,294	Within range
Hermit thrush	2,122	3,908	2,622	Within range
Gray flycatcher	1,933	4,254	1,189	Below range
Black-backed woodpecker	11,395	22,218	16,581	Within range

This alternative would alter the current trend in displacement of riparian vegetation due to encroachment by young conifers in the portions of this habitat type where prescribed fire or thinning occur. This would result in a beneficial effect to species associated with riparian woodland and shrub plant communities (red-eyed vireo, veery, and willow flycatcher). This alternative also proposes aspen restoration activities involving thinning of conifers which are competing with aspen clones. This would result in a beneficial effect to species associated with aspen dominated vegetation, such as red-naped and Williamson's sapsuckers.

This alternative reduces habitat for species that select for dense forest conditions and reverses the decline in habitat conditions for species that use open forest conditions, riparian hardwoods, and upland shrubs.

Alternative 3

This alternative would treat 15,501 acres. Some of this treatment would occur in habitat for neotropical birds during the nesting season and potentially impact nesting birds. This alternative results in more habitat for species that select for open forest and early-seral conditions due to stand density reduction and the favoring of early seral species. As described above for Alternative 2, the amount of habitat relative to HRV changes to within the historic range for chipping sparrow and olive-sided flycatcher. However, habitat for Townsend’s warbler remains above the historic range, and moves to below the minimum for MacGillivray’s warbler. This effect on MacGillivray’s warblers should be short term as thick patches of understory vegetation should recover rapidly on these mesic sites, especially in riparian areas and other seasonally moist areas. Habitat for gray flycatcher moves further below the low end of the HRV, due to reduction in small tree and tall shrub structure on ponderosa pine and western juniper sites. In the long term, Alternative 3 results in the least (among the action alternatives) acres of habitat for open forest species. This alternative promotes habitat for open forest species as well as those that select for large tree size, but not as much as in alternatives with commercial harvest. Proposed treatments would cause a short-term reduction in the amount of habitat for species that select for denser forests or later seral conditions, but canopy closure is expected to recover within 15 to 20 years on relatively mesic sites.

This alternative would alter the current trend in displacement of riparian vegetation due to encroachment by young conifers in the portions of this habitat type where prescribed fire or thinning occur. This would result in a beneficial effect to species associated with riparian woodland and shrub plant communities (red-eyed vireo, veery, and willow flycatcher). This alternative also proposes aspen restoration activities involving thinning of conifers which are competing with aspen clones. This would result in a beneficial effect to species associated with aspen dominated vegetation.

Table 77. Habitat acres for Alternative 3.

Species	Low HRV (acres)	High HRV (acres)	Post Treatment (acres)	HRV
Flammulated owl	23,520	40,799	27,453	Within range
Chipping sparrow	14,808	28,778	14,828	Within range
Lewis’ woodpecker	10,253	18,012	11,679	Within range
Varied thrush	3,421	9,508	4,650	Within range
MacGillivray’s warbler	260	782	245	Below range
Olive-sided flycatcher	14,695	28,044	15,154	Within range
Townsend’s warbler	781	1,667	1,772	Above range
Hermit thrush	2,122	3,908	3,342	Within range
Gray flycatcher	1,933	4,254	1,163	Below range
Black-backed woodpecker	11,395	22,218	16,551	Within range

This alternative reduces habitat for species that select for dense forest conditions and reverses the decline in habitat conditions for species that use open forest conditions, but to a lesser extent than Alternatives 2, 4, or 5.

Alternative 4

This alternative would treat 16,740 acres. Some of this treatment would occur in habitat for neotropical birds during the nesting season and potentially impact nesting birds. This alternative results in increases in habitat for species that select for open forest and early seral conditions due to stand density reduction and the favoring of early seral species. As described above for Alternative 2, the amount of habitat relative to HRV changes to within the historic range for chipping sparrow, olive-sided flycatcher, and Townsend's warbler. The amount of habitat moves to below the minimum for MacGillivray's warbler. Habitat for gray flycatcher moves further below the low end of the HRV primarily due to reduction in small tree and tall shrub structure on ponderosa pine and western juniper sites. As described above for Alternative 2, the level of impact on gray flycatcher nesting habitat will depend on how thoroughly small tree and shrub structure (ground fuels) are removed from potential habitat and subsequent maintenance treatments. Proposed treatments would cause a reduction in the amount of habitat for species that select for denser forests or later seral conditions compared to no action.

Table 78. Habitat acres for Alternative 4.

Species	Low HRV (acres)	High HRV (acres)	Post Treatment (acres)	HRV
Flammulated owl	23,520	40,799	25,883	Within range
Chipping sparrow	14,808	28,778	16,920	Within range
Lewis' woodpecker	10,253	18,012	13,987	Within range
Varied Thrush	3,421	9,508	3,812	Within range
MacGillivray's warbler	260	782	247	Below range
Olive-sided flycatcher	14,695	28,044	17,146	Within range
Townsend's warbler	781	1,667	1,421	Within range
Hermit thrush	2,122	3,908	2,773	Within range
Gray flycatcher	1,933	4,254	1,166	Below range
Black-backed woodpecker	11,395	22,218	16,616	Within range

This alternative would alter the current trend in displacement of riparian vegetation due to encroachment by young conifers in the portions of this habitat type where prescribed fire or silvicultural treatments are employed. This would result in a beneficial effect to species associated with riparian woodland and shrub plant communities (red-eyed vireo, veery, and willow flycatcher). This alternative includes aspen restoration activities involving thinning of conifers which are competing with aspen clones. This would result in a beneficial effect to species associated with aspen dominated vegetation.

This alternative reduces habitat for species that select for dense forest conditions and reverses the decline in habitat conditions for species that use open forest conditions compared to no action, but to a lesser extent than Alternative 2.

Alternative 5

This alternative would treat 15,850 acres. Some of this treatment would occur in habitat for neotropical birds during the nesting season and potentially impact nesting birds. This alternative results in increases in habitat for species that select for open forest and early seral conditions due to stand density reduction and the favoring of early seral species. As described above for Alternatives 2 and 4, the amount of habitat relative to HRV changes to within the historic range for chipping sparrow, olive-sided flycatcher, and Townsend's warbler, and the amount of habitat moves to below the minimum for MacGillivray's warbler. Habitat for gray flycatcher moves further below the low end of the HRV. Proposed activities would cause a short-term reduction in the amount of habitat for species that select for denser forests or later seral conditions compared to no action, but retains more closed forest habitat than Alternatives 2 and 4.

Table 79. Habitat acres for Alternative 5.

Species	Low HRV (acres)	High HRV (acres)	Post Treatment (acres)	HRV
Flammulated owl	23,520	40,799	27,453	Within range
Chipping sparrow	14,808	28,778	17,075	Within range
Lewis' woodpecker	10,253	18,012	14,141	Within range
Varied thrush	3,421	9,508	3,753	Within range
MacGillivray's warbler	260	782	245	Below range
Olive-sided flycatcher	14,695	28,044	17,297	Within range
Townsend's warbler	781	1,667	1,395	Within range
Hermit thrush	2,122	3,908	2,739	Within range
Gray flycatcher	1,933	4,254	1,167	Below range
Black-backed woodpecker	11,395	22,218	16,632	Within range

This alternative would alter the current trend in displacement of riparian vegetation due to encroachment by young conifers in the portions of this habitat type where prescribed fire or silvicultural treatments are employed. This would result in a beneficial effect to species associated with riparian woodland and shrub plant communities (red-eyed vireo, veery, and willow flycatcher). This alternative includes aspen restoration activities involving thinning of conifers which are competing with aspen clones. This would result in a beneficial effect to species associated with aspen dominated vegetation, such as sapsuckers.

This alternative reduces habitat for species that select for dense forest conditions and reverses the decline in habitat conditions for species that use open forest conditions compared to no action, but to a lesser extent than Alternatives 2 or 4.

Cumulative Effects

Regeneration harvest activities have occurred on 7,563 acres in the project area in the last 30 to 35 years. Much of this harvest history resulted in a reduction of large pine and other LOS stands. Since the early 1990's the emphasis has shifted from removal of large pine to re-establishment of large pine and larch, and other single-strata LOS stands. Forested areas would continue to managed to increase the abundance of open, single-storied ponderosa pine dominated stands on dry sites. This is the type of forest structure thought to be the historic condition on the majority of ponderosa pine sites. Forests would continue to managed to increase the abundance of LOS in both single and multiple layer structural classes on more mesic sites. This management trend is likely to continue until the multi-strata LOS and single-strata LOS is within the HRV that has been defined for this project area. This process would reduce the amount of habitat available for species that prefer dense forest canopy, while increasing the amount of habitat available for species that select more open stands. Thinning of stands with relatively small trees should promote the development of large tree habitat in the future. The recruitment of large trees and large snags would contribute potential habitat for species that nest high in tall trees, that require large branches, or large snags to accommodate appropriately sized cavity nests or colonial roosts. Ultimately, all species habitat would move toward an abundance and distribution that is thought to be within the historic range of variability based on site potential within the project area.

Riparian planting and hardwood protection has been implemented at various locations throughout the project area. These actions have lead to improved riparian hardwood habitat in many areas. At the same time, elk populations have continued to climb and livestock grazing has continued to occur. The combined grazing and browsing pressure from wild and domestic ungulates has limited the extent and structure of riparian habitat in some areas.

Threatened, Endangered, and Sensitive Species

Affected Environment

There are no endangered species known or expected to occur on the Ochoco National Forest. The northern bald eagle, a threatened species, is known to occur within the project area.

The Canada lynx, a threatened species, is not expected to occur in the project area or on the Ochoco National Forest. Canada lynx occupies boreal forests where subalpine fir is common and lodgepole pine is a seral species. Their primary prey is snowshoe hare. Based on implementation of habitat descriptions contained in the second edition of the Canada Lynx Conservation Assessment and Strategy (Ruediger et al. 2000), there is inadequate primary vegetation to constitute any Lynx Analysis Units (LAUs) on the Ochoco National Forest. There are no other LAUs within 40 kilometers of the Ochoco National Forest; thus, no Key Linkage Areas were identified. On May 29, 2001 the Ochoco National Forest received concurrence from the U.S. Fish and Wildlife Service that implementation of any activities contained within the Ochoco National Forest Land and Resource Management Plan, as amended, is "not likely to adversely affect the Canada lynx outside of an existing LAU" (McMaster 2001). Because habitat has been determined to not be present on the Forest in a quantity sufficient to apply the standards and guidelines contained in the LCAS, and the completion of informal consultation with the U.S. Fish and Wildlife Service is contained in a separate document (McMaster 2001), the species will not be discussed further.

here.

Of the eight wildlife species on the Regional Forester's list that are documented or suspected to occur on the Ochoco National Forest, four sensitive species have potential or suitable habitat within the project area. These species are: California wolverine (*Gulo gulo*), gray flycatcher (*Empidonax wrightii*), bufflehead (*Bucephala albeola*), and tricolored blackbird (*Agelaius tricolor*).

The other four sensitive species do not have potential habitat within the project area and the proposed alternatives would have no effects to these species. They are: Peregrine falcon (*Falco peregrinus anatum*), upland sandpiper (*Bartramia longicauda*), western sage grouse (*Centrocercus urophasiuanus*), and pygmy rabbit (*Brachylagus idahoensis*).

Peregrine falcon nests on sheer rock cliffs with horizontal ledges or caves and forages over a variety of habitats. Birds are a primary source of prey for this species. The nearest suitable nesting habitat for this species is in the adjacent Mill and McKay Creek watersheds and on the cliffs that overlook Ochoco Reservoir. These sites are currently occupied by prairie falcons. Nesting by peregrine falcons has not been confirmed on the Lookout Mountain Ranger District. There is no suitable nesting habitat for this species in the project area; this project would not impact nesting habitat and is not expected to affect individual members of this species. For these reasons, this project would have no impact on peregrine falcons.

Upland sandpiper occupies large open wetlands, marshes, and wet meadow habitats. The nearest confirmed nesting area is in Big Summit Prairie, approximately 8 miles east of the project area. There is no suitable nesting habitat for this species in the project area; this project would not impact nesting habitat and is not expected to affect individual members of this species. For these reasons, this project would have no impact on upland sandpipers.

Western sage grouse occupies open arid shrub steppe and grassland habitat in relatively treeless environments. They feed on forbs and insects when they are available, but sustain themselves on sagebrush leaves in the winter. There is no suitable nesting habitat for this species in the project area; this project would not impact nesting habitat and is not expected to affect individual members of this species. For these reasons, this project would have no impact on western sage grouse.

Pygmy rabbit occupies sagebrush habitats with deep loose soil conditions suitable for excavation and maintenance of burrows. Although they feed on grasses and forbs seasonally, big sagebrush is their primary food source. There is no suitable denning habitat for this species in the project area; this project would not impact reproductive habitat and is not expected to affect individual members of this species. For these reasons, this project would have no impact on pygmy rabbits.

Northern Bald Eagle

There are no known nest sites or essential habitat within the project area for bald eagles. The nearest known bald eagle nest sites are approximately 5 miles southwest and 6 miles southeast of the project boundary. Eagles have been observed foraging along Marks Creek and east of the project area along Ochoco Creek. There are large trees in the project area that may serve as perch trees, roost sites, or potential future nest sites. Improved nesting success and a population increase lead to a 1999 proposal to delist the bald eagle as a threatened species (Marshall et al. 2003).

California Wolverine

There are no known California wolverine dens within the project area. Wolverines have been recorded 3 miles north of the project area in 1981, 1983, and 1994. Wolverine have also been recorded in and within 2 miles of the south end of the project area in 1979 (three locations) and 1980. Wolverines are thought to avoid areas with dense young regenerating forest (Csuti et al. 1997), large open areas, and areas with high road density and human use (Verts and Carraway 1998 and Rowland et al. 2002). Wolverines are wide ranging and persist at extremely low population densities, making detection difficult. It is uncertain whether wolverines occur in Oregon as a self-maintaining population, or if the occasional sightings in this area represent long distance foraging or dispersal of populations centered farther to the north. The wolverine is a U.S. Fish and Wildlife Service Species of Concern and is classified as S2-OR (imperiled in Oregon) in the Natural Heritage Program ranking (Csuti et al. 1997).

Gray Flycatcher

Gray flycatchers have been documented on Ochoco National Forest with confirmed breeding on the Crooked River National Grassland and in the Maury Mountains/Camp Creek area. The Oregon Breeding Bird Atlas (Adamus et al. 2001) mapped an area, that includes the Marks Creek Watershed, as possible breeding habitat. Gray flycatchers nest in tall shrubs or small trees in very open areas or on the edges of shrub steppe and woodland ecotones. Breeding bird survey data indicate an increasing trend in gray flycatcher populations in Oregon, and Eastern Oregon has some of the highest population densities in the species' breeding range (Marshall et al. 2003). The species currently holds a ranking by the Natural Heritage program as N3B - either rare throughout its range or found locally in a restricted range.

Bufflehead

Bufflehead are a species of cavity nesting ducks that nest along shorelines of mountain lakes. Within the project area, buffleheads are most likely to be seen on private lakes or ponds, or in stock watering or borrow pit ponds during migration. Bufflehead have been seen on the Lookout Mountain Ranger District using ponds as migratory stop over sites. Because the only water-body of sufficient size to serve as a potential nesting area in the project area is surrounded by privately owned residential property, it is unlikely that bufflehead will nest in this project area. There are no confirmed nesting records in Crook County, but there have been broods recorded in Deschutes County (Marshall et al. 2003). The Oregon breeding population is considered sensitive in Oregon because of small breeding population size, limited nesting structure, potential for disturbance due to recreational use, and potential for loss of nest sites through snag removal (Marshall et al. 2003). The species currently holds rankings in Oregon as SU sensitive (undetermined status) and by the Natural Heritage program as S2B-OR Imperiled in Oregon.

Tricolored Blackbird

Tricolored blackbirds are a colonial nesting species that prefer to nest in emergent vegetation such as cattails or tall sedges or in thickets of willows or other shrubs. Their breeding distribution in Oregon is unpredictable from year to year, but is often found in mixed flocks along with red-winged blackbirds (Csuti 1997). Very small breeding colonies have been confirmed in northwestern Crook County. The Oregon population, which represents only 1% of the total population of this species, declined during the 1980’s due to elimination of habitat, burning, plowing, loss of food source, pesticides, human disturbance (traffic), small colony size, and shifting local populations. The species currently holds rankings in Oregon as SP sensitive (peripheral or naturally rare) and by the Natural Heritage program as G3 Vulnerable - either rare throughout its range or found locally in a restricted range.

Environmental Consequences

Northern Bald Eagle

Alternative 1

This alternative would not directly alter habitat for bald eagles in the short term, but may lead to increased mortality of large ponderosa pine in the future which may reduce potential future nesting habitat. However, the lack of high quality foraging habitat (large water bodies with abundant fish and waterfowl resources) limits the potential of this project area to contribute to essential habitat for this species. There are no cumulative effects for the no action alternative, as there are no action related effects to be combined with effects of past, present and reasonably foreseeable actions. Because this alternative may contribute to changing conditions which could result in future loss of nesting sites, this alternative is determined to be may affect, but not likely to adversely affect for bald eagles.

Alternative 2

This alternative would improve habitat for bald eagles by creating more open forest conditions which would make prey and carrion more accessible. However, this alternative may also have some potential to result in disturbance to roosting or foraging eagles. This alternative is expected to increase longevity of large, live ponderosa pine which would maintain potential future nesting habitat. However, the lack of high quality foraging habitat limits the potential of this project area to contribute to essential habitat for this species. Because this alternative has potential to improve the longevity of potential nest trees and potential to disturb individuals, the effect of this alternative is may affect, but not likely to adversely affect for bald eagles.

Alternative 3

This alternative would improve habitat in the short term by creating slightly more open forest conditions which would make prey and carrion more accessible. However, this alternative may also have some potential to result in disturbance to roosting or foraging eagles. This alternative would lead to increased longevity of large, live ponderosa pine which would maintain potential future nesting habitat. However, the lack of high quality foraging habitat limits the potential of this project area to contribute to essential habitat for this species. Because this alternative has potential to improve the longevity of potential nest trees and potential to disturb individuals, the effect of this alternative is may affect, but not likely to adversely affect for bald eagles.

Alternative 4

This alternative would improve habitat for bald eagles by creating more open forest conditions which would make prey and carrion more accessible, but the project may also have some potential to result in disturbance to roosting or foraging eagles. This alternative would lead to increased longevity of large, live ponderosa pine in the future which would maintain potential future nesting habitat. However, the lack of high quality foraging habitat limits the potential of this project area to contribute to essential habitat for this species. Because this alternative has potential to improve the longevity of potential nest trees and potential to disturb individuals, the effect of this alternative is may affect, but not likely to adversely affect for bald eagles.

Alternative 5

This alternative would improve habitat for this species by creating more open forest conditions which would make prey and carrion more accessible. However, this alternative may also have some potential to result in disturbance to roosting or foraging eagles. This alternative would lead to increased longevity of large live ponderosa pine in the future which would maintain potential future nesting habitat. However, the lack of high quality foraging habitat limits the potential of this project area to contribute to essential habitat for this species. Because this alternative has potential to improve the longevity of potential nest trees and potential to disturb individuals, the effect of this alternative is may affect, but not likely to adversely affect for bald eagles.

Cumulative Effects

Past activities, ongoing projects, and reasonably foreseeable activities that could potentially affect bald eagles include past timber harvest, salvage sales, recreational use, agricultural practices, and management of fish and game. Effects from these activities are not expected to combine with this project to result in cumulative effects.

The 2006 Joint Aquatic and Terrestrial Programmatic Biological Assessment (BA) for Federal Lands within the Deschutes Basin administered by the BLM Prineville Office and the Deschutes and Ochoco National Forests addresses program activities that may affect, but are not likely to adversely affect listed species. The BA identifies project design criteria (PDC) that should be used for bald eagles to streamline consultation. This project meets the PDCs for bald eagle nesting and roosting areas because the alternatives were designed to retain all trees greater than 21 inches dbh and retain potential roost snags. There is no essential habitat for bald eagles within the project area, and the project is not inconsistent with any PDCs recommended in the Programmatic BA, which is consistent with the Pacific Bald Eagle Recovery Plan. For these reasons, the determination for this project is may affect but not likely to adversely affect for all action alternatives.

California Wolverine

Alternative 1

This alternative would not directly alter habitat for this species. Densely forested areas would remain so, at least in the short term and road density would remain approximately the same as it is today. Overtime, patches of forage and accumulations of down wood may develop in conjunction with increased insect/disease infestations or fire. These features may contribute to future wolverine habitat by increasing food resources for big game (a primary source of carrion) and by providing potential denning habitat associated with down woody debris. However, due to the lack of remoteness (due to high levels of human activity) and the lack of high potential denning sites (north and northeast facing cirque basins with talus slopes), the potential for this project area to provide suitable habitat for denning wolverines is very limited. There are no cumulative effects because there are no effects from this alternative that would add to the effects of past, present, and reasonably foreseeable actions. Because this alternative may contribute to changing conditions which could result in changes in the availability of food and sites for denning, this alternative may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species for wolverine.

Alternative 2

This alternative would alter habitat for the California wolverine. Some densely forested areas would be made more open, and road density would be reduced upon completion of the project. Over time, development of large down wood may be accelerated in stands where it is currently lacking. Forage availability would be increased for small mammals and big game. These features may contribute to wolverine habitat by increasing food resources and by promoting potential future denning habitat associated with large down woody debris. This alternative may disturb wolverines that may be moving through the project area during treatment activities. However, due to the lack of remoteness (due to high levels of human activity) and the lack of high potential denning sites (north and northeast facing cirque basins with talus slopes), the potential for this project area to provide suitable habitat for denning wolverines is very limited. Therefore, the effect of this alternative on wolverine is determined to be may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species.

Alternative 3

This alternative would alter habitat for this species. Some densely forested areas would be made slightly more open, and road density would remain approximately the same as it is today. Over time, development of large down wood may be accelerated in stands where it is currently lacking. Forage availability may be increased slightly in treated stands. These features may contribute to wolverine habitat by increasing food resources and by promoting potential future denning habitat associated with large down woody debris. This alternative may disturb wolverines that may be moving through the area. However, due to the lack of remoteness and the lack of high potential denning sites, the project area only has limited potential to provide suitable habitat for denning wolverines. Therefore, the effect of this alternative on wolverine is determined to be may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species.

Alternative 4

This alternative would alter habitat for the California wolverine. Some densely forested areas would be made more open, and road density would be reduced upon completion of the project. Over time, development of large down wood may be accelerated in stands where it is currently lacking. Forage availability would be increased for small mammals and big game. These features may contribute to wolverine habitat by increasing food resources and by promoting potential future denning habitat associated with large down woody debris. There is potential for project activities to cause disturbance to wolverine that may be moving through the area. However, due the lack of remoteness and the lack of high potential denning sites, the potential for this project area to provide suitable habitat for denning wolverines is very limited. Therefore, the effect of this alternative on wolverine is determined to be may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species.

Alternative 5

This alternative would alter habitat for this species. Some densely forested areas would be made more open, and road density would be reduced upon completion of the project. Over time, development of large down wood may be accelerated in stands where it is currently lacking. Forage availability would be increased for small mammals and big game. These features may contribute to wolverine habitat by increasing food resources and by promoting potential future denning habitat associated with large down woody debris. There is potential for project activities to cause disturbance to wolverine that may be moving through the area. However, due the lack of remoteness and the lack of high potential denning sites, the potential for this project area to provide suitable habitat for denning wolverines is very limited. Therefore, the effect of this alternative on wolverine is determined to be may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species.

Cumulative Effects

Past activities, ongoing projects, and reasonably foreseeable activities that could impact wolverine include livestock grazing, recreational use, and big game management. Impacts from these activities are not expected to add to the effects from this project to result in cumulative effects.

For the reasons stated above, the determination for this project is may impact individuals or habitat, but will not likely contribute to a trend toward federal listing for all action alternatives.

Gray Flycatcher

Alternative 1

This alternative would not alter habitat for this species. Densely stocked dry forest and woodland areas would remain unsuitable for gray flycatchers. Overtime, large scale disturbances may develop which would re-set succession to an early seral stage in non-forested, juniper, and dry pine sites. Such events may contribute to restoring future gray flycatcher habitat by producing open settings and regenerating upland shrubs. However, there is also potential for future high intensity disturbance to promote dominance by weedy annuals such as cheat grass. If such species become dominant, fire regimes can change in a way which results in frequent reburning, which can prevent development of tall shrub structure and thus nesting habitat for gray flycatchers. Based on disturbance history within the project area, and vegetative responses observed within previous burned areas, future disturbance patterns are not expected to result in large scale or prolonged loss of gray flycatcher habitat. There are no cumulative effects for the no action alternative. Because this alternative may contribute to changing conditions which could result in changes in the availability of habitat for this species, this alternative may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to gray flycatcher.

Alternative 2

This alternative would slightly alter habitat for the gray flycatcher. Some densely stocked dry forest and woodland areas would be thinned and/or burned. Initially, these activities are expected to reduce nesting structure as described in the section on Neotropical Migratory Birds. However, nesting habitat may be improved within treated areas on xeric sites (non-forest, juniper, and dry ponderosa pine PAGs) if overstory density is reduced sufficiently, and if suitable tall shrub nesting cover is retained. Based on previous experience with prescribed fire behavior, it is expected that patches of tall shrubs and occasional small trees would be retained in the post-fire mosaic, and that gray flycatcher habitat structure would be retained in patches distributed across treated areas. Therefore, the effect of this alternative on gray flycatchers is determined to be may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species.

Alternative 3

This alternative would alter habitat for this species. Some densely stocked dry forest and woodland areas would be thinned and/or prescribed burned. Initially these treatments may reduce nesting structure as described in the section on Neotropical Migratory Birds. However, nesting habitat may be improved within treated areas on xeric sites (non-forest, juniper and dry ponderosa pine PAGs) if overstory density is reduced sufficiently, and if suitable tall shrub nesting cover is retained. Based on previous experience with prescribed fire behavior it is expected that patches of tall shrubs and occasional small trees would be retained in the post-fire mosaic, and that gray flycatcher habitat structure would be retained in patches distributed across treated areas. Therefore, the effect of this alternative on gray flycatchers is determined to be may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species.

Alternative 4

This alternative would alter habitat for the gray flycatcher. Some densely stocked dry forest and woodland areas would be thinned and/or prescribed burned. Initially these activities are expected to reduce nesting structure as described in the section on Neotropical Migratory Birds. However, nesting habitat may be improved within treated areas on xeric sites (non-forest, juniper and dry ponderosa pine PAGs) if overstory density is reduced sufficiently, and if suitable tall shrub nesting cover is retained. Based on previous experience with prescribed fire behavior, it is expected that patches of tall shrubs and occasional small trees would be retained in the post-fire mosaic, and that gray flycatcher habitat structure would be retained in patches distributed across treated areas. Therefore, the effect of this alternative on gray flycatchers is determined to be may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species.

Alternative 5

This alternative would slightly alter habitat for this species. Some densely stocked dry forest and woodland areas would be thinned and/or prescribed burned. Initially, these activities are expected to reduce nesting structure as described in the section on Neotropical Migratory Birds. However, nesting habitat may be improved within treated areas on xeric sites (non-forest, juniper, and dry ponderosa pine PAGs) if overstory density is reduced sufficiently, and if suitable tall shrub nesting cover is retained. Based on previous experience with prescribed fire behavior, it is expected that patches of tall shrubs and occasional small trees would be retained in the post-fire mosaic, and that gray flycatcher habitat structure would be retained in patches distributed across treated areas. Therefore, the effect of this alternative on gray flycatchers is determined to be may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species.

Cumulative Effects

Past activities, ongoing projects, and reasonably foreseeable activities that could result in impacts to gray flycatchers include grazing and mining. Impacts from these activities are not expected to add to the effects from this project and result in cumulative effects to gray flycatcher.

The Breeding Bird Atlas (Adamus et al. 2001) indicates that this species population is presently increasing and that this species is widely distributed across its range. Lower elevation areas, below the forest boundary are the core reproductive habitats for this species. For these reasons and the considerations described above, the determination is may impact individuals or habitat, but will not likely to contribute to a trend toward federal listing for all action alternatives.

Bufflehead

All Alternatives

None of the alternatives would alter habitat for this species. The alternatives would have no effect on this species or its habitat. Therefore, the determination for all alternatives is no impact to bufflehead.

Cumulative Effects

Past activities, ongoing projects, and reasonably foreseeable activities that could impact bufflehead include lake shore development and recreational use. The proposed alternatives would not effect lake shore development and are not expected to change recreational use that would have an effect on bufflehead. There would be no cumulative effects to bufflehead.

Within the project area, habitat is marginal for this species, with low likelihood of occupancy by nesting pairs. Project activities would not alter lake or lakeshore habitat and is not likely to result in disturbance to nesting pairs. For these reasons, the determination is no impact to bufflehead for all action alternatives

Tricolored Blackbird

All Alternatives

None of the alternatives would alter habitat for this species. The alternatives would have no effect on this species or its habitat. Therefore, the determination for all alternatives is no impact to bufflehead.

Cumulative Effects

Past activities, ongoing projects, and reasonably foreseeable activities that could impact tricolored blackbird include development near wetlands and recreational use. Impacts from these activities are not expected to add to the effects from this project. There would be no cumulative effects to tricolored blackbird.

The project would not alter vegetation that would provide habitat for nesting or migrating tricolored blackbirds. This project would have no impact on this species or its habitat. For these reasons, the determination is no impact for tricolored blackbird for all alternatives.

Elk

Affected Environment

Long-term records indicate that elk were absent from the Ochoco National Forest in 1936 (Bailey 1936). This is the oldest written record of elk populations on the Forest. Anecdotal information indicates elk did inhabit the Forest in the mid to late 1800's but were probably extirpated by over-hunting and habitat losses due to heavy grazing pressure in the early 1900's. Since that time, elk populations have made steady increases in populations and are now found throughout the Ochoco National Forest.

The Spears project area lies within two Oregon Department of Fish and Wildlife (ODFW) management zones, the Ochoco and Grizzly Game Management Units (GMUs). ODFW, in their state-wide "Oregon's Elk Management Plan" established population management objectives (MOs) for all GMUs in the state. The population objectives for the Grizzly and Ochoco GMUs were 1,500 and 2,600 respectively, both of which were met in 1996 population estimates. ODFW population estimates for 2003 for these units were 1,500 and 4,600 respectively. The Ochoco GMU population peaked in 2000-2001, but has exceeded management goals each year form 1995 through 2003. While trend information is presented, it is important to note that many of the population dynamics exhibited on the Forest are affected by hunting scenarios and trends are not necessarily a reflection of habitat conditions. Mortality rates due to hunting may be the factor limiting total population. Bull/cow ratios are most significantly affected by hunting activities and it is hard to determine the effect from Forest management activities on this parameter. However, the abundance and distribution of escapement cover, the density of open roads, and degree of accessibility by off-highway vehicles are factors that likely affect survival of animals during hunting seasons.

The Habitat Effectiveness Index (HEI) for elk was used to analyze the elk habitat condition and the effects of alternatives within the Spears Project Area. HEI is a measure of habitat suitability based on cover quality (relative abundance of marginal and satisfactory thermal cover), cover quantity (percent of the project area in existing cover), and open road density. The Forest Plan specifies goals within each of the management areas: General Forest, General Forest Winter Range, and Winter Range. For this analysis, visual corridors were combined into the three Management Areas with HEI goals, as they are not biologically distinct (i.e. elk do not know when they are in a visual corridor). The analysis also assumed that in General Forest commercial harvest in marginal cover (40-69% crown closure) would render the stand non-cover at least in the short term, but that precommercial thinning would retain enough canopy closure to maintain marginal cover. In General Forest Winter Range and Winter Range it was assumed that any treatment in marginal cover would result in taking the stand out of cover. This assumption is applied to these areas due to elevation and the prevalence of relatively dry PAGs within those areas (proposed activities will promote more open conditions on juniper, ponderosa pine, and Douglas-fir sites). The assumption was also made that any treatment in satisfactory cover (70% + canopy closure) would change the stand to marginal cover at least in the short term in all three management areas. Values determined by the analysis, and specified in the Forest Plan are displayed in Tables 80-83. Table 80 displays the existing condition and Forest Plan goals. Tables 81, 82, and 83 display a summary of the results by alternative for General Forest, General Forest Winter Range, and Winter Range areas, post-treatment and after road closures are completed.

The January 29, 2007, Spears Wildlife Report contains additional information on elk.

Alternative 1

No satisfactory cover or marginal cover would be treated under this alternative, and no roads would be closed. Percent cover and HEI would remain at the current levels for a period of time. Habitat effectiveness would continue to follow the current trend, with gradual development of additional cover as the canopy of untreated stands continue to close. At the same time the development of understory vegetation would gradually increase the risk of future loss of cover to fire, insects, and disease. The year-round open road density is expected to remain at approximately the current level. The winter open road density is expected to remain at 1.0 miles/square mile between December 1 and May 1 with continued on-going implementation of the seasonal restrictions that are currently in place.

Goals established in the Forest Plan for overall HEI would be met under this alternative. Open road density would remain slightly above the maximum included in the plan standards for General Forest. Current trends in cover and forage availability would continue. Satisfactory cover would not be impacted and road density would not be reduced. Elk would continue to use the area, but forage availability is expected to gradually decrease as the area dominated by dense forest cover continues to expand. Forage would return in areas where future disturbances such as insects, disease, or fire reduce forest canopy closure.

Alternative 2

Within General Forest, this alternative would reduce satisfactory cover by 895 acres, and decrease marginal cover by 609 acres. Total cover acres in General Forest would be reduced by 1,504 acres, resulting in a 7 percent decrease of percent cover and no change to the cover quality index (an index included in the HEI analysis which represents the relative quality of cover based on canopy closure). Within General Forest Winter Range, this alternative would reduce satisfactory cover by 162 acres, and would reduce marginal cover by 742 acres. Total cover acres in General Forest Winter Range would be reduced by 904 acres, resulting in a 29 percent decrease in percent cover and no change to the cover quality index. Within Winter Range, this alternative would reduce satisfactory cover by 337 acres and marginal cover by 1,220 acres. Total cover acres in Winter Range would be reduced by 1,557 acres, resulting in a 32 percent decrease of percent cover and no change to the cover quality index.

Seasonal restriction on harvest, thinning, fuels and related activities would be implemented between December 1 and May 1 in General Forest Winter Range and in Winter Range allocations.

Alternative 2 would initially increase road density in the short term (during implementation) as follows: General Forest 0.1 miles per square mile, General Forest Winter Range 0.2 miles per square mile, and Winter Range 1.1 miles per square mile. After timber and follow-up operations are complete, road closures would reduce road density by 0.3 mile per square mile in General Forest, 0.2 miles per square mile General Forest Winter Range and 0.4 miles per square mile Winter Range (compared to existing conditions). Combined with the cover effects described above, HEI would be decreased from 39.2 to 33.6 in General Forest, decreased from 45.1 to 17.5 in General Forest Winter Range, and reduced from 53.8 to 15 in Winter Range.

Goals established in the Forest Plan for HEI would be met under this alternative. Open road density would increase temporarily above standards during implementation, but would then be reduced to below the maximum included in the plan standards for General Forest. Current ratios in cover and forage availability would be altered, resulting in a shift from 52 to 23 percent cover on General Forest Winter Range; from 52 to 20 percent cover on Winter Range and 36 to 29 percent cover on General Forest. A ratio of 40 percent land in cover to 60 percent land in forage is thought to provide optimal deer and elk habitat (Thomas 1979). Satisfactory cover would be reduced by 895 acres on General Forest, 162 acres on General Forest Winter Range and 337 acres on Winter Range, but road density would be reduced when closures are implemented on all three of these areas. Elk would continue to use the area, but cover would be limited in the short-term. Cover availability is expected to increase as forest canopy recovers and road closures are expected to partially compensate for loss of cover.

Tables 81, 82, and 83 display changes in HEI values. Initial decreases are due to reductions in cover and increases in road density. Final HEI values reflect partial compensation that results from road closures.

Alternative 3

Within General Forest, this alternative would reduce satisfactory cover by 801 acres and increase marginal cover by 801 acres. Total cover acres in General Forest would not change and there would be no change in percent cover and the cover quality index. Within General Forest Winter Range, this alternative would reduce satisfactory cover by 141 acres, and would reduce marginal cover by 617 acres. Total cover acres in General Forest Winter Range would be reduced by 758 acres, resulting in a 24 percent reduction in percent cover and no change to the cover quality index. Within Winter Range, this alternative would reduce satisfactory cover by 338 acres and marginal cover by 1,217 acres. Total cover acres in Winter Range would be reduced by 1,555 acres, resulting in 32 percent cover and no change to the cover quality index.

Seasonal restriction on thinning, fuels, and related activities would be implemented between December 1 and May 1 in General Forest Winter Range and in Winter Range allocations.

This alternative would not reduce road densities. HEI would remain at 39.2 in General Forest, and would be reduced from 45.1 to 37.6 in General Forest Winter Range, and be reduced from 53.8 to 14 in Winter Range.

Goals established in the Forest Plan for HEI would be met under this alternative. Open road density would remain slightly above standards for General Forest. Current ratios in cover and forage availability would shift from 52 to 28 percent cover on General Forest Winter Range and from 52 to 20 percent cover on Winter Range. Cover would stay at 36 percent on General Forest. A ratio of 40 percent land in cover to 60 percent land in forage is thought to provide optimal deer and elk habitat (Thomas 1979). Satisfactory cover would be reduced by 801 acres on General Forest, 141 acres on General Forest Winter Range, and 338 acres on Winter Range. Road density would not be changed by this alternative. Elk would continue to use the area, but cover would be limited in the short-term. Cover availability is expected to increase as forest canopy recovers, which should occur relatively quickly under this alternative. Tables 81, 82, and 83 display changes in HEI values. Decreases are due to reductions in cover.

Alternative 4

Within General Forest, this alternative would reduce satisfactory cover by 870 acres and decrease marginal cover by 513 acres. Total cover acres in General Forest would be reduced by 1,383 acres, resulting in a 6 percent reduction of percent cover and no change to the cover quality index. Within General Forest Winter Range, this alternative would reduce satisfactory cover by 152 acres, and would reduce marginal cover by 688 acres. Total cover acres in General Forest Winter Range would be reduced by 840 acres, resulting in a 26 percent reduction in percent cover and no change to the cover quality index. Within Winter Range, this alternative would reduce satisfactory cover by 332 acres and marginal cover by 1,201 acres. Total cover acres in WR would be reduced by 1,533 acres, resulting in a 32 percent decrease of percent cover and no change to the cover quality index.

Seasonal restriction on harvest, thinning, fuels and related activities would be implemented between December 1 and May 1 in General Forest Winter Range and in Winter Range allocations.

Alternative 4 would initially increase road density in the short term (during implementation) as follows: Winter Range 0.1 miles per square mile. After timber and follow-up operations are complete, road closures would reduce road density by 0.3 miles per square mile in General Forest, 0.2 miles per square mile in General Forest Winter Range, and 0.5 miles per square mile in Winter Range. Combined with the cover effects described above, HEI would be decreased from 39.2 to 33.6 in General Forest, decreased from 45.1 to 40.0 in General Forest Winter Range, and reduced from 53.8 to 15.5 in Winter Range.

Goals established in the Forest Plan for HEI would be met. Open road density would remain slightly above standards during implementation, but would then be reduced to below the maximum included in the Forest Plan for General Forest. Current ratios in cover and forage availability would be altered, resulting in a shift from 52 to 26 percent cover on General Forest Winter Range; from 52 to 20 percent cover on Winter Range and 36 to 30 percent cover on

General Forest. A ratio of 40 percent land in cover to 60 percent land in forage is thought to provide optimal deer and elk habitat (Thomas 1979). Satisfactory cover would be reduced by 870 acres on General Forest,152 acres on General Forest Winter Range and 332 acres on Winter Range, but road density would be reduced when closures are implemented in all three of these areas. Elk would continue to use the area, but cover would be limited in the short term. Cover availability is expected to increase as forest canopy recovers and road closures are expected to partially compensate for loss of cover. Tables 81, 82, and 83 display changes in HEI values. Initial decreases are due to reductions in cover and increases in road density. Final HEI values reflect partial compensation that results from implementation of road closures.

Alternative 5

Within General Forest, this alternative would reduce satisfactory cover by 788 acres and decrease marginal cover by 246 acres. Total cover acres in General Forest would be reduced by 1,034 acres, resulting in a 4 percent reduction of percent cover and no change to the cover quality index. Within General Forest Winter Range, this alternative would reduce satisfactory cover by 155 acres, and would reduce marginal cover by 680 acres. Total cover acres in General Forest Winter Range would be reduced by 835 acres, resulting in a 26 percent reduction in percent cover and no change to the cover quality index. Within Winter Range, this alternative would reduce satisfactory cover by 334 acres and marginal cover by 1,209 acres. Total cover acres in Winter Range would be reduced by 1,543 acres, resulting in a 32 percent decrease of percent cover and no change to the cover quality index.

Seasonal restriction on harvest, thinning, fuels and related activities would be implemented between December 1 and May 1 in General Forest Winter Range and in Winter Range allocations.

Alternative 5 would initially increase road density in the short term (during implementation) as follows: Winter Range 0.1 miles per square mile. After timber and follow-up operations are complete, road closures would reduce road density by 0.3 miles per square mile in General Forest; 0.2 miles per square mile in General Forest Winter Range; and 0.2 miles per square mile in Winter Range (compared to existing conditions). Combined with the cover effects described above, HEI would be decreased from 39.2 to 38.5 in General Forest, decreased from 45.1 to 40.0 in General Forest Winter Range, and reduced from 53.8 to 14.5 in Winter Range.

Goals established in the Forest Plan for HEI would be met under this alternative. Open road density would not change, but would remain slightly above standards during implementation, but would then be reduced to below the maximum included in the plan standards for General Forest. Current ratios in cover and forage availability would be altered, resulting in a shift from 52 to 26 percent cover on General Forest Winter Range; from 52 to 20 percent cover on WR and 36 to 32 percent cover on General Forest. A ratio of 40 percent of land in cover to 60 percent land in forage is thought to provide optimal deer and elk habitat (Thomas, 1979). Satisfactory cover would be reduced by 788 acres on General Forest, 155 acres on General Forest Winter Range and 334 acres on Winter Range, but road density would be reduced when closures are implemented on all three of these areas. Elk would continue to use the area, but cover would be limited in the short-term. Cover availability is expected to increase as forest canopy recovers, which should occur quickly under this alternative within treatment units where higher stocking levels are to be retained by prescription within PFA, pileated feeding habitat, connective corridors, satisfactory cover and mesic swales and drainages. Road closures are expected to partially compensate for loss of cover. Tables 81, 82, and 83 display changes in HEI values. Initial decreases are due to reductions in cover and increases in road density. Final HEI values reflect partial compensation that results from implementation of road closures.

Table 80. Existing percent cover, road density, HEI, and Forest Plan goal.

Management Area (MA)	**Cover % of MA**	**Road Density mi./sq. mi**	**HEI**	**Forest Plan HEI Goal (2nd Decade)**
General Forest	36	3.1	39.2	28
General Forest Winter Range	52	2.5	45.1	6
Winter Range	52	1.8	53.8	6

Table 81. HEI General Forest (Summer Range).

		Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**
Cover (acres)		7,970	4,659	5,263	4,730	5,086
Open Road Den, treat/closure	3.0	3.1	3.2/2.8	3.1	3.1/2.8	3.1/2.9
Percent Cover		36	29	36	30	32
HEI Value, treat/closure	**LRMP Goal: 28**	39.2	31.2/ 33.6	39.2	32.0/ 33.6	37.6/ 38.5

Table 82. HEI General Forest Winter Range.

		Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**
Cover (acres)		1,655	751	897	815	820
Open Road Den. (mi./sq. mi.) treat/closure	Winter 1.0 Summer 3.0	1.0* 2.5	1.0* 2.7/2.3	1.0* 2.5	1.0* 2.5/2.3	1.0* 2.5/2.3
Percent Cover		52	23	28	26	27
HEI Value Treat/closure	**LMRP Goal: 6**	45.1	15.0/ 17.5	37.6	37.6/ 40.0	37.6/ 40.0

Table 83. HEI Winter Range.

		Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5**
Cover (acres)		2,505	948	950	972	962
Open Road Den. (mi./sq. mi.) treat/closure	Winter 1.0 Summer 3.0	1.0* 1.8	1.0* 2.9/1.4	1.0* 1.8	1.0* 1.9/1.3	1.0* 1.9/1.6
Percent Cover		52	20	20	20	20
HEI Value	**LRMP Goal: 6**	53.8	10.2/ 15.0	14	13.8/ 15.5	13.7/ 14.5

* 1.0 miles/square mile density is based on implementation of seasonal road closure program in winter range from December 1 to May 1 of each year.

The analysis indicates that the project area meets HEI standards for General Forest, General Forest Winter Range, and Winter Range.

Cumulative Effects

There were approximately 260 acres of satisfactory and marginal cover reduced by the Hash Rock Fire, but the habitat effectiveness values for cover quality and quantity did not change, due to the relatively small number of acres in relation to the total number of acres in the project area. Therefore, the Habitat Effectiveness Index (HEI) values did not change for the project area as a result of the Hash Rock Fire.

Within the project area 13.5 miles of open road exist in Winter Range (MA-20), resulting in an open road density of 1.8 miles/square mile. There are also 12.2 miles of open road in General Forest Winter Range (MA-21), resulting in an open road density of 2.5 miles per square mile. Ongoing activities are planned that would reduce accessibility of roads in Winter Range (MA-F20) between December 1 and May 1 of each year by reinforcement of existing closures. Seasonal restrictions would be required for road work within these allocations between December 1 and May 1 of each year. All alternatives have seasonal road closures in place to meet Forest Plan road density requirements. Monitoring would be conducted to confirm that the existing closure program is being effectively implemented to the extent necessary to meet this requirement. If this standard is not being met, then modifications will be made to the existing closure program to ensure that the seasonal standard is met.

In the Marks Creek Watershed and Veazie Creek drainage approximately 5,098 acres were treated with commercial timber harvest within General Forest in the last 30 years. The majority of these treatments were regeneration harvests. These treatments reduced the abundance of both satisfactory and marginal cover for elk. At the same time fire exclusion has allowed the development of moderate to dense canopy closure (cover) in other areas. The proposed alternatives further reduce the percent cover in General Forest. Combined with the proposed action the net cumulative effect is that the percent cover will be as displayed in Table 81.

Within General Forest Winter Range approximately 1,019 acres were treated with commercial timber harvest or post fire salvage in the Marks Creek Watershed during the last 35 years. The majority of these treatments were regeneration prescriptions. These treatments reduced the abundance of both satisfactory and marginal cover for elk. The proposed alternatives reduce the percent cover as described above. The net cumulative effect is that the percent cover be as displayed in Table 82.

In Winter Range approximately 414 acres have been treated with commercial timber harvest in the Marks Creek Watershed and Veazie Creek drainage during the last 30 years. These treatments reduced cover for elk. The percent cover goal for Winter Range is relatively low based on site potential and estimated capability to produce cover. All action alternatives would further reduce cover within this allocation, the net cumulative effect is that the percent cover will be as displayed in Table 83.

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

The action alternatives propose short-term harvest of timber, while enhancing the long-term health of forested stands. Existing conditions are outside the historic range of variability and may not be sustainable over the long term. Proposed activities including prescribed fire move conditions toward a balance of sustainable vegetative conditions. Soil and water are two key factors in ecosystem productivity and protection of these resources is provided by the design elements discussed in Chapter 2. Sustainable levels of timber, wildlife habitat, water quality, and other resources depend on maintaining the long-term soil productivity upon which vegetation relies. Quality and quantity of water from the project area would fluctuate as described previously, but no long-term effects to water resources are anticipated as a result of commercial harvest, precommercial thinning, and fuels reduction activities. All alternatives provide fish and wildlife habitat at levels necessary to maintain viable populations of the species within the project area. The amounts of suitable habitat vary with the level of activities in each alternative.

Unavoidable Adverse Effects

All of the action alternatives considered result in some adverse effects. Many of these adverse effects can be reduced through implementation of the design elements identified in Chapter 2. Even after minimizing these adverse effects, there are still some adverse effects that cannot be avoid. Adverse effects that cannot be avoided relate to air quality, noxious weeds, and soils.

<u>Air quality</u>. All four action alternatives include underburning activities that would produce smoke, including particulate matter such as PM 10. Chapter 2 includes design elements, such as only burning when anticipated weather conditions would be favorable for smoke dispersion, to reduce the adverse effects from burning. However, weather cannot always be predicted and unexpected changes in weather conditions during burning may result in smoke pooling in inhabited areas. These effects cannot be avoided. Prescribed fire would not be ignited or would be suspended during persistent inversion conditions, which would decrease the potential for smoke pooling in the Marks Creek area.

<u>Non-native Invasive Species (noxious weeds)</u>. The potential for introduction and spread of noxious weeds exists under every alternative considered, including no action, and cannot be completely avoided. All of the action alternatives result in some areas that are conducive to the introduction and spread of noxious weeds. Design elements have been included in every action alternative to reduce these adverse effects. However, proposed activities such as commercial

timber harvest, log haul, road construction and reconstruction, grapple piling, and underburning still result in conditions conducive to the introduction and spread of noxious weeds.

Soils. Additional detrimental soil conditions are expected as a result of implementing Alternatives 2, 4, and 5. The use of tractor (ground-based) logging equipment would result in additional areas with detrimental soil compaction and displacement. Underburning and burning both grapple and landing piles would also result in small amounts of detrimental charring. The design elements in Chapter 2 and the unit-specific mitigation in Appendix B identify the resource protection measures that would minimize the unavoidable adverse effects to soils. Alternatives 2, 4, and 5 were specifically designed to limit the amount of detrimental soil conditions consistent with Regional guidelines for soils.

Road construction also results in adverse effects to soils that cannot be avoided. Road construction results in soil compaction and displacement. On roads that are decommissioned, the road surface can and would be revegetated, but soil productivity is still reduced because of compaction. These adverse effects to soils cannot be avoided.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or road.

Irreversible commitments are decisions affecting nonrenewable resources such as soils, wetlands, roadless areas, and cultural resources. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at great expense or because the resource has been destroyed or removed.

The construction of roads, to provide access to timber, is an irreversible action because of the time it takes for a constructed road to revert to natural conditions. Alternatives 2, 4, and 5 propose some level of road construction.

Removing aggregate (gravel) from mineral material sources would result in an irreversible commitment of resources. Once aggregate is removed from material source sites and placed on roads, it cannot be renewed.

Irretrievable commitments of natural resources involve the loss of production or use of resources for a period of time. This represents opportunities foregone for the period of time that the resource cannot be used.

Timber stands that are not managed at this time present an irretrievable loss of growth potential. Although the lost growth is irretrievable, it is not irreversible because the stands may be managed at a later date.

Cumulative Effects

Cumulative effects have been discussed throughout this chapter. As discussed in the June 24, 2005, Council on Environmental Quality Memorandum on Guidance of the Consideration of Past Actions in Cumulative Effects Analysis, past actions that warrant consideration because they are continuing to cause identifiable effects in the project area have been considered. For example, in the last 30-35 years there has been regeneration harvest on more than 7,000 acres. Regeneration harvest reduced the amount of LOS and wildlife habitat in the project area. This past harvest was considered in the sections on LOS and wildlife species such as the goshawk and pileated woodpecker. Past activities that have changed the environmental baseline have been included in the description of the affected environment. For example, in the analysis of effects to soils, past harvest activities using ground-based equipment resulted in detrimental soil conditions. The unit-by-unit analysis for soils contained in Appendix B describes the existing amount of detrimental soil conditions by alternative. Much of the detrimental disturbance was caused by past harvest. Other events in the project area such as the Hash Rock Fire of 2000 and the Marks Creek Burn in 1968 are also discussed where appropriate.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with … other environmental review laws and executive orders."

National Forest Management Act

To ensure consistency with the National Forest Management Act, the Ochoco National Forest Land and Resource Management Plan, as amended, was consulted. The Forest Plan contains several standards and guidelines that apply forest-wide or to specific management areas. Both forest-wide and management area specific standards and guidelines were reviewed. Table 84 briefly identifies the applicable standards and guidelines and how the alternatives are consistent. If the alternatives are not consistent, a brief description of the needed Forest Plan amendment is included. In addition, the requirements at USC (United States Code) 1604(g)(3) were reviewed and the proposed activities are consistent.

Alternative 1 is the no action alternative and is not included in Table 84 because no management activities would occur.

All of the action alternatives are consistent with long-term management objectives as discussed in the Forest Plan as amended. However, Alternatives 2 and 4 would require three amendments, Alternative 3 would require one amendment, and Alternative 5 would require two amendments. These amendments are briefly discussed in the alternative descriptions in Chapter 2 and in Table 84.

Amendment 1

The Eastside Screens (aka Regional Forester's Forest Plan Amendment No. 2) contain standards that indicate there should be no net loss of LOS if either one or both of the LOS stages are below HRV. The eastside screens also indicate that some timber sale activities can occur within LOS stages that are within HRV, such as manipulating one type of LOS to move stands into the LOS stage that is deficit if it meets historical conditions. Currently, the amount of multi-strata LOS in the Douglas-fir PAG is within HRV and single-strata LOS is below HRV. Timber harvest in multi-strata LOS within the Douglas-fir PAG is designed to reduce competition and maintain large trees in this area; these stands would be converted to single-strata LOS. Following treatment, multi-strata LOS would be below HRV. A Forest Plan amendment is needed to allow this activity in Alternatives 2, 4, and 5 because the Eastside Screens does not allow timber sale activities to move multi-strata LOS below HRV.

These commercial harvest activities are designed to reduce stand density, improve growth of the residual trees, and reduce potential mortality resulting from inter-tree competition. Commercial harvest would more quickly restore historic seral/structural stage conditions and improve growing conditions for larger trees than no action, noncommercial thinning alone, or prescribed fire alone. Commercial harvest would also decrease the probability of wildfires and decreases the severity of wildfire impacts. No trees greater than 21 inches dbh would be cut and removed in any area except in isolated cases for safety reasons or for road construction.

This amendment is consistent with the Regional Forester's June 11, 2003, letter on guidance for implementing Eastside Screens. In that letter the Regional Forester encouraged Forest Supervisor's to encourage site-specific Forest Plan amendment that would meet LOS objectives of increasing the number of large trees and LOS on the landscape. The commercial harvest proposed in multi-strata LOS in the Douglas-fir PAG is consistent with the intent of the Eastside Screens to maintain and/or enhance LOS.

Timing – The Forest Plan has been in effect since 1897. This amendment is occurring during the second decade of the plan period and is less likely to be significant. The commercial harvest treatments in Alternative 2, 4, and 5 are expected to be implemented within the next 5 years.

Location and Size – In Alternative 2 approximately 309 acres would be treated out of the 988 acres of multi-strata LOS in the Douglas-fir PAG within the 39,200 acre project area. In Alternative 4, approximately 216 acres would be treated. In Alternative 5, approximately 224 acres would be treated. In all three alternatives, the acres that are treated would remain LOS; it would change from multi-strata LOS to single-strata LOS.

Goals, Objectives, and Outputs – There would be no change in the long-term relationships between the levels of goods and services projected by the Forest Plan Final EIS and the impacts of implementing any of these alternatives because of the small number of acres treated and the objectives of the treatments (to maintain LOS in the long term).

Management Prescription – The amendment applies only to this project area and would not apply to future decisions within the project area. The amendment does not alter the desired future condition of the land or resources or the anticipated goods and services to be produced. Only a small acreage would be treated and options for future management of LOS would be maintained.

Amendment 2

The Eastside Screens contain standards that indicate timber harvest should be deferred in connective corridors when all the criteria for connective corridors cannot be met. A Forest Plan amendment is needed to implement Alternatives 2 and 4 to allow commercial harvest within connective corridors. Commercial harvest in these alternatives would reduce canopy closure to less than two-thirds of site potential. The Eastside Screens indicate that canopy closure should be maintained within the top one-third of site potential. Connective corridors within the project area represent the best connections given the existing conditions resulting from physical restrictions such as ridges, meadows, and previous harvest practices. Timber harvest in Alternatives 2 and 4 within connective corridors are designed to maintain existing large trees and promote development of additional large trees. Alternative 2 includes 787 acres of commercial harvest in connective corridors. Alternative 4 includes 700 acres of commercial harvest in connective corridors. This activity will help develop LOS in corridors and would improve connectivity in the long term.

This amendment is consistent with the Regional Forester's June 11, 2003, letter on guidance for implementing Eastside Screens. In that letter the Regional Forester encouraged Forest Supervisor's to encourage site-specific Forest Plan amendment that would meet LOS objectives of increasing the number of large trees and LOS on the landscape. The commercial harvest proposed in connective corridors is consistent with the intent of the Eastside Screens to maintain and/or enhance LOS.

Timing – The Forest Plan has been in effect since 1989. This amendment is occurring during the second decade of the plan period and is less likely to be significant. The commercial harvest in Alternatives 2 and 4 are expected to be implemented within the next 5 years.

Location and Size – The project area contains 3,260 acres of connective corridors. Alternative 2 includes 787 acres of commercial harvest in connective corridors. Alternative 4 includes 700 acres of commercial harvest in connective corridors. The commercial harvest retains options for future management of connective corridors. Treatments would maintain existing large trees and would promote the development of additional large trees.

Goals, Objectives, and Outputs – There would be no change in the long-term relationships between the levels of goods and services projected by the Forest Plan Final EIS and the impacts of implementing Alternatives 2 or 4 because of the few acres being treated and the objectives of the treatments (to maintain LOS in the long term).

Management Prescription – The amendment applies only to this project and would not apply to future decisions. The amendment does not alter the desired future condition of the land or resources or the anticipated goods and services to be produced. Only a small acreage would be treated and options for future management of connective corridors would be maintained.

Amendment 3

The Forest Plan (p. 4-251) states that vegetative management (except livestock use) will not be allowed within MA-F6 Old Growth, until further research is available on the needs of the dependent species. All four action alternatives include precommercial thinning, hand piling, and underburning in the Stewart Springs OGMA. These activities are proposed to improve the longevity of large ponderosa pine on south and west facing slopes. The activities are consistent with the emphasis for the OGMA which is to provide habitat for wildlife species dependent on old growth stands. A Forest Plan amendment is needed because the activities are not consistent with the standard and guideline that indicates vegetative management is not allowed.

Timing – The Forest Plan has been in effect since 1989. This amendment is occurring during the second decade of the plan period and is less likely to be significant. The proposed activities are expected to be implemented within the next 5-7 years.

Location and Size – The project area contains three OGMAs. The alternatives includes activities on 70 acres out of 821 within OGMAs. No activities are proposed in the other two OGMAs within the project area. The proposed activities would maintain existing large trees.

Goals, Objectives, and Outputs – There would be no change in the long-term relationships between the levels of goods and services projected by the Forest Plan Final EIS and the impacts of implementing any of the action alternatives because of the low number of acres being treated and the objectives of maintaining large trees.

Management Prescription – The amendment applies only to this project and would not apply to future decisions. The amendment does not alter the desired future condition of the land or resources or the anticipated goods and services to be produced. Only a small acreage would be treated and options for future management would be maintained.

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
MA-F6. Vegetative management will not be allowed until further research is available on the needs of the dependent species (Forest Plan, p. 4-251)	Thinning, hand piling, and burning would occur in the Stewart Springs MA-F6 area to improve the longevity of large ponderosa pine on south and west facing slopes. A Forest Plan amendment is needed to implement this activity.	Thinning, hand piling, and burning would occur in the Stewart Springs MA-F6 area to improve the longevity of large ponderosa pine on south and west facing slopes. A Forest Plan amendment is needed to implement this activity.	Thinning, hand piling, and burning would occur in the Stewart Springs MA-F6 area to improve the longevity of large ponderosa pine on south and west facing slopes. A Forest Plan amendment is needed to implement this activity.	Thinning, hand piling, and burning would occur in the Stewart Springs MA-F6 area to improve the longevity of large ponderosa pine on south and west facing slopes. A Forest Plan amendment is needed to implement this activity.
Forest-wide. Do not allow timber sale harvest activities to occur within LOS stages that are below HRV (Eastside Screens, App. B, p. 9)	The Douglas-fir PAG is currently within HRV for multi-strata LOS. Activities in this PAG would decrease the amount of multi-strata LOS below HRV and increase the amount of single-strata LOS. There would be no net loss of LOS in the Douglas-fir PAG. A Forest Plan amendment is needed because harvest activities would reduce multi-strata LOS below HRV in the Douglas-fir PAG.	No timber harvest would occur in the Douglas-fir PAG.	The Douglas-fir PAG is currently within HRV for multi-strata LOS. Activities in this PAG would decrease the amount of multi-strata LOS below HRV and increase the amount of single-strata LOS. There would be no net loss of LOS in the Douglas-fir PAG. A Forest Plan amendment is needed because harvest activities would reduce multi-strata LOS below HRV in the Douglas-fir PAG.	The Douglas-fir PAG is currently within HRV for multi-strata LOS. Activities in this PAG would decrease the amount of multi-strata LOS below HRV and increase the amount of single-strata LOS. There would be no net loss of LOS in the Douglas-fir PAG. A Forest Plan amendment is needed because harvest activities would reduce multi-strata LOS below HRV in the Douglas-fir PAG.

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Forest-wide. Maintain or enhance connectivity between LOS stands and Old Growth Management Areas. (Eastside Screens, App. B., p. 10)	Activities within connective corridors would enhance development of large trees over time. Commercial harvest would reduce canopy closure below the upper third of site potential. A Forest Plan amendment is needed to implement harvest activities within connective corridors.	Activities within connective corridors would maintain overstory canopy closure within the upper third of site potential. Activities would enhance development of large trees over time.	Activities within connective corridors would enhance development of large trees over time. Commercial harvest would reduce canopy closure below the upper third of site potential. A Forest Plan amendment is needed to implement harvest activities within connective corridors.	Activities within connective corridors would maintain overstory canopy closure within the upper third of site potential. Activities would enhance development of large trees over time.
Forest-wide. Protect active and historical goshawk nest sites. Seasonal restrictions will be required for activities near sites that may disturb or harass pair while brooding and nesting (Eastside Screens, App. B, p. 13)	Design elements seasonally restrict activities near goshawk nest sites.	Design elements seasonally restrict activities near goshawk nest sites.	Design elements seasonally restrict activities near goshawk nest sites.	Design elements seasonally restrict activities near goshawk nest sites.
Forest-wide. 30 acres of the most suitable nesting habitat for goshawks will be deferred from harvest (Eastside Screens, App. B, p. 13)	30-acre nest stands have been identified. No harvest would occur in 30-acre nest stands.	No harvest would occur in this alternative.	30-acre nest stands have been identified. No harvest would occur in 30-acre nest stands.	30-acre nest stands have been identified. No harvest would occur in 30-acre nest stands.

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Forest-wide. A 400-acre post-fledging area will be established around goshawk nest sites. Retain LOS stands and enhance younger stands toward LOS condition (Eastside Screens, App. B, p. 13).	400-acre post-fledging areas have been identified around known nest sites. Activities have been designed to maintain and enhance LOS conditions.	400-acre post-fledging areas have been identified around known nest sites. Activities have been designed to maintain and enhance LOS conditions.	400-acre post-fledging areas have been identified around known nest sites. Activities have been designed to maintain and enhance LOS conditions.	400-acre post-fledging areas have been identified around known nest sites. Activities have been designed to maintain and enhance LOS conditions.
TM-1b. Prohibit timber harvest in RHCAs except to acquire desired vegetation characteristics where needed to attain RMOs. Apply silvicultural practices in a manner that does not retard attainment of RMOs and that avoids adverse effects on inland native fish.(INFISH, p. A-7)	Timber harvest would occur within RHCAs to promote development of large woody debris (LWD) and to reduce competition with brushy, shrubby species. Harvest would be at least 25 feet from Class IV streams, 50 feet from Class III streams, and 200 feet from Class I and II streams. Harvest activities would not result in adverse effects to inland native fish because vegetation on the ground would filter sediment and future recruitment of LWD would be enhanced.	No timber harvest would occur.	Timber harvest would occur within RHCAs to promote development of large woody debris (LWD) and to reduce competition with brushy, shrubby species. Harvest would be at least 25 feet from Class IV streams, 50 feet from Class III streams, and 200 feet from Class I and II streams. Harvest activities would not result in adverse effects to inland native fish because vegetation on the ground would filter sediment and future recruitment of LWD would be enhanced.	Timber harvest would occur within RHCAs to promote development of large woody debris (LWD) and to reduce competition with brushy, shrubby species. Harvest would be at least 25 feet from Class IV streams, 50 feet from Class III streams, and 200 feet from Class I and II streams. Harvest activities would not result in adverse effects to inland native fish because vegetation on the ground would filter sediment and future recruitment of LWD would be enhanced.

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
FM-1. Design fuel treatment so as not to prevent attainment of RMOs, 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 could perpetuate or be damaging to long-term ecosystem function or inland native fish (INFISH, p. A-11).	Fire within RHCAs is designed to burn in a mosaic to retain vegetation for infiltration. An estimated 20 percent of identified units within RHCAs would burn to increase diversity. Streamside vegetation would be retained to filter sediment. Fuel treatments would contribute to meeting RMOs for LWD. Fuel treatments would not prevent attainment of other RMOs.	Fire within RHCAs is designed to burn in a mosaic to retain vegetation for infiltration. An estimated 20 percent of identified units within RHCAs would burn to increase diversity. Streamside vegetation would be retained to filter sediment. Fuel treatments would contribute to meeting RMOs for LWD. Fuel treatments would not prevent attainment of other RMOs.	Fire within RHCAs is designed to burn in a mosaic to retain vegetation for infiltration. An estimated 20 percent of identified units within RHCAs would burn to increase diversity. Streamside vegetation would be retained to filter sediment. Fuel treatments would contribute to meeting RMOs for LWD. Fuel treatments would not prevent attainment of other RMOs.	Fire within RHCAs is designed to burn in a mosaic to retain vegetation for infiltration. An estimated 20 percent of identified units within RHCAs would burn to increase diversity. Streamside vegetation would be retained to filter sediment. Fuel treatments would contribute to meeting RMOs for LWD. Fuel treatments would not prevent attainment of other RMOs.
FM-4. Design prescribed burn projects and prescriptions to contribute to the attainment of RMOs (INFISH, p. A-11).	Fuel reduction activities were designed to reduce fuel loading to approximate historic levels and maintain or enhance the growth of residual vegetation. Fuel treatments would contribute to attaining RMOs.	Fuel reduction activities were designed to reduce fuel loading to approximate historic levels and maintain or enhance the growth of residual vegetation. Fuel treatments would contribute to attaining RMOs.	Fuel reduction activities were designed to reduce fuel loading to approximate historic levels and maintain or enhance the growth of residual vegetation. Fuel treatments would contribute to attaining RMOs.	Fuel reduction activities were designed to reduce fuel loading to approximate historic levels and maintain or enhance the growth of residual vegetation. Fuel treatments would contribute to attaining RMOs.

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
RF-2b. Minimize road and landing locations in RHCAs (INFISH, p. 7).	Alternative design minimizes new road construction in RHCAs to 0.26 miles. Design criteria limits landing locations in RHCAs.	No road work within RHCAs. No landings located in RHCAs.	Alternative design minimizes new road construction in RHCAs to 0.11 miles. Design criteria limits landing locations in RHCAs.	Alternative design minimizes new road construction in RHCAs to 0.14 miles. Design criteria limits landing locations in RHCAs.
RF-2c. Initiate development and implementation of a Road Management Plan or a Transportation Management Plan. (5) Regulate traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives (INFISH, p. 7).	A roads analysis was completed in 2002 and has been updated for this project. This alternative includes a design element to suspend haul during wet periods when haul is contributing sediment.	A roads analysis was completed in 2002 and has been updated for this project. This alternative does not include commercial timber harvest or road work.	A roads analysis was completed in 2002 and has been updated for this project. This alternative includes a design element to suspend haul during wet periods when haul is contributing sediment.	A roads analysis was completed in 2002 and has been updated for this project. This alternative includes a design element to suspend haul during wet periods when haul is contributing sediment.
RF-2d. Avoid sediment delivery to streams from the road surface by (1) outsloping of the roadway surface, or (2) routing road drainage away from potentially unstable stream channels, fills, and hill slopes (INFISH, p. 8).	Design elements include installing relief drainage or erosion control devices to route drainage away from stream channels. Road reconstruction and culvert removal included to reduce sediment delivery to streams.	This alternative does not include commercial timber harvest or road work.	Design elements include installing relief drainage or erosion control devices to route drainage away from stream channels. Road reconstruction and culvert removal included to reduce sediment delivery to streams.	Design elements include installing relief drainage or erosion control devices to route drainage away from stream channels. Road reconstruction and culvert removal included to reduce sediment delivery to streams.

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
RF-2e. Avoiding disruption of natural hydrologic flow paths (INFISH, p. 8).	Design elements includes installing adequate relief drainage at stream crossings to avoid disrupting hydrologic flow.	This alternative does not include commercial timber harvest or road work.	Design elements includes installing adequate relief drainage at stream crossings to avoid disrupting hydrologic flow.	Design elements includes installing adequate relief drainage at stream crossings to avoid disrupting hydrologic flow.
RF-3a. Reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards, or do not protect the watershed from increased sedimentation (INFISH, p. 8).	Design elements includes installing adequate relief drainage at stream crossings. Road reconstruction and culvert removal included to reduce sediment delivery to streams.	This alternative does not include commercial timber harvest or road work.	Design elements includes installing adequate relief drainage at stream crossings. Road reconstruction and culvert removal included to reduce sediment delivery to streams.	Design elements includes installing adequate relief drainage at stream crossings. Road reconstruction and culvert removal included to reduce sediment delivery to streams.
RF-3c. Close and stabilize or obliterate, and stabilize roads not needed for future management activities (INFISH, p. 8).	Includes road work within RHCAs to stabilize roads and reduce sediment delivery. Within RHCAs, 8.4 miles of road would be closed, decommissioned, or reconstructed.	This alternative does not include road work.	Includes road work within RHCAs to stabilize roads and reduce sediment delivery. Within RHCAs 8.2 miles of road would be closed, decommissioned, or reconstructed.	Includes road work within RHCAs to stabilize roads and reduce sediment delivery. Within RHCAs 8.2 miles of road would be closed, decommissioned, or reconstructed.

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
RF-4. Construct new, and improve existing, culverts, bridges, and other stream crossings to accommodate a 100-year flood where those improvement pose a substantial risk to riparian conditions (INFISH, p. A-8).	Design elements require new and reconstructed roads with stream crossings to have adequate relief drainage. Two culverts on Rush Creek would be removed.	This alternative does not include road work.	Design elements require new and reconstructed roads with stream crossings to have adequate relief drainage. Two culverts on Rush Creek would be removed.	Design elements require new and reconstructed roads with stream crossings to have adequate relief drainage. Two culverts on Rush Creek would be removed.
RF-5. Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams (INFISH, p. A-8).	Roads would be constructed and closed using proper drainage and surfacing to ensure fish passage.	This alternative does not include road work.	Roads would be constructed and closed using proper drainage and surfacing to ensure fish passage.	Roads would be constructed and closed using proper drainage and surfacing to ensure fish passage.
Forest-wide. Project activities will be planned to reduce soil compaction and displacement to the lowest reasonable level. Strive to reduce compaction and displacement of the total activity area to get as close to 90 percent of the activity area in a noncompacted/nondisplaced condition. The minimum will be 80 percent (Forest Plan, p. 4-196).	Unit specific mitigations to reduce compaction and displacement have been identified. These include design of logging systems, avoidance of specific areas, and identification of tilling.	This alternative would result in no net increase in the amount of area which exceeds the 20 percent detrimental soil condition standard.	Unit specific mitigations to reduce compaction and displacement have been identified. These include design of logging systems, avoidance of specific areas, and identification of tilling.	Unit specific mitigations to reduce compaction and displacement have been identified. These include design of logging systems, avoidance of specific areas, and identification of tilling.

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Forest-wide. Maintain viable populations of all threatened, endangered, and sensitive plant and animal species (Forest Plan, p. 4-120).	Biological Evaluations (BEs) were completed. This alternative would not adversely affect any threatened or endangered species. This alternative would not cause a trend toward federal listing for any sensitive species.	BEs were completed. This alternative would not adversely affect any threatened or endangered species. This alternative would not cause a trend toward federal listing for any sensitive species.	BEs were completed. This alternative would not adversely affect any threatened or endangered species. This alternative would not cause a trend toward federal listing for any sensitive species.	BEs were completed. This alternative would not adversely affect any threatened or endangered species. This alternative would not cause a trend toward federal listing for any sensitive species.
Forest-wide. Protect fragile sites such as shallow soil areas (scablands) and natural meadows (Forest Plan, p. 4-121).	Design elements were incorporated in all alternatives to protect fragile sites. Ground-based machinery would be restricted in scablands, meadows, and RHCAs.	Design elements were incorporated in all alternatives to protect fragile sites. No ground-based machinery would be used in scablands, meadows, and RHCAs.	Design elements were incorporated in all alternatives to protect fragile sites. Ground-based machinery would be restricted in scablands, meadows, and RHCAs.	Design elements were incorporated in all alternatives to protect fragile sites. Ground-based machinery would be restricted in scablands, meadows, and RHCAs.
Forest-wide. Identify and protect unique ecological situations, such as representative examples of aspen clones (Forest Plan, p. 4-121	Several aspen stands and two cottonwood stands would be enhanced by reducing competition with conifers. Conifers would be cut or girdled. To protect regeneration from browse fencing and/or individual cages may be installed.	Several aspen stands and two cottonwood stands would be enhanced by reducing competition with conifers. Conifers would be cut or girdled. To protect regeneration from browse fencing and/or individual cages may be installed.	Several aspen stands and two cottonwood stands would be enhanced by reducing competition with conifers. Conifers would be cut or girdled. To protect regeneration from browse fencing and/or individual cages may be installed.	Several aspen stands and two cottonwood stands would be enhanced by reducing competition with conifers. Conifers would be cut or girdled. To protect regeneration from browse fencing and/or individual cages may be installed.

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Forest-wide. Prevention of invasive plant introduction, establishment, and spread will be addressed in fire and fuels and vegetation management plans (2005 ROD for Preventing and Managing Invasive Plants, Standard 1).	Chapter 3 includes a discussion of noxious weeds. Factors favoring the establishment and spread of weeds have been identified. Existing infestations were identified and considered during alternative development. Prevention measures have been developed and incorporated as design elements in Chapter 2.	Chapter 3 includes a discussion of noxious weeds. Factors favoring the establishment and spread of weeds have been identified. Existing infestations were identified and considered during alternative development. Prevention measures have been developed and incorporated as design elements in Chapter 2.	Chapter 3 includes a discussion of noxious weeds. Factors favoring the establishment and spread of weeds have been identified. Existing infestations were identified and considered during alternative development. Prevention measures have been developed and incorporated as design elements in Chapter 2.	Chapter 3 includes a discussion of noxious weeds. Factors favoring the establishment and spread of weeds have been identified. Existing infestations were identified and considered during alternative development. Prevention measures have been developed and incorporated as design elements in Chapter 2.
Forest-wide. Actions conducted or authorized by written permit by the Forest Service require the cleaning of heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) prior to entering National Forest System Lands (2005 ROD for Preventing and Managing Invasive Plants, Standard 2).	To reduce the potential for transport or spread of noxious weeds, contracts would include a clause that equipment be clean of all plant or soil material (Chapter 2, design element).	To reduce the potential for transport or spread of noxious weeds, contracts would include a clause that equipment be clean of all plant or soil material (Chapter 2, design element).	To reduce the potential for transport or spread of noxious weeds, contracts would include a clause that equipment be clean of all plant or soil material (Chapter 2, design element).	To reduce the potential for transport or spread of noxious weeds, contracts would include a clause that equipment be clean of all plant or soil material (Chapter 2, design element).

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Forest-wide. Use weed-free straw and mulch for all projects on National Forest System Lands (2005 Region 6 ROD for Preventing and Management of Invasive Plants, Standard 3).	Straw materials that are used in sediment traps will be certified weed-free or be acquired from certified fields that produce weed-free seed for the grain or grass seed industry (Chapter 2, design element).	Straw materials that are used in sediment traps will be certified weed-free or be acquired from certified fields that produce weed-free seed for the grain or grass seed industry (Chapter 2, design element).	Straw materials that are used in sediment traps will be certified weed-free or be acquired from certified fields that produce weed-free seed for the grain or grass seed industry (Chapter 2, design element).	Straw materials that are used in sediment traps will be certified weed-free or be acquired from certified fields that produce weed-free seed for the grain or grass seed industry (Chapter 2, design element).
Forest-wide. Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists (2005 ROD for Preventing and Managing Invasive Plants, Standard 7).	Ochoco NF material sources would be inspected to ensure materials are weed-free. Sale contract would include provisions requiring any material from other sources is weed-free (Chapter 2, design element).	Ochoco NF material sources would be inspected to ensure materials are weed-free. Sale contract would include provisions requiring any material from other sources is weed-free (Chapter 2, design element).	Ochoco NF material sources would be inspected to ensure materials are weed-free. Sale contract would include provisions requiring any material from other sources is weed-free (Chapter 2, design element).	Ochoco NF material sources would be inspected to ensure materials are weed-free. Sale contract would include provisions requiring any material from other sources is weed-free (Chapter 2, design element).
Forest-wide. Conduct road blading, brushing, and ditch cleaning in areas with high concentrations of invasive plants in consultation with District or Forest-level invasive plant specialists. Incorporate invasive plant prevention practices as appropriate (2005 Region 6 ROD for Preventing and Management of Invasive Plants, Standard 8).	Pre-project weed surveys have been completed. A weed locator map has been prepared. Prevention measures have been incorporated during alternative development (Chapter 2, design elements).	Pre-project weed surveys have been completed. A weed locator map has been prepared. Prevention measures have been incorporated during alternative development (Chapter 2, design elements).	Pre-project weed surveys have been completed. A weed locator map has been prepared. Prevention measures have been incorporated during alternative development (Chapter 2, design elements).	Pre-project weed surveys have been completed. A weed locator map has been prepared. Prevention measures have been incorporated during alternative development (Chapter 2, design elements).

Table 84. Applicable Forest Plan Direction.

Standards and Guidelines	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Forest-wide. Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used (2005 Region 6 ROD for Preventing and Management of Invasive Plants, Standard 13).	Use source-identified, locally-collected native grass species for revegetation, if available, or use native cultivars (Chapter 2, design element). Native seed has been propagated.	Use source-identified, locally-collected native grass species for revegetation, if available, or use native cultivars (Chapter 2, design element). Native seed has been propagated.	Use source-identified, locally-collected native grass species for revegetation, if available, or use native cultivars (Chapter 2, design element). Native seed has been propagated.	Use source-identified, locally-collected native grass species for revegetation, if available, or use native cultivars (Chapter 2, design element). Native seed has been propagated.

Clean Air Act

The selected alternative is designed to be consistent with the Clean Air Act. The Oregon DEQ is responsible for assuring compliance with the Clean Air Act. In 1994, the Forest Service, in cooperation with the DEQ, the Oregon Department of Forestry, and the BLM, signed a Memorandum of Understanding (MOU) to establish a framework for implementing an air quality program in Northeast Oregon. The MOU includes a prescribed fire emission limit of 15,000 tons of PM 10 per year for the national forests of the Blue Mountains (Malheur, Ochoco, Umatilla, and Wallowa-Whitman). (PM 10 are particulate matter that measure 10 microns in diameter or less, and are small enough to enter the human respiratory system.) All prescribed burning on these forests is coordinated with the DEQ through the State of Oregon smoke management program. All prescribed fire activities proposed in the action alternatives would be conducted in compliance with the State of Oregon Smoke Management System and would meet smoke management objectives for total emissions.

Clean Water Act

The Clean Water Act establishes a non-degradation policy for all federally proposed projects. The action alternative meets anti-degradation standards through planning, application, and monitoring of Best Management Practices (BMPs). The Environmental Protection Agency has certified the Oregon Forest Practices Act and regulations as BMPs. The State of Oregon has compared Forest Service practices with the State practices and concluded that Forest Service practices meet or exceed State requirements. Site-specific BMPs have been designed to protect beneficial uses. Chapter 2 lists the design elements and resource protection measures that are common to all action alternatives. A number of these measures are BMPs.

The Draft EIS documents the analysis of effects to streams listed on the Oregon State 303(d) list of Water Quality Limited Water Bodies for summer water temperature. These streams are: Marks, Little Hay, and Hamilton Creeks. Implementation of any of the action alternatives would not result in any measurable increase in water temperatures in any fish-bearing or non-fish bearing perennial stream in the project area. Commercial timber harvest and precommercial thinning activities were designed so that they do not reduce shade. There is a potential to increase water temperature in intermittent non-fish bearing streams (Class IV) when they are flowing, but this would not result in a violation of state water quality standards because these streams go dry before peak water temperatures occur in the project area.

All four of the action alternatives will comply with the Clean Water Act.

Endangered Species Act

Biological Evaluations (BEs) have been prepared to document possible effects of proposed activities on threatened and endangered species in the project area. There are no endangered species known or suspected to occur on the Ochoco National Forest. Threatened species that are known or suspected to occur on the Ochoco National Forest include bull trout, mid-Columbia

River steelhead, northern bald eagle, and Canada lynx. Potential effects to these species were analyzed and the analysis is summarized in the BEs (February 9, 2007, Wildlife BE and January 2007 BE for Aquatic Species) and in Chapter 3 of this Draft EIS. The analysis documents that there would be no effect to bull trout or mid-Columbia River steelhead. The project may affect, but is not likely to adversely affect northern bald eagle and Canada lynx. Consultation with the U.S. Fish and Wildlife Service has been completed. Consultation with the National Marine Fisheries Service is not needed.

National Historic Preservation Act

A cultural resource inventory has been completed for the project area. The activities in the preferred alternative have been designed to have either No Effect or No Adverse Effect to cultural resource sites through both protection and avoidance.

Environmental Justice and Civil Rights

Civil Rights legislations, including the Civil Rights Act (CR) of 1964, Title VI, prohibit discrimination in Forest Service program delivery. The underlying principal behind the Civil Rights Act is that no activity shall negatively affect minorities, woman, or persons with disabilities by virtue of their race, color, sex, national origin, religion, age, disability, or material or familial status. Executive Order 12898 directs each Federal agency to make achieving Environmental Justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

There is no known potential for disparate or disproportionately high effects from any of the alternatives considered in this environmental impact statement to low-income or minority populations. None of the alternatives considered would discriminate or negatively impact any individual or subset of the population described above.

CHAPTER 4. CONSULTATION AND COORDINATION

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes, and non-Forest Service persons during the development of this environmental impact statement:

Interdisciplinary Team Members

Jeffrey Bell, Fuels Specialist, studied Technical Fire Management at Washington Institute and received credits from Colorado State University and Central Oregon Community College. Jeff has 32 years of firefighting experience. He started fighting fire in 1975 for the Oregon Department of Forestry as an AD firefighter. He began working for the USDA Forest Service in 1978 in recreation and moved into fuels in the fall of the same year. He has worked as an engine supervisor, burn boss, fuels technician, fuels planner, area fire planner, suppression technician, and fire management officer. Jeff is currently a Battalion Chief. Jeff holds several fire qualifications including Operations Section Chief 2, Fire Behavior Analyst, Incident Commander Type 3, Prescribe Burn Boss I, and Prescribe Fire Manager.

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Jim David, Forest Soil Scientist, has a B.S. degree in Range and Wildlands Science (soils and hydrology emphasis) and a M.S. degree in Range Ecology from the University of California at Davis. His experience includes working in ranching, farming, contract inventory, California Division of State Lands, BLM, and the Forest Service. His experience includes 23 years of federal service with the Ely and Las Vegas Districts of the BLM in Nevada and the Ochoco National Forest in central Oregon. He has worked as the Forest Soil Scientist for the Ochoco National Forest and Crooked River National Grassland for the last 17 years.

Erica Ellison, Recreation Specialist, graduated from the College of Forestry and Conservation at the University of Montana in 2005. She has a B.S. degree in Recreation Resources Management. Her curriculum focused on the management of scenic and recreation resources on private, state, and federal lands. It also included the study of characteristics, needs, activities, and behavior of recreation visitors. She worked seasonally for 3 years as a trail crew leader and wilderness ranger in the Absaroka/Beartooth Wilderness on Gallatin National Forest. She has worked for the Ochoco National Forest for the last 2 years.

Katherine Farrell is the Project Leader. She has more than 18 years experience working for the Forest Service in planning. She has been involved in numerous planning efforts including timber sales, range allotment plans, Wild and Scenic River management plans, land exchanges, watershed analyses, and recreation projects. She is currently District Environmental Coordinator for the Lookout Mountain Ranger District of the Ochoco National Forest.

Barbara Franano, Fisheries Biologist, has B.S. and M.S. degrees in Biology (fish and wildlife emphasis) from West Texas State University in Canyon, Texas. Her experience includes 26 years of government service working for the Wasatch-Cache, Uinta, and Ochoco National Forests, U.S. Bureau of Reclamation, and the Division of Wildlife Resources in Utah. She has worked as a fisheries and wildlife biologist and as a program manager for special uses. For the last 8 years, she has been the Fisheries Biologist for the Lookout Mountain Ranger District and Crooked River National Grassland, Ochoco National Forest.

Caroline L. Gordon, Forest Geologist, earned her B.A. in Geology in 1977 from Central Washington University, Ellensburg, WA. She is a Registered Geologist in the State of Oregon and in the State of Washington. She began working for the Forest Service in 1978 as a Civil Engineering Technician. In 1984, she converted to the Geology series. Carrie specializes in providing general geology for planning areas/watershed analysis, managing the rock resource program, and conducting slope stability investigations. In addition, she assists administering small scale mineral material permits and plans of operation for small mining claims. She has worked on the Ochoco National Forest since 1992.

Gayle Hammond, Road Manager, has an A.S. degree in Engineering Technology from Linn-Benton Community College. She has been with the Forest Service 26 years working for the Malheur, Siskiyou, and Wallowa-Whitman National Forests as an engineering technician. Her experience includes planning, location, survey and design, contract preparation and administration of roads and recreation sites. She is currently the road manager and transportation planner for the Ochoco National Forest.

Theresa (Terry) Holtzapple, District Archaeologist, earned a B.A. in Anthropology from the University of Texas at Austin in 1975. Her experience includes more than 25 years of archaeological excavation and survey work in Texas, Alaska, and Oregon with University Research Centers, Texas State Parks and Wildlife Department Historic Sites and Restoration, National Park Service, and the Forest Service. She has worked on the Ochoco National Forest in cultural resource management since 1979. In 1985, she made a career shift and worked on a local ranch, the Paulina School, and the Post Store. She returned to the Ochoco National Forest in 1990. Terry is currently the District Archaeologist on the Lookout Mountain Ranger District and Crooked River National Grassland and an active member of the Archaeological Society of Central Oregon and the Crook County Historical Society.

Mark G. Lesko, Botanist and Noxious Weed Coordinator, has B.S. in Forest Science from The Pennsylvania State University, and post-graduate education in botany from Oregon State University. His experience includes 27 years in forestry, ecology, lands and minerals, botany, and noxious weed management for The Confederated Tribes of the Warm Springs Reservation of Oregon, BLM, and the Forest Service. For the last 9 years, he has been the botanist for the Lookout Mountain Ranger District and Crooked River National Grassland, Ochoco National Forest.

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Robert Rawlings, Silviculturist, earned a B.S. in Forest Management from Washington State University in 1979. He has more than 20 years experience in silviculture, including 8 years of forest inventory experience. Rob has been a certified Silviculturist since 1992. For the last 15 years, Rob has been a Silviculturist on the Ochoco National Forest.

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Dede Steele, Wildlife Biologist, has a B.S. degree in Wildlife Science and a B.S degree in Rangeland Resources from Oregon State University. Her experience includes 24 years of government service working for the Willamette, Ochoco, and Deschutes National Forests and for the U.S. Fish and Wildlife Service. She has worked as a District and Forest level Biologist, as an interdisciplinary resource planner, and as a Service Biologist. She is currently a District Wildlife Biologist on the Lookout Mountain Ranger District, Ochoco National Forest.

Distribution of the Environmental Impact Statement

Copies of this EIS have been sent to the following individuals, adjacent landowners, Federal agencies, federally recognized tribes, Sate and local governments, and organizations representing a wide range of views. This includes individuals that have specifically requested a copy of the document.

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APPENDIX A

Description of Proposed Treatments

Commercial harvest (HIM or HTH): This prescription would be used in overstocked stands with a surplus of merchantable sized trees, trees between 9 and 20.9 inches dbh. Most stands contain an existing component of large trees (greater than 21 inches dbh). Current stand conditions often include multiple canopies and dense stocking and may include all seral stages. The stands would be thinned from below to recommended stocking levels in Alternatives 2 and 4. In Alternative 5, certain stands located within wildlife emphasis areas would have a higher residual stocking level and/or retain a portion of the stand in an untreated condition (approximately 10 percent untreated in stringers or 1/2 to 1 acre patches). Merchantable trees would be sold and removed from the stand.

Recommended stocking levels vary depending on site quality, tree size, and species. For example, the desired density range for an uneven-aged ponderosa pine stand on a grand fir-pinegrass site is 89 to 133 trees per acre when the average diameter is 10 inches dbh. The basal area would be between 49 and 73 square feet per acre. If the average diameter were larger, then fewer trees would be retained but the residual basal area would increase. Fewer trees would be retained on drier sites relative to moister sites. Recommended stocking levels are derived from "Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington: An Implementation Guide for the Umatilla National Forest" (Powell 1999).

Logging System: This proposal includes **Tractor (T), Skyline (S), and Helicopter (H)** logging systems. Tractor systems include the use of ground-based equipment such as tractors, rubber-tired skidders, and feller/bunchers to move the logs to a landing where they can be loaded onto a truck. Tractor systems are usually prescribed in areas with slopes that are less than 35 percent. On steeper slopes, such as those more than 35 percent, skyline or helicopter systems are prescribed. Skyline systems include the use of a cable system to suspend the logs into the air to move them to a landing. Helicopter systems use a helicopter to lift logs into the air to move them to a landing. Helicopter systems are also used in areas less than 35 percent slope where there are concerns about using tractor systems.

Yard Tops Attached (YTA): This activity includes moving cut trees with the tops still attached to a landing. The tops are then cut off at the landing area before the logs are loaded onto a truck. This activity is prescribed in areas where leaving the tree tops in the unit is likely to result in fuel loadings that are considered too high for activity-fuels underburning. This activity is only prescribed in combination with commercial harvest.

Precommercial thinning (PCT): This activity cut small nonmerchantable trees generally less than 9 inches dbh. Diseased or damaged trees and juniper trees up to 12 inches dbh could

The number of small trees left varies by stand depending on the overall stocking objectives and the amount of existing overstory. Where the objective in the stand is to have single-storied LOS and many large diameter trees exist, then few small understory trees would be retained (40 or less per acre). Where few overstory trees exist, such as in young plantations, then the precommercial thinning may retain 135 or more small trees per acre. Species retained are usually ponderosa pine and western larch. Species infected with/or susceptible to insects and disease are normally removed. Precommercial thinning can occur in combination with commercial harvest. Trees cut during this activity are usually left on site. Slash may be reduced by fuels treatments, such as underburning.

Hardwood thinning (HWD): This activity is prescribed to reduce conifer competition in hardwood stands by cutting down and/or girdling conifers (mostly ponderosa pine) that have encroached into these areas. Commercial harvest would not occur in these stands. In general, conifers up to 15 inches dbh would be cut. Most, if not all, conifers within 50 feet of any aspen (including sprouts) or cottonwood tree would be cut down and left in place, or girdled and left standing. Slash generated from these activities would be lopped or hand piled. The slash would not be burned. To prevent browsing, fencing and/or individual tree cages may be installed. Two types of fencing may be used. In some stands, livestock fencing would be installed; livestock fencing is four-strand barbed or smooth wire approximately 4 feet in height. In some stands, buck and pole fences may be installed to discourage livestock; buck and pole fences will be created from slash. In other stands, big game fencing would be installed; big game fencing is smooth wire or plastic netting approximately 7 feet in height. Individual tree cages are constructed of hard wire mesh 2 to 4 feet in diameter and 3 to 4 feet in height. Cages are placed to protect individual or clumps of sprouts.

Grapple piling (GP): This activity involves the use of a machine such as an excavator with a grapple on an articulating arm. The machine operates on existing skid trails and reaches out to pick up and pile material. It is estimated that the machine would be able to reach 60 to 70 percent of the anticipated slash, breaking up its continuity and lowering the overall amount. Grapple piles would be located on existing skid trails or landings, be approximately 5 to 10 feet high and 10 to 15 feet in diameter. These grapple piles would generally be burned within 2 to 3 years of piling. Grapple piling will not occur within RHCAs.

Hand piling (HP): This activity involves the hand piling of material 0-5 inches dbh and stacked in line with the slope. Hand piles would be less then 6 feet in diameter and no taller than 4 feet. In general, hand piling will be used along private land boundaries and in areas that have too much slash to be underburned safely and are too steep for grapple piling. Hand piles would generally be burned within 2 to 3 years of piling.

Jackpot burning (JP): During a jackpot burn, concentrations of fuels are ignited. Jackpot burning would result in a mosaic of lightly and moderately burned areas. Jackpot burning is expected to kill some trees and create small openings (less than 1/10th of an acre), but is not expected to result in changes in species composition. The follow up underburn would remove additional surface and ladder fuels.

Underburning (UB): Prescribed underburning is the application of fire in pre-determined patterns under specified conditions to produce a desired average flame length and rate of spread. The most common ignition techniques are the strip head fire and the backing fire. A strip head fire involves igniting strips of fire across a slope, or with the wind, until one strip reaches the area burned by the strip ahead of it. Fire intensity and rate of spread is controlled by adjusting the distance between the strips, and the number of strips ignited at one time. A backing fire involves igniting a strip of fire and allowing that strip to “back” into the wind or downhill. Fire intensity and rate of spread is controlled by adjusting how often and where fire is ignited to keep it moving (Kilgore and Curtis 1987). Usually, prescribed fire units that face south and west are in prescription to burn in the spring. Units that face north and east do not usually dry out enough to burn in the spring, and are generally burned in the fall. Units that sit at lower elevations are generally burned in the spring, while units at higher elevations are generally not in prescription to burn until the fall.

Alternative Specific Activities by Unit

The following tables identify the specific activities that are prescribed in each unit, by alternative. The activities are displayed in sequential order. For example, in Unit 100 precommercial thinning would occur and then underburning would occur. In Unit 110, the unit would be underburned, then commercial harvest would occur followed by precommercial thinning and a second underburn.

Alternative 2								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
100					PCT	UB		120.32
101		H	HTH		PCT	UB		40.36
104		T	HTH		PCT	UB		36.80
105		S	HTH		PCT	GP	UB	20.84
107		T	HTH		PCT	GP	UB	65.16
108		T	HTH		PCT	UB		238.81
109					UB	PCT	UB	136.72
110	UB	T	HTH		PCT	UB		26.92
111		T	HTH		PCT	GP	UB	48.33
112		T	HTH		PCT	UB		53.23
113					PCT	UB		57.04
114		H	HTH	YTA	PCT	UB		17.00
115		T	HTH		PCT	UB		47.64
117		S	HTH		UB	PCT	UB	16.34
118		T	HTH		PCT	UB		36.57
119					PCT	UB		24.95
120		T	HTH		PCT	GP	UB	157.30
124					UB	PCT	UB	90.92
125		T	HTH		PCT	GP	UB	56.21
126		T	HTH		PCT	UB		30.59
127		T	HTH		PCT	UB		45.73
129		T	HTH		PCT	GP	UB	31.54
133					UB			37.71

Alternative 2								
Unit	Pre-harvest Burn	Logging System	Commercial Harvest		Noncommercial or Fuel Reduction Activities			Acres
134					PCT	UB		33.04
135					PCT	UB		31.14
136					UB			32.10
137					UB			220.48
138		T	HTH		PCT	GP	UB	19.87
139		T	HTH		PCT	GP	UB	146.72
141		H	HTH		PCT	UB		36.89
142		T	HTH		PCT	GP	UB	16.97
143		H	HTH		PCT	UB		79.62
144					PCT	UB		88.15
145					HWD			2.18
148		T	HTH		PCT	UB		82.80
150					UB	PCT	UB	32.08
151					UB			27.69
155		H	HIM	YTA	PCT	UB		20.24
160		T	HTH		PCT	GP	UB	113.95
161					UB			14.56
162		T	HTH		PCT	UB		27.14
163		T	HTH		PCT	GP	UB	159.69
166		T	HTH		PCT	GP	UB	36.49
171					PCT	UB		16.58
172		H	HIM		PCT	JP	UB	42.52
173					PCT	GP	UB	20.11
174		T	HIM	YTA	PCT	UB		32.77
175					UB			54.37
176		T	HIM		PCT	GP	UB	19.42
177		H	HTH		PCT	UB		39.29
179		H	HTH		PCT	UB		22.20
181		T	HIM		PCT	GP	UB	26.67
184		H	HIM	YTA	PCT	UB		64.77
185		T	HIM		PCT	GP	UB	8.27
186		T	HIM		PCT	GP	UB	34.75
187					UB			9.73
188		H	HIM	YTA	PCT	UB		37.68
189		H	HIM		UB			71.61
190					PCT	UB		57.71
191		T	HIM		PCT	GP	UB	10.49
192					PCT	UB		69.17
193		T	HIM		PCT	GP	UB	59.68
196					PCT	UB		59.49
198		T	HIM		PCT	GP	UB	34.19
199		T	HIM	YTA	PCT	UB		76.75

Alternative 2								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
200		T	HIM	YTA	PCT	UB		20.79
201		T	HIM	YTA	PCT	UB		20.05
202		T	HTH		PCT	UB		201.10
203		T	HTH		PCT	UB		116.88
206					UB	PCT	UB	29.68
207		T	HTH		PCT	UB		80.60
208					UB			106.99
209					PCT	UB		41.73
210	UB	T	HTH		PCT	GP	UB	29.41
211					PCT	UB		77.85
212		T	HTH		PCT	UB		38.04
214					PCT	UB		49.63
300		T	HIM		PCT	GP	UB	48.79
301		T	HIM		GP	UB		30.21
302		T	HTH		PCT	UB		27.97
303		T	HTH		PCT	UB		61.18
304		T	HTH		PCT	UB		43.23
306		T	HTH		PCT	GP	UB	19.60
310		T	HIM		PCT	GP	UB	49.58
311		T	HIM		PCT	GP	UB	47.12
312					UB			62.88
313					UB			44.56
314					UB			126.22
315					PCT	UB		53.99
316					PCT	UB		42.72
317		T	HIM		PCT	GP	UB	38.08
400		S	HTH		UB	PCT	UB	9.62
401					HWD			12.33
402					HWD			13.71
403					HWD			15.36
404					HWD			4.88
405					HWD			9.45
406					HWD			0.93
407					HWD			7.91
408					HWD			13.63
409					HWD			7.97
410					HWD			2.70
411					HWD			2.60
501					JP	UB		62.18
502					HWD			17.90
503					JP	UB		26.42
505					PCT	GP	UB	18.64

Alternative 2								
Unit	Pre-harvest Burn	Logging System	Commercial Harvest		Noncommercial or Fuel Reduction Activities			Acres
506					PCT	UB		17.52
507					HWD			3.84
508					PCT	UB		34.21
509		T	HIM		PCT	GP	UB	25.66
510					PCT	UB		241.74
511					UB			103.81
512					UB			30.23
513					UB			27.09
514					PCT	UB		33.92
515		T	HIM		PCT	GP	UB	18.07
517		T	HIM		PCT	GP	UB	12.57
518					PCT	UB		6.63
519					PCT	UB		33.64
520					UB			47.10
521					PCT	UB		74.68
522					UB			20.48
524		T	HIM		PCT	GP	UB	27.99
525					HWD			4.55
530		T	HIM		PCT	UB		11.68
531		T	HTH		PCT	GP	UB	17.91
532		T	HIM		PCT	GP	UB	66.70
533					HWD			3.68
534					UB			25.24
535		T	HTH		UB			81.32
537					PCT	UB		22.03
538					UB			65.36
542		T	HIM		PCT	UB		70.70
544					PCT	UB		6.25
546		T	HIM		PCT	GP	UB	30.88
550		T	HIM		PCT	GP	UB	50.78
551					PCT	UB		48.01
552					HWD			13.45
555					PCT	UB		26.54
559		T	HIM		PCT	GP/HP	UB	102.77
560		T	HIM		PCT	GP	UB	63.90
562					UB			136.85
563		T	HTH		PCT	GP	UB	55.47
564		T	HTH	YTA	PCT	UB		7.36
565		T	HTH		PCT	UB		48.31
566					PCT	UB		17.93
567					PCT	UB		79.54
568					PCT	UB		20.61

Alternative 2								
Unit	Pre-harvest Burn	Logging System	Commercial Harvest		Noncommercial or Fuel Reduction Activities			Acres
569		T	HTH		PCT	UB		4.00
570		T	HTH		PCT	GP	UB	25.61
571					PCT	UB		20.09
572		T	HIM		PCT	GP	UB	60.33
577					HWD			1.37
700		T	HTH		PCT	UB		61.44
701		H	HTH		PCT	UB		49.48
703		H	HTH		PCT	UB		57.68
704		T	HTH		PCT	UB		109.93
705		T	HIM		PCT	UB		39.57
707		T	HTH		PCT	UB		62.35
708					PCT	UB		106.55
711		T	HTH		PCT	UB		29.54
718		T	HIM		PCT	GP	UB	17.46
719					PCT	UB		17.57
722					PCT	HP	UB	121.37
723					PCT	UB		47.61
727					UB			38.52
729		T	HTH		PCT	UB		92.24
734		T	HTH		PCT	HP	UB	54.70
737					HWD			10.98
738		T	HIM		PCT	GP	UB	56.34
739					PCT	UB		17.33
740		T	HTH		PCT	GP	UB	150.20
741					UB			53.53
742		T	HIM		PCT	GP	UB	49.57
743					PCT	HP	UB	39.72
744					PCT	HP	UB	39.73
745					HWD			2.89
747					UB			47.89
748		T	HIM		PCT	GP	UB	36.09
751		T	HIM		PCT	GP/HP	UB	109.86
752		T	HIM		PCT	GP/HP	UB	30.44
772					PCT	UB		44.88
776		T	HIM		PCT	GP	UB	52.84
800					PCT			32.14
801					PCT			50.31
803					UB			333.68
804					UB			65.08
805					UB			107.84
806		T	HTH		PCT	GP	UB	29.00
807					UB			111.64

Alternative 2								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
808		H	HTH		PCT	UB		13.69
809		H	HTH		PCT	UB		31.54
810	UB	T	HTH		PCT	UB		13.86
811		T	HTH		PCT	GP	UB	63.49
812					UB			57.88
813					PCT	UB		80.66
814		H	HTH		PCT	UB		14.27
815		T	HTH	UB				42.89
816		H	HTH		PCT	UB		6.56
817		H	HTH		PCT	UB		5.04
818					PCT	UB		133.89
819					PCT	UB		25.05
820					UB			25.60
821		T	HTH		PCT	UB		61.18
823					UB			12.94
824		H	HIM		PCT	GP	UB	11.30
825		T	HTH		PCT	GP	UB	26.67
828					PCT	UB		47.24
829					PCT	UB		31.33
830					PCT	UB		102.58
831		T	HTH		PCT	UB		26.52
832					UB			54.91
833					UB			13.53
834		H	HTH		PCT	UB		20.73
835					PCT	UB		75.90
836		T	HTH		PCT	GP	UB	38.83
837					PCT	UB		72.15
838					UB			52.20
840					PCT	UB		74.45
841		H	HTH		PCT	UB		19.06
842					UB			53.14
843					UB			22.87
844					PCT	UB		436.98
845		S	HTH	YTA	PCT	UB		22.01
846		T	HTH		PCT	GP	UB	24.65
847		S	HTH	YTA	PCT	UB		13.36
848		T	HTH		PCT	GP	UB	16.40
850					PCT	UB		128.43
851		H/T	HIM		PCT	GP	UB	70.73
852					PCT			22.58
853					PCT			8.70
854					UB			22.09

Alternative 2								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
855					PCT			13.89
857					PCT	UB		76.44
858		T	HTH		PCT	GP	UB	88.93
859		T	HTH		PCT	GP	UB	77.06
860					UB			106.80
861					UB			459.12
862					UB			27.23
863		T	HTH		UB			96.47
865		T	HTH		PCT	UB		26.18
866					UB			53.21
867					UB			37.35
869		T	HTH		PCT	UB		25.20
870					PCT			36.22
871					UB			27.80
872					PCT			12.38
873					PCT	HP	UB	48.25
874					PCT	HP	UB	152.54
875					PCT	HP		39.72
876					UB			62.72
878		T	HIM		PCT	GP	UB	20.66
879		T	HTH		PCT	UB		88.61
880					UB			30.63
882					PCT	HP		44.70
883					PCT	HP		23.09
884					UB			14.29
885					PCT	UB		10.07
886					UB			29.34
887		T	HIM		PCT	GP	UB	19.39
888		T	HIM		PCT	GP	UB	63.52
891		T	HIM		PCT	GP	UB	23.22
892		T	HIM		PCT	GP	UB	4.60
893					PCT	UB		26.36
894					UB			6.71
895					UB			30.53
896					PCT	UB		26.61
898					UB			136.38
899					PCT			22.46
900					UB			36.03
901					JP	UB		87.87
902					UB			37.70
903					UB			39.14
904					HWD			1.91

Alternative 2								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
905					HWD			7.41
908					HWD			0.79
909					HWD			12.57
910					HWD			3.51
911					HWD			0.87
912					HWD			1.26
913					HWD			0.72
914					HWD			9.63
915					HWD			4.73
916					HWD			0.76
917					UB			8.48
918					UB			4.55
919					PCT	UB		19.11
920					UB			62.52
921					UB			97.95
922					UB			199.63
923					UB			32.41
924					UB			78.93
925					UB			34.44
926					UB			14.31
928					UB			159.03
929					UB			6.26
930					UB			16.25
931					UB			9.63
934					UB			819.72
935					PCT			34.84
936					PCT			66.21
937					PCT			35.93
938					PCT			36.28
939					PCT			40.76
940					PCT			11.76
941					PCT			35.88
942					PCT			26.81
943					PCT			29.67
944					PCT			37.73
945					PCT			14.43
946					PCT			30.09
947					PCT			31.85
949					PCT			7.35
950					PCT			20.81
951					PCT			25.43
952					PCT			13.00

Alternative 2								
Unit	Pre-harvest Burn	Logging System	Commercial Harvest		Noncommercial or Fuel Reduction Activities			Acres
953					PCT			19.57
954					PCT			8.83
955					PCT			80.28
956					PCT			30.72
957					PCT			28.68
958					PCT			14.53
959					PCT			155.87
960					PCT			27.18
961					UB			39.60
964					PCT	UB		20.95
967					UB			0.78
968					PCT	UB		4.91
969					PCT	UB		25.35
970		H	HIM		PCT	UB		23.00
971		T	HIM		PCT	UB		22.29
972					PCT	UB		31.46
973					UB			4.47
974					UB			39.77
975					UB			6.82
976					PCT	UB		16.49
977					PCT	UB		48.48
980					UB			29.19
981					PCT	HP	UB	44.05
982					PCT	HP		41.18
983					PCT	HP		69.16
984					UB			18.91
985		T	HIM		PCT	GP	UB	6.98

Alternative 3				
Unit	Noncommercial or Fuel Reduction Activities			Acres
100	PCT	UB		120.32
101	PCT	UB		40.36
104	PCT	UB		36.80
105	JP	PCT	UB	20.84
107	JP	PCT	UB	65.16
108	PCT	UB		238.81
109	UB	PCT	UB	136.72
110	UB	PCT	UB	26.92
111	JP	PCT	UB	48.33
112	PCT	UB		53.23

Alternative 3				
Unit	**Noncommercial or Fuel Reduction Activities**			**Acres**
113	PCT	UB		57.04
114	PCT	UB		17.00
115	PCT	UB		47.64
117	JP	PCT	UB	16.34
118	PCT	UB		36.57
119	PCT	UB		24.95
120	JP	PCT	UB	157.30
124	UB	PCT	UB	90.92
125	JP	PCT	UB	56.21
126	PCT	UB		30.59
127	PCT	UB		45.73
129	JP	PCT	UB	31.54
133	UB			37.71
134	PCT	UB		33.04
135	PCT	UB		31.14
136	UB			32.10
137	UB			220.48
138	JP	PCT	UB	19.87
139	JP	PCT	UB	146.72
141	PCT	UB		36.89
142	PCT	UB		16.97
143	PCT	UB		79.62
144	PCT	UB		88.15
145	HWD			2.18
148	PCT	UB		82.80
151	UB			27.69
155	PCT	UB		20.24
166	PCT	UB		21.06
171	PCT	UB		16.58
172	PCT	HP		49.49
173	PCT	UB		20.11
174	PCT	UB		32.77
175	UB			54.37
181	JP	PCT	UB	28.90
184	PCT	UB		64.77
185	PCT	UB		8.27
186	PCT	UB		34.75
187	UB			9.73
188	PCT	UB		37.68
189	UB			71.61
190	PCT	UB		57.71
191	PCT	UB		10.49

Alternative 3				
Unit	**Noncommercial or Fuel Reduction Activities**			**Acres**
192	PCT	UB		69.17
193	PCT	UB		59.68
196	PCT	UB		79.17
198	PCT	UB		34.19
202	PCT	UB		201.10
203	PCT	UB		116.88
206	UB	PCT	UB	29.68
207	PCT	UB		80.60
208	UB			106.99
209	PCT	UB		41.73
210	JP			29.41
211	UB			77.85
212	UB			38.04
214	PCT	UB		49.63
300	UB	PCT	UB	48.79
301	UB			30.21
302	PCT	UB		27.97
303	PCT	UB		61.18
304	PCT	UB		43.23
306	UB			8.05
310	UB			49.58
311	JP	PCT	UB	84.00
312	UB			62.88
313	UB			44.56
314	UB			126.22
315	PCT	UB		53.99
316	PCT	UB		42.72
400	JP	PCT	UB	9.62
401	HWD			12.33
402	HWD			13.71
403	HWD			15.36
404	HWD			4.88
405	HWD			9.45
406	HWD			0.93
407	HWD			7.91
408	HWD			13.63
409	HWD			7.97
410	HWD			2.70
411	HWD			2.60
501	JP	UB		62.18
502	HWD			17.90
503	JP	UB		26.42

Alternative 3				
Unit	**Noncommercial or Fuel Reduction Activities**			**Acres**
505	PCT	HP	UB	18.64
506	PCT	UB		17.52
507	HWD			3.84
508	PCT	UB		34.21
509	JP	PCT	UB	25.66
510	PCT	UB		241.74
511	UB			103.81
512	UB			30.23
513	UB			27.09
514	PCT	UB		33.92
515	PCT	HP		18.07
517	PCT	UB		12.57
518	PCT	UB		6.63
519	PCT	UB		33.64
520	UB			47.10
521	PCT	UB		74.68
522	UB			20.48
525	HWD			4.55
530	PCT	UB		11.68
531	PCT	UB		17.91
532	JP	PCT	UB	66.70
533	HWD			3.68
534	UB			25.24
535	UB			81.32
537	PCT	UB		22.03
538	UB			65.36
542	PCT	UB		70.70
544	PCT	UB		6.25
546	PCT	HP		30.88
550	UB			50.78
551	PCT	UB		48.01
552	HWD			13.45
555	PCT	UB		26.54
559	PCT	UB		102.77
562	UB			126.45
565	PCT	UB		48.31
566	PCT	UB		17.93
567	PCT	UB		79.54
568	PCT	UB		20.61
569	PCT	UB		4.00
570	PCT	UB		25.61
571	PCT	UB		20.09

Alternative 3				
Unit	**Noncommercial or Fuel Reduction Activities**			**Acres**
572	PCT	UB		60.33
577	HWD			1.37
700	PCT	UB		61.44
701	PCT	UB		49.48
703	UB	PCT	UB	57.68
704	UB	PCT	UB	109.93
708	PCT	UB		106.55
719	PCT	UB		17.57
722	PCT	HP	UB	121.37
723	PCT	UB		47.61
727	UB			38.52
734	PCT	HP	UB	54.70
737	HWD			10.98
738	JP	PCT	UB	56.34
739	PCT	UB		17.33
740	JP	PCT	UB	150.20
741	UB			53.53
742	JP	PCT	UB	49.57
743	PCT	HP	UB	39.72
744	PCT	HP	UB	39.73
745	HWD			2.89
747	UB			47.89
748	JP	PCT	UB	36.09
751	JP	PCT	UB	109.86
752	JP	PCT	UB	30.44
772	PCT	UB		44.88
776	JP	PCT	UB	52.84
800	PCT			32.14
801	PCT			50.31
803	UB			333.68
804	UB			65.08
805	UB			107.84
806	JP	PCT	UB	29.00
807	UB			111.64
808	PCT	UB		13.69
809	PCT	UB		31.54
810	UB	PCT	UB	13.86
811	PCT	UB		63.49
812	UB			57.88
813	PCT	UB		80.66
814	UB	PCT	UB	14.27
815	UB	PCT	UB	42.89

Alternative 3				
Unit	**Noncommercial or Fuel Reduction Activities**			**Acres**
816	UB	PCT	UB	6.56
817	UB	PCT	UB	5.04
818	UB	PCT	UB	133.89
819	UB	PCT	UB	25.05
820	UB			25.60
821	PCT	UB		61.18
823	UB			12.45
824	PCT	HP	JP	21.15
825	JP	PCT	UB	26.67
828	PCT	UB		47.24
829	PCT	UB		31.33
830	PCT	UB		102.58
831	PCT	UB		26.52
832	UB			54.91
833	UB			13.53
834	PCT	UB		20.73
835	PCT	UB		75.90
836	JP	PCT	UB	38.83
837	PCT	UB		72.15
838	UB			52.20
840	PCT	UB		74.45
841	PCT	UB		19.06
842	UB			53.14
843	UB			22.87
844	PCT	UB		423.00
845	UB	PCT	UB	82.94
850	PCT	UB		135.39
851	JP	PCT	UB	70.73
852	PCT			22.58
853	PCT			8.70
854	UB			22.09
855	PCT			13.89
859	PCT	UB		77.06
860	UB			55.83
861	UB			459.12
862	UB			27.23
863	UB			96.47
865	UB			22.10
866	UB			76.20
867	UB			37.35
870	PCT			36.22
871	UB			27.80

Alternative 3				
Unit	**Noncommercial or Fuel Reduction Activities**			**Acres**
872	PCT			12.38
873	PCT	HP	UB	48.25
874	PCT	HP	UB	152.54
875	PCT	HP		39.72
879	PCT	UB		88.61
880	UB			30.63
882	PCT	HP		44.70
883	PCT	HP		23.09
884	UB			14.29
885	PCT	UB		10.07
886	UB			29.34
887	JP	PCT	UB	19.39
888	JP	PCT	UB	63.52
891	PCT	UB		23.22
893	PCT	UB		26.36
894	UB			6.71
895	UB			30.53
896	PCT	UB		26.61
898	UB			136.38
899	PCT			22.46
900	UB			36.03
901	JP	UB		87.87
902	UB			38.79
903	UB			39.14
904	HWD			1.91
905	HWD			7.41
908	HWD			0.79
909	HWD			12.57
910	HWD			3.51
911	HWD			0.87
912	HWD			1.26
913	HWD			0.72
914	HWD			9.63
915	HWD			4.73
916	HWD			0.76
917	UB			8.48
918	UB			4.55
920	UB			62.52
921	UB			97.95
922	UB			199.63
923	UB			32.41
924	UB			78.93

Alternative 3				
Unit	**Noncommercial or Fuel Reduction Activities**			**Acres**
926	UB			14.31
928	UB			159.30
929	UB			6.26
930	UB			16.25
931	UB			9.63
934	UB			819.72
935	PCT			34.84
936	PCT			66.21
937	PCT			35.93
938	PCT			36.28
939	PCT			40.76
940	PCT			11.76
941	PCT			35.88
942	PCT			26.81
943	PCT			29.57
944	PCT			37.73
945	PCT			14.43
946	PCT			30.09
947	PCT			31.85
949	PCT			7.35
950	PCT			20.81
951	PCT			25.43
952	PCT			13.00
953	PCT			19.57
954	PCT			8.83
955	PCT			80.28
956	PCT			30.72
957	PCT			28.68
958	PCT			14.53
959	PCT			155.87
960	PCT			27.18
961	UB			39.60
964	PCT	UB		20.95
967	UB			0.78
968	PCT	UB		4.91
969	PCT	UB		25.35
972	PCT	UB		31.46
973	UB			4.47
977	PCT	UB		48.48
980	UB			29.19
981	PCT	HP	UB	44.05
982	PCT	HP		41.18

Alternative 3				
Unit	Noncommercial or Fuel Reduction Activities			Acres
983	PCT	HP		69.16

Alternative 4								
Unit	Pre-harvest Burn	Logging System	Commercial Harvest		Noncommercial or Fuel Reduction Activities			Acres
100					PCT	UB		120.32
101		H	HTH		PCT	UB		40.36
104		T	HTH		PCT	UB		41.13
105		H	HTH		PCT	GP	UB	19.20
107		T	HTH		PCT	GP	UB	65.16
108		T	HTH		PCT	UB		182.30
109					UB	PCT	UB	140.59
110	UB	T	HTH		PCT	UB		23.05
111		T	HTH		PCT	GP	UB	44.99
112		T	HTH		PCT	UB		53.23
113					PCT	UB		57.04
114		H	HTH	YTA	PCT	UB		44.37
115					PCT	UB		47.64
117		H	HTH		UB	PCT	UB	16.34
118		T	HTH		PCT	UB		36.57
119					PCT	UB		24.95
120		T	HTH		PCT	GP	UB	152.09
124					UB	PCT	UB	99.62
125		T	HTH		PCT	GP	UB	50.98
126		T	HTH		PCT	UB		30.59
127		T	HTH		PCT	UB		36.63
129		T	HTH		PCT	GP	UB	31.54
133					UB			37.71
134					PCT	UB		33.04
135					PCT	UB		31.14
136					UB			32.10
137					UB			220.48
138		T	HTH		PCT	GP	UB	16.84
139		H/T	HTH		PCT	GP	UB	23.78
141					PCT	UB		36.89
142					PCT	UB		16.97
143		H	HTH		PCT	UB		73.65
144					PCT	UB		88.15
145					HWD			2.18
148		T	HTH		PCT	UB		98.72

Alternative 4								
Unit	Pre-harvest Burn	Logging System	Commercial Harvest		Noncommercial or Fuel Reduction Activities			Acres
150					UB	PCT	UB	32.08
151					UB			29.50
155		H	HIM	YTA	PCT	UB		20.24
160		T	HTH		PCT	GP	UB	68.05
162		T	HTH		PCT	UB		27.14
163		T	HTH		PCT	GP	UB	141.03
166		T	HTH		PCT	GP	UB	36.49
171					PCT	UB		16.58
172		T	HIM		PCT	GP	UB	39.24
173					PCT	GP	UB	20.11
174		T	HIM	YTA	PCT	UB		32.77
175					UB			54.37
176		T	HIM		PCT	GP	UB	19.42
177		H	HTH		PCT	UB		39.29
179		H	HTH		PCT	UB		22.20
181		T	HIM		PCT	GP	UB	26.67
184		H	HIM	YTA	PCT	UB		73.04
186		T	HIM		PCT	GP	UB	34.75
187					UB			9.73
188		H	HIM	YTA	PCT	UB		37.68
189		H	HIM		UB			71.61
190					PCT	UB		57.71
191		T	HIM		PCT	GP	UB	10.49
192					PCT	UB		69.17
193		T	HIM		PCT	GP	UB	59.68
196					PCT	UB		59.49
198		T	HIM		PCT	GP	UB	34.19
199		T	HIM	YTA	PCT	UB		76.75
200		T	HIM	YTA	PCT	UB		20.79
201		T	HIM	YTA	PCT	UB		20.05
202					PCT	UB		201.10
203					PCT	UB		116.88
206					UB	PCT	UB	29.68
207					PCT	UB		74.37
208					UB			106.99
209					PCT	UB		137.29
210	UB	T	HTH		PCT	GP	UB	30.02
211					PCT	UB		96.65
212					PCT	UB		38.04
214					PCT	UB		49.63
300		T	HIM		PCT	GP	UB	48.79
301		T	HIM		GP	UB		30.21

Alternative 4								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
302		T	HTH		PCT	UB		26.31
303		T	HTH		PCT	UB		50.75
304		T	HTH		PCT	UB		43.23
306		T	HTH		PCT	GP	UB	19.60
311		T	HIM		PCT	GP	UB	47.12
312					UB			62.88
313					UB			44.56
314					UB			126.22
315					PCT	UB		53.99
316					PCT	UB		42.72
317		T	HIM		PCT	GP	UB	44.34
400		H	HTH		UB	PCT	UB	9.62
401					HWD			12.33
402					HWD			13.71
403					HWD			15.36
404					HWD			4.88
405					HWD			9.45
406					HWD			0.93
407					HWD			7.91
408					HWD			13.63
409					HWD			7.97
410					HWD			2.70
411					HWD			2.60
501					JP	UB		57.53
502					HWD			17.90
503					JP	UB		26.42
505					PCT	HP	UB	18.64
506					PCT	UB		17.52
507					HWD			3.84
508					PCT	UB		40.04
509		T	HIM		PCT	GP	UB	25.66
510					PCT	UB		241.74
511					UB			103.81
512					UB			30.23
513					UB			27.09
514					PCT	UB		33.92
515		T	HIM		PCT	GP	UB	18.07
517		T	HIM		PCT	GP	UB	12.57
518					PCT	UB		6.63
519					PCT	UB		33.64
520					UB			47.10
521					PCT	UB		74.68

Alternative 4								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
522					UB			20.48
525					HWD			4.55
530		T	HIM		PCT	UB		11.68
531		T	HTH		PCT	GP	UB	17.91
532		T	HIM		PCT	GP	UB	48.85
533					HWD			3.68
534					UB			25.24
535		T	HTH		UB			81.32
537					PCT	UB		22.03
538					UB			65.36
542					PCT	UB		32.48
544					PCT	UB		6.25
546		T	HIM		PCT	GP	UB	30.88
550		T	HIM		PCT	GP	UB	50.78
551					PCT	UB		48.01
552					HWD			13.45
555					PCT	UB		26.54
559		T	HIM		PCT	GP/HP	UB	89.26
560		T	HIM		PCT	GP	UB	63.90
562					UB			136.85
563		T	HTH		PCT	GP	UB	55.47
564		T	HTH	YTA	PCT	UB		7.36
565		T	HTH		PCT	UB		48.31
566					PCT	UB		17.93
567					PCT	UB		79.54
568					PCT	UB		20.61
569		T	HTH		PCT	UB		4.00
570		T	HTH		PCT	GP	UB	25.61
571					PCT	UB		20.09
572		T	HIM		PCT	GP	UB	60.33
577					HWD			1.37
700		T	HTH		PCT	UB		61.44
701		H	HTH		PCT	UB		49.48
703		H	HTH		PCT	UB		57.68
704		T	HTH		PCT	UB		104.81
705		T	HIM		PCT	UB		31.60
707		T	HTH		PCT	UB		33.66
708					PCT	UB		106.55
711		T	HTH		PCT	UB		29.54
718		T	HIM		PCT	GP	UB	17.46
719					PCT	UB		17.57
722					PCT	HP	UB	121.37

Alternative 4								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
723					PCT	UB		47.61
727					UB			38.52
729		T	HTH		PCT	UB		92.24
734		T	HTH		PCT	HP	UB	54.70
737					HWD			10.98
738		T	HIM		PCT	GP	UB	56.34
739					PCT	UB		17.33
740		T	HTH		PCT	GP	UB	150.20
741					UB			53.53
742		T	HIM		PCT	GP	UB	49.57
743					PCT	HP	UB	39.72
744					PCT	HP	UB	39.73
745					HWD			2.89
747					UB			47.89
748		T	HIM		PCT	GP	UB	36.09
751		T	HIM		PCT	GP/HP	UB	109.86
752		T	HIM		PCT	GP/HP	UB	30.44
772					PCT	UB		44.88
776		T	HIM		PCT	GP	UB	52.84
800					PCT			32.14
801					PCT			50.31
803					UB			333.68
804					UB			65.08
805					UB			107.84
806		H	HTH		JP	PCT	UB	29.00
807					UB			111.64
808		H	HTH		PCT	UB		13.69
809		H	HTH		PCT	UB		34.89
810	UB	T	HTH		PCT	UB		13.86
811		T	HTH		PCT	GP	UB	63.49
812					UB			57.88
813					PCT	UB		80.66
814					PCT	UB		14.27
815					PCT	UB		42.89
816		H	HTH		PCT	UB		6.56
817		H	HTH		PCT	UB		5.04
818					PCT	UB		133.89
819					PCT	UB		25.05
820					UB			25.60
821		T	HTH		PCT	UB		41.06
823					UB			12.94
824		T	HIM		PCT	GP	UB	21.15

Alternative 4								
Unit	Pre-harvest Burn	Logging System	Commercial Harvest		Noncommercial or Fuel Reduction Activities			Acres
825					PCT	UB		26.67
828					PCT	UB		47.24
829					PCT	UB		31.33
830					PCT	UB		102.58
831					PCT	UB		26.52
832					UB			54.91
833					UB			13.53
834		H	HTH		PCT	UB		20.73
835					PCT	UB		80.80
836		T	HTH		PCT	GP	UB	26.54
837					PCT	UB		79.55
838					UB			52.20
840					PCT	UB		74.45
841		H	HTH		PCT	UB		19.06
842					UB			53.14
843					UB			22.87
844					PCT	UB		436.98
845		H	HTH	YTA	JP	PCT	UB	22.01
846					JP	PCT	UB	24.65
847		H	HTH	YTA	JP	PCT	UB	13.36
848		T	HTH		PCT	GP	UB	16.40
850					PCT	UB		128.43
851		H/T	HIM	YTA	UB	PCT	UB	70.73
852					PCT			22.58
853					PCT			8.70
854					UB			22.09
855					PCT			13.89
857					PCT	UB		76.44
858		T	HTH		PCT	GP	UB	43.26
859		T	HTH		PCT	GP	UB	77.06
860					UB			106.80
861					UB			459.12
862					UB			36.53
863		T	HTH		UB			87.17
865		T	HTH		PCT	UB		11.37
866					UB			67.76
866					UB			19.16
867					UB			37.35
869		T	HTH		PCT	UB		30.41
870					PCT			36.22
871					UB			27.80
872					PCT			12.38

Alternative 4								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
873					PCT	HP	UB	48.25
874					PCT	HP	UB	152.54
875					PCT	HP		39.72
876					UB			62.72
878		T	HIM		PCT	GP	UB	20.66
879		T	HTH		PCT	UB		88.61
880					UB			30.63
882					PCT	HP		44.70
883					PCT	HP		23.09
884					UB			14.29
885					PCT	UB		10.07
886					UB			29.34
887		T	HIM		PCT	GP	UB	13.55
888		T	HIM		PCT	GP	UB	63.52
891		T	HIM		PCT	GP	UB	23.22
892		T	HIM		PCT	GP	UB	4.60
893					PCT	UB		26.36
894					UB			6.71
895					UB			30.53
896					PCT	UB		64.83
898					UB			136.38
899					PCT			22.46
900					UB			36.03
901					JP	UB		92.51
902					UB			37.70
903					UB			39.14
904					HWD			1.91
905					HWD			7.41
908					HWD			0.79
909					HWD			12.57
910					HWD			3.51
911					HWD			0.87
912					HWD			1.26
913					HWD			0.72
914					HWD			9.63
915					HWD			4.73
916					HWD			0.76
917					UB			8.48
918					UB			4.55
919					PCT	UB		19.11
920					UB			62.52
921					UB			97.95

Alternative 4								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
922					UB			199.63
923					UB			32.41
924					UB			88.71
925					UB			34.44
926					UB			14.31
928					UB			159.03
929					UB			6.26
930					UB			34.10
931					UB			9.63
934					UB			819.72
935					PCT			34.84
936					PCT			66.21
937					PCT			35.93
938					PCT			36.28
939					PCT			40.76
940					PCT			11.76
941					PCT			35.88
942					PCT			26.81
943					PCT			29.67
944					PCT			37.73
945					PCT			14.43
946					PCT			30.09
947					PCT			31.85
949					PCT			7.35
950					PCT			20.81
951					PCT			25.43
952					PCT			13.00
953					PCT			19.57
954					PCT			8.83
955					PCT			80.28
956					PCT			30.72
957					PCT			28.68
958					PCT			14.53
959					PCT			155.87
960					PCT			27.18
961					UB			39.60
964					PCT	UB		20.95
967					UB			0.78
968					PCT	UB		4.91
969					PCT	UB		16.99
970		H	HIM		PCT	UB		19.33
971		T	HIM		PCT	UB		22.29

Alternative 4								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
972					PCT	UB		31.46
973					UB			4.47
975					UB			6.82
976					PCT	UB		45.18
977					PCT	UB		48.48
980					UB			29.19
981					PCT	HP	UB	44.05
982					PCT	HP		41.18
983					PCT	HP		69.16
984					PCT	HP		56.29
985					UB			77.20

Alternative 5								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
100					PCT	UB		120.32
101		H	HTH		PCT	UB		40.36
104		T	HTH		PCT	UB		41.13
105		H	HTH	YTA	PCT	JP	UB	19.20
107		T	HTH		PCT	GP	UB	54.96
108		T	HTH		PCT	UB		238.81
109					UB	PCT	UB	153.86
110	UB	T	HTH		PCT	UB		26.92
111		T	HTH		PCT	GP	UB	48.33
112		T	HTH		PCT	UB		53.23
113					PCT	UB		57.04
114		H	HTH	YTA	PCT	UB		44.37
115					PCT	UB		47.64
117					UB	PCT	UB	16.34
118		T	HTH		PCT	UB		36.57
119					PCT	UB		24.95
120		T	HTH		PCT	GP	UB	157.30
124					UB	PCT	UB	90.92
125		T	HTH		PCT	GP	UB	56.21
126					PCT	UB		30.59
127		T	HTH		PCT	UB		45.73
129					JP	PCT	UB	31.54
134					PCT	UB		33.04
135					PCT	UB		31.14
136					UB			27.89
137					UB			44.05

Alternative 5								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
138		T	HTH		PCT	GP	UB	19.87
139		H/T	HTH		PCT	GP	UB	23.78
141					PCT	UB		36.89
142					PCT	UB		16.97
143					PCT	UB		79.62
144					PCT	UB		88.15
145					HWD			2.18
150					UB	PCT	UB	32.08
151					UB			11.43
155		H	HIM	YTA	PCT	UB		20.24
160					PCT	HP		113.95
161					UB			14.56
162					PCT	UB		27.14
163		T	HTH		PCT	GP	UB	83.07
166		T	HTH		PCT	GP	UB	30.91
172		T	HIM		PCT	GP	UB	49.49
173					PCT	GP	UB	20.11
174		T	HIM	YTA	PCT	UB		27.13
175					UB			54.37
176		T	HIM		PCT	GP	UB	19.42
177		H	HTH		PCT	UB		39.29
179		H	HTH		PCT	UB		22.20
181					PCT	JP	UB	28.90
184		H	HIM	YTA	PCT	UB		64.77
185		T	HIM		PCT	GP	UB	8.27
186		T	HIM		PCT	GP	UB	34.75
187					UB			9.73
188		H	HIM	YTA	PCT	UB		37.68
189		H	HIM		UB			71.61
190					PCT	UB		57.71
191		T	HIM		PCT	GP	UB	10.49
192					PCT	UB		36.65
193		T	HIM		PCT	GP	UB	35.86
196					PCT	UB		59.49
198		T	HIM		PCT	GP	UB	34.19
199		T	HIM	YTA	PCT	UB		76.75
200		T	HIM	YTA	PCT	UB		20.79
201		T	HIM	YTA	PCT	UB		20.05
202					PCT	UB		201.10
203					JP	PCT	UB	116.88
207					PCT	JP	UB	74.37
208					UB			106.99

Alternative 5								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
209					PCT	UB		137.29
210	UB	T	HTH		PCT	GP	UB	29.41
211					PCT	UB		172.23
212					PCT	UB		38.04
214					PCT	UB		49.63
300		T	HIM		PCT	GP	UB	48.79
301					PCT	JP		30.21
302		T	HTH		PCT	UB		27.97
303		T	HTH		PCT	UB		61.18
304		T	HTH		PCT	UB		43.23
306		T	HTH		PCT	GP	UB	19.60
310					PCT	JP	UB	37.30
311		T	HIM		PCT	GP	UB	43.50
312					UB			62.88
313					UB			44.56
314					UB			126.22
315					PCT	UB		53.99
316					PCT	UB		42.72
317		T	HIM		PCT	GP	UB	44.59
400		H	HTH	YTA	UB	PCT	UB	9.62
401					HWD			12.33
402					HWD			13.71
403					HWD			15.36
404					HWD			4.88
405					HWD			9.45
406					HWD			0.93
407					HWD			7.91
408					HWD			13.63
409					HWD			7.97
410					HWD			2.70
411					HWD			2.60
501					JP	UB		62.18
502					HWD			17.90
503					JP	UB		26.42
505					PCT	HP	UB	18.64
506					PCT	UB		17.52
507					HWD			3.84
508					PCT	UB		34.21
509		T	HIM		PCT	GP	UB	25.66
510					PCT	UB		241.74
511					UB			103.81
512					UB			30.23

Alternative 5								
Unit	Pre-harvest Burn	Logging System	Commercial Harvest		Noncommercial or Fuel Reduction Activities			Acres
513					UB			27.09
514					PCT	JP	UB	33.92
515		T	HIM		PCT	GP	UB	18.07
517		T	HIM		PCT	GP	UB	12.57
518					PCT	UB		6.63
519					PCT	UB		33.64
520					UB			47.10
521					PCT	UB		74.68
522					UB			20.48
524		T	HIM		PCT	GP	UB	27.99
525					HWD			4.55
530		T	HIM		PCT	UB		11.68
531		T	HTH		PCT	GP	UB	17.91
532		T	HIM		PCT	GP	UB	66.70
533					HWD			3.68
534					UB			25.24
535					UB			81.32
537					PCT	UB		22.03
538					UB			65.36
542					PCT	UB	HP	70.70
544					PCT	UB		6.25
550					PCT	GP	UB	50.78
551					PCT	UB		48.01
552					HWD			13.45
555					PCT	UB		26.54
559		T	HIM		PCT	GP/HP	UB	89.26
560					PCT	JP	UB	60.26
562					UB			88.79
563		T	HTH		PCT	GP	UB	17.92
564					PCT	JP		7.36
565		T	HTH		PCT	UB		48.31
566					PCT	UB		17.93
567					PCT	UB		79.54
568					PCT	UB		20.61
569		T	HTH		PCT	UB		4.00
570		T	HTH		PCT	GP	UB	25.61
571					PCT	UB		20.09
572					PCT	JP		60.33
577					HWD			1.37
700		T	HTH		PCT	UB		61.44
701		H	HTH		PCT	UB		49.48
703		H	HTH		PCT	UB		54.88

Alternative 5								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
704		T	HTH		PCT	UB		106.91
705		T	HIM		PCT	UB		39.57
707		T	HTH		PCT	UB		33.66
708					PCT	UB		106.55
711					PCT	UB		29.54
718					PCT	JP	UB	17.46
722					PCT	HP	UB	121.37
723					PCT	UB		47.61
727					UB			38.52
729					UB			75.00
734					PCT	HP	UB	54.70
737					HWD			10.98
738		T	HIM		PCT	GP	UB	13.54
739					PCT	UB		17.33
740		T	HTH		PCT	GP	UB	150.20
741					UB			53.53
742		T	HIM		PCT	GP	UB	49.57
743					PCT	HP	UB	39.72
744					PCT	HP	UB	39.73
745					HWD			2.89
747					UB			47.89
748		T	HIM		PCT	GP	UB	36.09
751		T	HIM		PCT	GP/HP	UB	109.86
752		T	HIM		PCT	GP/HP	UB	30.44
772					PCT	UB		44.88
776		T	HIM		PCT	GP	UB	52.84
800					PCT			32.14
801					PCT			50.31
803					UB			221.03
804					UB			65.08
805					UB			107.84
806					JP	PCT	UB	29.00
807					UB			111.64
808		H	HTH		PCT	UB		13.69
809		H	HTH		PCT	UB		30.12
810	UB	T	HTH		PCT	UB		13.86
811		T	HTH		PCT	GP	UB	63.49
812					UB			57.88
813					PCT	UB		80.66
818					PCT	UB		202.66
819					PCT	UB		25.05
820					UB			25.60

Alternative 5								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
821		T	HTH		PCT	UB		50.16
823					UB			79.27
824		T	HIM		PCT	GP	UB	21.15
825					PCT	UB		26.67
828					PCT	UB		47.24
829					PCT	UB		31.33
830					PCT	UB		102.58
831		T	HTH		PCT	UB		26.52
832					PCT	JP		54.91
833					PCT	JP		13.53
834		H	HTH		PCT	UB		20.73
835					PCT	UB		75.90
836					PCT	JP	UB	54.16
837					PCT	UB		56.82
838					UB			52.20
840					PCT	UB		19.82
841		H	HTH		PCT	UB		19.06
842					UB			53.14
843					UB			22.87
844					PCT	UB		436.98
845		H	HTH	YTA	PCT	UB		22.01
846		H	HTH	YTA	PCT	JP	UB	24.65
847		H	HTH	YTA	PCT	UB		13.36
848		T	HTH		PCT	GP	UB	16.40
850					PCT	UB		128.43
851		H/T	HIM		PCT	GP	UB	70.73
852					PCT			22.58
853					PCT			8.70
855					PCT			13.89
857					PCT	UB		80.07
858		T	HTH		PCT	GP	UB	62.13
859		T	HTH		PCT	GP	UB	77.06
860					UB			100.28
861					UB			200.29
862					UB			27.23
863		T	HTH		UB			60.85
866					UB			19.04
866					UB			53.12
867					UB			37.35
869					PCT	UB		40.20
870					PCT			36.22
871					UB			27.80

Alternative 5								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
872					PCT			12.38
873					PCT	HP	UB	48.25
874					PCT	HP	UB	152.54
875					PCT	HP		39.72
876					UB			62.72
878					PCT	UB		20.66
879		T	HTH		PCT	UB		88.61
880					PCT	HP		30.63
882					PCT	HP		44.70
883					PCT	HP		23.09
884					UB			14.29
885					PCT	UB		10.07
886					UB			29.34
887					PCT	GP	UB	19.39
888		T	HIM		PCT	GP	UB	63.52
891		T	HIM		PCT	GP	UB	23.22
892		T	HIM		PCT	GP	UB	4.60
893					PCT	UB		26.36
894					UB			6.71
895					UB			30.53
896					PCT	UB		26.61
898					UB			136.38
899					PCT			22.46
900					UB			36.03
901					JP	UB		87.87
902					UB			37.70
903					UB			39.14
904					HWD			1.91
905					HWD			7.41
908					HWD			0.79
909					HWD			12.57
910					HWD			3.51
911					HWD			0.87
912					HWD			1.26
913					HWD			0.72
914					HWD			9.63
915					HWD			4.73
916					HWD			0.76
917					UB			8.48
918					UB			4.55
919					PCT	UB		19.11
920					UB			44.45

Alternative 5								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
921					UB			97.95
922					UB			199.63
923					UB			32.41
924					UB			78.93
926					UB			14.31
928					UB			29.02
929					UB			6.26
930					UB			16.25
931					UB			9.63
934					UB			784.45
935					PCT			34.84
936					PCT			66.21
937					PCT			35.93
938					PCT			36.28
939					PCT			40.76
940					PCT			11.76
941					PCT			35.88
943					PCT			29.67
944					PCT			37.73
945					PCT			14.43
946					PCT			30.09
947					PCT			31.85
949					PCT			7.35
950					PCT			20.81
951					PCT			25.43
952					PCT			13.00
953					PCT			19.57
954					PCT			8.83
955					PCT			80.28
956					PCT			30.72
957					PCT			28.68
958					PCT			14.53
959					PCT			155.87
960					PCT			27.18
961					PCT	JP		39.60
964					PCT	UB		20.95
967					UB			0.78
968					PCT	UB		4.91
969					PCT	UB		25.35
970					PCT	UB		17.10
971					PCT	UB		22.29
972					PCT	UB		31.46

Alternative 5								
Unit	**Pre-harvest Burn**	**Logging System**	**Commercial Harvest**		**Noncommercial or Fuel Reduction Activities**			**Acres**
973					UB			4.47
975					UB			6.82
976					PCT	UB		45.18
977					PCT	UB		48.48
980					UB			29.19
981					PCT	HP	UB	44.05
982					PCT	HP		41.18
983					PCT	HP		69.16
984					UB			163.60
985					PCT			49.99
986		T	HIM		PCT	GP	UB	16.49
987					PCT	UB		20.15
988		T	HTH		PCT	GP	UB	17.40
989		T	HIM		PCT	GP	UB	26.31

APPENDIX B

Unit-by-Unit Soils Analysis

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
101	H	H	H	40	10-40	20-30	None	20-30	Helicopter system will not add to existing detrimental condition. No additional mitigation needed. Meets standard.
104	T	T	T	36	10-20	10-20	Low	10-20	Previously thinned, not machine piled. Use existing disturbance. Designate new skid trails. Meets standard.
105	S - GP	H - GP	H - YTA	21	30	10-20	Low	10-20	New roads needed to skyline, may be too benchy. Grapple pile on tractor ground. Use existing disturbance. Meets standard.
107	T - GP	T - GP	T - GP	65	30	10-20	Low	10-20	New road construction. Use existing disturbance. Till 4-5 acres. Meets standard.
108	T	T	T	239	10-30	30-40	None	30-40	New road construction. Stay on existing disturbance. No new landings or skid trails. Potential for winter logging. Meets standard.
110	T	T	T	27	0-25	20-30	None	20-30	Use existing disturbance, including road in the bottom. Potential for winter logging. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
111	T - GP	T - GP	T - GP	48	0-30+	20-30	Low	20-30	Existing soil damage on west side of unit is 20-30% and is 10-20% on east side. Stay on existing disturbance. Not net increase. Minimize disturbance on scab/stringer interface. Intermittent tillage 1-2 acres. Meets standard.
112	T	T	T	26	20	20-30	None	20-30	New road is okay. Stay on existing disturbance. Meets standard.
114	H - YTA	H - YTA	H - YTA	17	20-40	10-20	Low	10-20	Existing unclassified road. Keep disturbance below 20%. Meets standard. If needed, may till in bottom.
115	T	NCH	NCH	47	20	low end 10-20	None	10-20	New road construction. Designate skid trails with 70 to 100 foot spacing and line pull. Use existing disturbance. Keep disturbance below 20 percent. Meets standard.
117	S	H	NCH	16	10-40	10-20	Low	10-20	New road construction would still stay within standard. Meets standard.
118	T	T	T	37	10-20	20-30	None	20-30	New road construction. Stay on existing disturbance. Meets standard.
120	T - GP	T - GP	T - GP	157	10-20	low end 10-20	Low	10-20	New road construction. Till 5 acres in center. Some ripping potential. Stay on existing disturbance. Meets standard.
125	T - GP	T - GP	T - GP	56	10-30	20-30	Low	20-30	New road construction. Till 2-3 acres. No net increase. Meets standard.
126	T	T	NCH	31	20	20-30	Low	20-30	New road construction. Stay on existing disturbance. No net increase. Meets standard.
127	T	T	T	46	10-20	0-10	Moderate	0-10	New road construction. Designate skid trails on 70-foot spacing. Till 1-2 acres. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
129	T - GP	T - GP	NCH	32	20-40	20-30	None	20-30	Stay on existing disturbance. Do not log steep portions. Meets standard.
138	T - GP	T - GP	T - GP	20	20-40	20-30	None	20-30	Re-use existing disturbance. Meets standard.
139	T - GP	H/T - GP	H/T - GP	147	10-40	10-20	Low/ Moderate	10-20	New road construction. Existing disturbance is variable throughout unit. In the southeast portion, till skid trails 2-3 acres. Meets standard.
141	H	NCH	NCH	37	20-50	10-20	None	10-20	S/SE aspect unit. Helicopter system will meet standard.
142	T - GP	NCH	NCH	17	25	10-20	None	10-20	Reuse existing disturbance. Designate skid trails. Scarify and plant landing and temp road. Meets standard.
143	H	H	NCH	80	0-40	20-30	Low	20-30	Till 1 acre. Reuse existing disturbance. No net increase. Meets standard.
148	T	T	NCH	83	15-35	10-20	None	10-20	Stay below 20 percent ground disturbance. Designated skid trails with 120 to 150-foot spacing with line pulling. Potential for some shallow tillage. Potential for winter logging. Meets standard.
155	H - YTA	H - YTA	H - TYA	21	20-40	10-20	Low/ Moderate	10-20	Meets standard with helicopter system.
160	T - GP	T - GP	NCH	114	10-20	20-30	Moderate	20-30	New road construction. Reuse existing disturbance. Till 2-4 acres. Meets standard.
162	T	T	NCH	27	10-20	20-30	Moderate	20-30	Till 1-2 acres. Meets standard
163	T - GP	T - GP	T - GP	160	10-30	20-30	Moderate	20-30	Reuse existing disturbance. Till 3-4 acres. Meets standard.
166	T - GP	T - GP	T - GP	37	10-40	20-30	Moderate	20-30	Existing disturbance is near 20%. No net increase. Till 3-6 acres. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
172	H	T - GP	T - GP	43	30-40	0-10	None	0-10 if H 10-20 T	No grapple piling over 35%slope. Design activities to stay below 20 percent for tractor alternatives. Meets standard.
173	GP	GP	NCH	20	10-30	20-30	Low	20-30	Reuse existing disturbance. Till 1-2 acres. Meets standard.
174	T- YTA	T	T - YTA	33	10-40	0-10	Low	0-10	Reuse existing disturbance. Designate skid trails. Meets standard.
176	T - GP	T - GP	T - GP	19	20-40	20-30	Low	20-30	Stay on existing disturbance.. Till or scarify 1 acre. No net increase. Meets standard
177	H	H	H	39	20-40	10-20	Low	10-20	Meets standard with helicopter system.
179	H	H	H	22	30-50	0-10	None	0-10	Meets standard with helicopter system.
181	T - GP	T - GP	NCH	27	10-50	20-30	Low	20-30	Till 1-3 acres. Reuse existing disturbance. Do not grapple pile or till steep areas (>35% slope). On steep sections over 35% slope, no harvest or pull line. No net increase. Meets standard.
184	H - YTA	H - YTA	H - YTA	65	20-50	10-20	Low	10-20	Rehabilitate new road construction. No increase over 20%. Meets standard.
185	T - GP	NCH	T - GP	8	30-50	10-20	None	10-20	Scarify and plant temporary road. No increase over 20%. Meets standard.
186	T - GP	T - GP	T - GP	35	20-50	20-30	None	20-30	Reuse existing disturbance. No net increase. On steep sections over 35% slope, no harvest or pull line. Meets standard.
188	H - YTA	H - YTA	H - YTA	38	30-50	0-10	None	0-10	Meets standard with helicopter system.
189	H	H	H	72	30-50	0-10	None	0-10	Meets standard with helicopter system.
191	T - GP	T - GP	T - GP	11	10-50	0-10	None	5-15	On steep sections over 35% slope, no harvest or pull line. Do not grapple pile steep areas (>35% slope). Keep disturbance below 20%. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
193	T - GP	T - GP	T - GP	60	10-50	0-10	None	0-10	Contains portions of steep tractor and ground over 35%. On steep sections over 35% slope, no harvest or pull line. Do not grapple pile steep areas (>35% slope). Keep disturbance below 20%. Meets standard.
198	T - GP	T - GP	T - GP	34	10-30	10-20	Low	10-20	Till 1-2 acres. Keep disturbance below 20%. Meets standard.
199	T - YTA	T - YTA	T - YTA	77	10-30	0-10	High	5-15	Design skid trail system to remain under 20%. Reuse existing disturbance. Meets standard.
200	T - YTA	T - YTA	T - YTA	21	10-30	0-10	High	5-15	Design skid trail system to remain under 20%. Reuse existing disturbance. Meets standard.
201	T - YTA	T - YTA	T - YTA	21	30-50	0-10	None	0-10	Steep tractor. Stay below 20% disturbance. Avoid portions of unit over 35% slope with equipment. Line pull on steeper portions. Meets standard.
202	T	NCH	NCH	201	0-30	10-20	None	10-20	New road construction. Moderate compaction hazard because of rocky soils. Reuse existing disturbance. Designate skid trails. Line pull from skid trails. Meets standard.
203	T	NCH	NCH	117	0-30	10-20	None	10-20	New road construction. Moderate compaction hazard because of rocky soils. Reuse existing disturbance. Designate skid trails. Line pull from skid trails. Meets standard.
207	T	NCH	NCH	79	25	20-30	Low	20-30	New road construction. Moderate compaction hazard because of rocky soils. Reuse existing disturbance. Designate skid trails with spacing of 80 to 100 feet. Line pull from skid trails. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
210	T - GP	T - GP	T - GP	29	25	20-30	Low	20-30	Reuse existing disturbance. Light or shallow tilling on 2 acres. Meets standard.
212	T	NCH	NCH	38	15-50	20-30	Low	20-30	New road construction. Reuse existing disturbance. Designate skid trails. No net increase. Meets standard.
300	T - GP	T - GP	T - GP	49	0-20	20-30	High	20-30	85% of unit is tillable. Reuse existing disturbance. Till 2-4 acres on west side. Meets standard.
301	T - GP	T - GP	NCH	30	10-40	30-40	Low	30-40	Spot till 2-3 acres. Existing skid trails are well distributed. Reuse existing disturbance. Meets standard.
302	T	T	T	28	0-20	20-30	High	20-30	Reuse existing disturbance. Till 1-3 acres. Meets standard.
303	T	T	T	61	0-20	10-20	Low	10-20	Reuse existing disturbance. Close and rip 2610-153 road on south side of unit. Scarify landings closest to creek. Meets standard.
304	T	T	T	44	0-20	10-20	Moderate	10-20	Reuse existing disturbance. Pull line. Winter logging possible. Scarify landings closest to creek. Meets standard.
306	T - GP	T - GP	T - GP	20	30-40	0-10	Low	5-15	Stay on existing disturbance. Keep overall disturbance below 20%. Meets standard.
310	T - GP	NCH	NCH	50	10 - 35	20 - 30	Moderate	20-30	Reuse existing disturbance. Till 2-3 acres. Meets standard.
311	T - GP	T - GP	T - GP	46	10-40	30-40	Moderate	30-40	Good distribution of existing skid trails. Minor increase this entry. Till 2-4 acres. Avoid swales. Meets standard.
317	T - GP	T - GP	T - GP	38	10-35	20-30	Moderate	20-30	Reuse existing disturbance. Till 2 acres in north half. 150-foot buffer around sag pond. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
400	S	H	H - YTA	10	10 - 40	20-30	Low	20-30	Re-use existing disturbance. No net increase. Meets standard.
505	GP	NO GP	NO GP	19	2- 20	20-30	High	20-30	No commercial harvest. Stay on existing disturbance. No net increase. Meets standard.
509	T - GP	T - GP	T - GP	26	10-55	20-30	Low	20-30	Reuse existing disturbance. Till 2-3 acres. No net increase. Meets standard.
515	T - GP	T - GP	T - GP	18	15-25	40-50	Low/ Moderate	30-40	Till 2-3 acres. No net increase. Meets standard.
517	T - GP	T - GP	T - GP	13	10-30	20-30	Low	20-30	Reuse existing disturbance. No tilling. Potential for winter logging. Meets standard.
524	T - GP	NCH	T - GP	28	10-40	20-30	Moderate	20-30	New road construction. NW portion can be tilled. Till 2-3 acres. No net increase. Meets standard.
530	T	T	T	12	5-20	50-60	Low	50-60	Reuse existing disturbance. No net increase. Meets standard.
531	T - GP	T - GP	T - GP	18	10-40	40-50	Moderate	30-40	Reuse existing disturbance. May till 2-3 acres to reduce existing damage. Meets standard.
532	T - GP	T - GP	T - GP	66	15-35	30-40	Low/ Moderate	30-40	Till 3-5 acres. No net increase. Meets standard.
535	T	T	NCH	81	10-30	30-40	Low	30-40	New road construction. Reuse existing disturbance. No net increase. Meets standard.
542	T	NCH	NCH	71	10-50	20-30	Low	20-30	New road construction. Reuse existing disturbance. Meets standard.
546	T - GP	T - GP	NCH	31	10-40	10-20	Moderate	10-20	Reuse existing disturbance. Designated skid trails. No increase above 20%. Meets standard.
550	T - GP	T - GP	NCH	51	10-35	20-30	High	20-30	Reuse existing disturbance if not in swales. Till 2-3 acres. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
559	T - GP	T - GP	T - GP	103	10-40	20-30	Moderate	20-30	New road construction. Tillage potential is mostly in the lower 1/3 of the unit. Till 4-6 acres to offset road construction. Meets standard.
560	T - GP	T - GP	NCH	64	20-50	20-30	Low	20-30	Damage ranges from 10-20% on upper slopes to 30-40% on lower slopes. Tillage potential in bottom of unit towards Rush Creek. Till 1-3 acres. Meets standard.
563	T - GP	T - GP	T - GP	56	10-40	0-10	Low	0-10	Reuse existing disturbance. Till 1-2 acres. Meets standard.
564	T - YTA	T - YTA	NCH	6	20-30	0-10	Low	0-10	Stay on existing disturbance. No more than 10% increase. Meets standard.
565	T	T	T	49	0-30	20-30	Moderate	20-30	Good tillage opportunity for site restoration. Till approximately 5 acres. Meets standard.
569	T	T	T	4	0-15	20-30	High	20-30	No net increase. Till approximately 0.5 acre. Meets standard.
570	T - GP	T - GP	T - GP	26	10-30	20-30	Moderate	20-30	Reuse existing disturbance. Till 2-3 acres. No net increase. Meets standard.
572	T - GP	T - GP	NCH	60	10-50	10-20	Moderate	10-20	Reuse existing disturbance. Till 2-4 acres. Has some areas of steep ground. Meets standard.
700	T	T	T	46	10-30	20-30	Moderate	20-30	Reuse existing disturbance. No net increase. Till 4-6 acres. Meets standard
701	H	H	H	33	30-50	0-10	None	0-10	Helicopter system will meet standard.
703	H	H	H	58	30-60	0-10	None	0-10	Helicopter system will meet standard.
704	T	T	T	109	10-20	10-20	Low	10-20	New road construction. Most activity can stay on existing damage to minimize new disturbance. Till approximately 1 acre if desired for rehabilitation, not mandatory. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
705	T	T	T	40	10-20	0-10	Moderate	0-10	New road construction. Reuse existing trails and designate new skid trails to keep below 20% damage. Can till 2-3 acres if desired for rehabilitation, not mandatory. Meets standard.
707	T	T	T	62	10-25	20-30	Low	20-30	Reuse existing disturbance. No net increase. Till 1-2 acres. Meets standard
711	T	T	NCH	30	10-40	20-30	Low	20-30	Reuse existing skid trails and designate new skid trails. No net increase. Till 2-3 acres. Meets standard.
718	T - GP	T - GP	NCH	17	10-40	20-30	Moderate	20-30	Eastern portion of unit (bottom) has 20-30% damage. Western portion (top) has 10-20%. Average is approx. 20-24%. Reuse existing disturbance. Till 1-3 acres mostly in east. No net increase. Meets standard.
729	T	T	NCH	91	10-30	20-30	Low	20-30	Reuse existing disturbance. Till 3-5 acres. No net increase. Meets standard.
734	T	T	NCH	55	10-40	20-30	Moderate	20-30	Reuse existing disturbance. Till 3-4 acres on lower slopes. No net increase. Meets standard.
738	T - GP	T - GP	T - GP	56	10-50	20-30	Moderate	20-30	New road construction. Reuse existing disturbance, including landings. Till 2-4 acres. No net increase. Meets standard.
740	T - GP	T - GP	T - GP	150	10-40	20-30	Moderate	20-30	Reuse existing disturbance. Till 4-6 acres on lower slopes. No net increase. Meets standard.
742	T - GP	T - GP	T - GP	50	0-30	20-30	High	20-30	Reuse existing disturbance. Till 2-5 acres. No net increase. Meets standard.
748	T - GP	T - GP	T - GP	36	10-30	10-20	Moderate	10-20	New road construction. Good distribution of existing skid trails, can reuse most. Designate new skid trails to stay below 20%damage. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
751	T - GP	T - GP	T - GP	20	10-40	20-30	Moderate	20-30	Reuse existing disturbance. Till 1-3 acres. No net increase. Meets standard.
752	T - GP	T - GP	T - GP	30	5 - 20	20-30	Moderate	20-30	New road construction. Reuse existing skid trails. Designated new skid trails. Till 1-3 acres. No net increase. Meets standard.
776	T - GP	T - GP	T - GP	53	20-40	20-30	Low	20-30	Stay on existing skid trails or pull line. No net increase. Meets standard.
806	T - GP	H	NCH	29	10-35	20-30	None	20-30	New road construction. Stay on existing skid trails or pull line. No net increase. Meets standard.
808	H	H	H	14	10-50	10- 20	None	10-20	Helicopter system will meet standard.
809	H	H	H	32	20-50	10-20	None	10-20	Helicopter system will meet standard.
810	T	T	T	14	10-40	20-30	Low	20-30	Stay on existing skid trails or pull line. No net increase. Meets standard.
811	T - GP	T - GP	T - GP	63	10-30	20-30	Moderate	20-30	Stay on existing trails. Till 2-3 acres. Meets standard.
814	H	NCH	NCH	14	20-60	10-20	None	10-20	Helicopter system will meet standard.
815	T	NCH	NCH	43	10-40	20-30	Moderate	20-30	Stay on existing trails. Till 1-2 acres. Meets standard.
816	H	H	NCH	7	40-60	0-10	None	0-10	Helicopter system will meet standard.
817	H	H	NCH	5	20-50	0-10	None	0-10	Helicopter system will meet standard.
821	T	T	T	61	10-35	10-20	Low	10-20	New road construction. Reuse existing disturbance.. Till 2-3 acres. No net increase over 20%. Meets standard.
824	T - GP	T - GP	T - GP	12	10-40	20-30	Low	20-30	Reuse existing disturbance. Till 1 acre if needed. No net increase. May have to pull line. Meets standard.
825	T - GP	NCH	NCH	27	15-40	20-30	Moderate	20-30	Reuse existing disturbance. Till 1-2 acres. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
831	T	NCH	T	27	10-40	20-30	Moderate	20-30	Reuse existing disturbance. Till 1-2 acres. Meets standard.
834	H	H	H	21	20-50	10-20	None	10-20	Helicopter system will meet standard.
836	T - GP	T - GP	NCH	39	20-40	20-30	Low	20-30	Reuse existing disturbance. Till 2-3 acres. Meets standard.
841	H	H	H	19	10-40	20-30	Low	20-30	Helicopter system will meet standard.
845	S - YTA	H - YTA	H - YTA	22	20-45	10-20	Low	10-20	New road construction. Skyline and helicopter systems will meet standard.
846	T - GP	NCH	H - YTA	25	15-40	20-30	Moderate	20-30	New road construction. Stay on existing disturbance. Till 1-2 acres. Meets standard.
847	S - YTA	H - YTA	H - YTA	13	20-50	10-20	None	10-20	New road construction. Skyline and helicopter systems will meet standard.
848	T - GP	T - GP	T - GP	16	10-40	20-30	Moderate	20-30	Reuse existing disturbance. Till 1-2 acres. Meets standard.
851	H/T - GP	H/T - GP	H/T - GP	71	20-40	20-30	Low	20-30	Reuse existing disturbance. No net increase. Meets standard.
858	T - GP	T - GP	T - GP	89	10-40	20-30	Low	20-30	Reuse existing disturbance. Flatter areas on ridge have more skid trails than slopes. Till 3-4 acres. Meets standard.
859	T - GP	T - GP	T - GP	77	10-40	20-30	Moderate	20-30	Reuse existing disturbance. Till 4-5 acres. Meets standard.
863	T	T	T	96	10-40	20-30	Moderate	20-30	Reuse existing disturbance. Till 4-5 acres. Meets standard.
865	T	T	NCH	26	5-20	30-40	High	20-30	New road construction. Reuse existing disturbance. Till 3-5 acres. No net increase. Meets standard.
869	T	T	NCH	26	10-40	20-30	Low	20-30	Reuse existing disturbance. Till 1-2 acres. Meets standard.

Unit	Alt. 2 Logging System	Alt. 4 Logging System	Alt. 5 Logging System	Acres	% Slope	% Existing Soil Damage	Tillage Potential	% Post Activity Soil Damage	Unit-specific analysis
878	T - GP	T - GP	NCH	21	5-20	20-30	Moderate	20-30	Reuse existing disturbance. Till 1-2 acres. Meets standard.
879	T	T	T	88	10-20	20-30	Low	20-30	Reuse existing disturbance. Pull line. Meets standard.
887	T - GP	T - GP	NCH	14	10-35	20-30	Low	20-30	New road construction. Stay on existing disturbance. Pull line. Meets standard.
888	T - GP	T - GP	T - GP	64	10-40	20-30	Moderate	20-30	Reuse existing disturbance. Till 3-4 acres. Meets standard.
891	T - GP	T - GP	T - GP	23	5-20	20-30	Moderate	20-30	Reuse existing disturbance. Till 1-2 acres. Meets standard.
892	T - GP	T - GP	T - GP	5	20-40	20-30	Low	20-30	Reuse existing disturbance. No net increase. Meets standard.
970	H	H	NCH	19	20-50	0-10	None	0-10	Helicopter system will meet standard.
971	T	T	NCH	22	5-20	20-30	Low	20-30	Reuse existing disturbance. No net increase. Meets standard.
986	NCH	NCH	T - GP	17	5-30	20-30	Moderate	20-30	Reuse existing disturbance. Till 1-2 acres. No net increase. Meets standard.
988	NCH	NCH	T - GP	18	15-40	10-20	Moderate	10-20	Reuse existing disturbance. Till 1-2 acre. No net increase over 20%. Meets standard.
989	NCH	NCH	T - GP	26	10-30	20-30	Low	20-30	Reuse existing disturbance. Pull line if necessary. No net increase.

T = tractor (ground-based)
H = helicopter
S = skyline
H/T = tractor prebunch with helicopter yarding
GP = grapple piling
YTA = yard tops attached
NCH - no commercial harvest

APPENDIX C