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Forest Service

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Environmental Assessment

Knox Hazardous Fuels / Forest Health Project

Prairie City Ranger District, Malheur National Forest
Grant and Harney Counties, Oregon

For More Information Contact:

Erin Dailey – District Planner
Prairie City Ranger District
P.O. Box 337
327 SW Front Street
Prairie City, Oregon 97869
(541) 820-3857

Elaine Kohrman – Responsible Official
Prairie City Ranger District
P.O. Box 337
327 SW Front Street
Prairie City, Oregon 97869
(541) 820-3800

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Document Summary

The Prairie City Ranger District of the Malheur National Forest proposes the Knox Hazardous Fuels / Forest Health Project on National Forest System lands in Grant and Harney Counties, Oregon. The proposed project is located approximately 27 air miles southeast of Prairie City near Crane Prairie (see Figure 1 at the end of Chapter 1).

Under applicable laws and public policies, the proposal addresses the current forest health needs of the area, including reduction of both hazardous fuels and the risk of insects such as bark-beetle and spruce budworm. The project would involve approximately 7,230 acres of forest management treatments and integrated design elements. Proposed treatment and harvest operations would include: harvest activities (commercial thinning, precommercial thinning, biomass utilization), fuel treatment (prescribed burning, hand-piling, machine slash treatments, whole tree yarding), and aspen restoration (release with lop and scatter, commercial thin, or caging). Transportation system activities include use of temporary roads, road maintenance, road closures, and road decommissioning. Integrated project design elements provide for protection of cultural or historical sites, soil, water, fish, wildlife, range, native plants and trees, scenery, and recreation resources.

This Environmental Assessment (EA) provides details of the project, and describes its effects on the human environment. It was prepared according to policies and regulations implementing the National Environmental Policy Act (NEPA). Its purpose is to inform both the public and responsible Forest Service officials so that the following decisions can be made:

- Whether the Forest Service has met NEPA procedural requirements to study and disclose effects of the proposed action and any alternatives on the quality of the human environment;
- Whether any predicted effects are inconsistent with Forest Plan standards and guidelines or other applicable laws, regulations, and policies;
- Whether any predicted effects amount to a significant adverse impact on the quality of the human environment; and
- Whether to implement the action as proposed, to modify it, to develop another alternative, or do further environmental review.

Following a public review period on the environmental assessment, a decision will be made whether to proceed with the project. If the decision is to proceed, it is anticipated that project operations could begin in 2010.

Chapter 1: Need for the Proposal

Project Purpose and Need for Action

The Knox Hazardous Fuels / Forest Health Project (Knox Project) would take action on hazardous-fuel reduction and related needs in the Tamarack Creek Subwatershed. The Tamarack Creek Subwatershed (24,485 acres) includes 20,147 acres of National Forest System lands and 4,338 acres of private lands. The Knox Project area is the portion of the Tamarack Creek Subwatershed within the Prairie City Ranger District, excluding privately owned lands.

The project would implement direction of the Land and Resource Management Plan of the Malheur National Forest (Forest Plan; USDA Forest Service 1990), which represents the preferred alternative of the Final Environmental Impact Statement, approved May 1990, and which provides direction for management of the Malheur National Forest and general discussions of the associated environmental impacts. The project would also implement direction provided by amendments to the Forest Plan that are currently in effect, and requirements of other applicable laws and public policies. Under this direction, the project would serve the following purposes:

1. Reduce the risk of uncharacteristically intense fire behavior by reducing surface fuels, duff and litter, lowering the risk of damage to the soil; reducing crown fuels, lowering the risk of excessive mortality in old forest and future old forest from wildfires; and returning stands to a condition consistent with the natural fire return interval.
2. Reduce conifer encroachment of aspen stands within Riparian Habitat Conservation Areas (RHCAs), and non-anadromous riparian areas (Management Area 3A), therefore reducing competition with riparian aspen.
3. Reduce stand densities and species competition to reduce the risk of bark beetles and other insects that cause mortality by decreasing the susceptibility of forest stands to bark beetle outbreaks; and to lower the risk of spruce budworm by reducing encroachment of fir species.
4. Capture the economic value of trees that are surplus to other resource needs such as for scenic value and to provide raw materials and jobs to aid in community stability.
5. Reduce the road density within the subwatershed to increase big game security by reducing the accessibility of the area, and to reduce road impacts to riparian areas.

The needs for the proposed action are derived from the differences between current conditions and desired conditions. Desired conditions are based on Forest Plan direction and management objectives. The proposed action is designed to move resource conditions closer to the desired conditions and address the management direction provided by the Forest Plan.

Specific "NEED" statements have been developed for each of the five purposes stated above. Each statement briefly compares the existing condition and desired conditions to show why the project is being proposed. Within each "Need" statement a link between the desired condition and management direction in the Malheur Forest Plan is provided.

Fuels Hazard Reduction Need

The historic high frequency/low severity fire regime has changed in the warm and hot-dry upland forest biophysical environments**.** This fire regime controlled regeneration of fire intolerant

species, maintained more open stand structures, maintained lower surface fuel loadings, and maintained low level impacts from insects and disease.

Both the tree density and the proportion of fire intolerant fir species have increased in the Knox project area from historical conditions. Due to a lack of periodic fire and increases in insect and disease mortality, surface and ladder fuels have increased and are more continuous across the High surface fuel loadings increases the potential flame length of a fire thereby increasing the chance of a surface fire moving into the crowns and increasing the mortality in old forest stands.

There is a need to reduce excess levels of fuels and promote fire tolerant species lowering the risk of damage to the soil; reducing crown fuels, lowering the risk of excessive mortality in old forest and future old forest from wildfires; and returning stands to a condition consistent with the natural fire return interval.

The desired condition would be multi-strata and single-stratum structural stage with ladder fuels in dry upland forest types to occur in smaller proportion where several fire cycles have been missed. Fire tolerant ponderosa pine, western larch, and to a lesser extent, Douglas-fir are the dominant conifer species in the dry upland forest with large trees well represented. Surface fuel loadings are reduced and not continuous and this part of the project area is maintained by low intensity, frequent fire. These conditions reduce the probability of a crown fire, lowering the risk of excessive mortality in old forest structures, that is not characteristic of the project area; improve conditions for successful fire suppression when needed, improve the ability of forest stands to survive wildfire and limit soil damage.

Aspen Protection Need

Aspen in the project area is in a declining condition from historical distribution and is not comprised of the historical range of age classes due to reduction in fires, conifer shading and competition, and grazing by both domestic and wild animals. There is a lack of younger aged aspen with most existing stands composed of declining older aspen trees. The desired condition is a landscape containing healthy stands that are characteristic of historic conditions in both overall representation and distribution. The Forest Plan includes direction to maintain or enhance quaking aspen stands using clear-cutting and prescribed fire as the principal means of regeneration where appropriate. Protect root sprouts where needed and practical. (Forest Plan, Standard #57, pg IV – 31).

Forest Composition and Density Reduction Need

A large portion of project area contains Warm Dry and Hot Dry upland forest biophysical environments. The existing condition of these forest types is a result of factors such as past timber harvest, insect activity, and fire exclusion that has changed the composition from a forest dominated by ponderosa pine to denser mixed species stands with higher components of fir species. Changes in composition and structure have increased the risk of greater fire severity and insect damage. Increases in intolerant fir species makes the area more susceptible to spruce budworm defoliation, while overstocking makes stands more susceptible to bark beetle attacks.

In the past, ecosystem interactions included a natural disturbance regime that included frequent low intensity fire that supported a more resilient forest condition. These historic stands were more resistant to fire damage, insects, and disease and supported resistant tree species such as ponderosa pine, growing in a more open condition.

The desired condition includes large trees that are well represented across the landscape in Hot Dry, Warm Dry, and upland forest biophysical environments. Fire tolerant ponderosa pine, western larch, and, to a lesser extent, Douglas-fir are the dominant conifer species in areas with flatter terrain and hot-dry growing conditions that represent approximately two-thirds of the analysis area. Within project area, where they historically occurred, stands with be open and park-like, maintained by low intensity, frequent fire. In timber stands with average tree size and density levels considered high-risk for bark-beetle activity that would kill trees and add to current fuel problems, reduce the density to a lower risk level within the range of densities recommended for productive management of the tree species present. The Forest Plan gives direction to minimized losses due to insects and diseases by maintaining stand vigor through the use of stocking level control and species composition (Forest Plan, Standard # 98, pg IV – 37).

Timber Production Need

Timber harvest plays an important role in the local economy by providing employment and revenues. There is a need to make wood products available for local, regional, and national use to provide jobs in the most cost-effective manner, while being sensitive to resource conditions such as the level of soil disturbance.

The Forest Plan includes direction to provide a sustainable flow of timber and associated wood products at a level that will contribute to economic stability and provide an economic return to the public. Wood material in the form of sawlogs and fiber will be utilized in a cost-effective manner, consistent with the various resource objectives environmental standards (Forest Plan goals pgs 24 –26, IV – 2).

Road Reduction Need

There is the need to reduce the road density for the benefit of wildlife security and reduce road related riparian impacts.

Open road densities within the Tamarack Creek Subwatershed exceed the Forest Plan 1999 desired condition and standards for big game summer range and winter range. For big game summer range the Forest Plan Standard is 3.2 miles per square mile, the current road density is 3.94 miles per square mile. For big game winter range the Forest Plan Standard is 2.2 miles per square mile, the current road density is 4.13 miles per square mile. (Forest Plan, Standard # 33, pg IV – 29, and MA-4A Standard #24, pg IV – 72).

The existing road system, the road density, and route location adjacent to streams poses a sediment risk to threatened fish species. There are slightly over 10.9 miles of roads that likely impact streams due to proximity (100 feet or less).

The desired condition for project area roads would be to provide safe and adequate access for forest users while protecting aquatic resources. Most roads that are impacting streams by reducing shade or causing sediment, or are not needed for future management activities would be closed or decommissioned. The Forest Plan gives direction to minimize the density of open roads in riparian areas by obliterating, revegetating, or closing unnecessary roads or any roads causing significant resource damage (Forest Plan, Standard # 41, pg IV – 67). The Forest Plan was amended in 1995 by direction of the Regional Forester with the Interim Strategy for Managing Non-Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (INFISH). Standards in INFISH also state that roads not

needed for future management activities should be closed, obliterated, or stabilized (INFISH, Standard RF-3c).

Legal Authorization and Policy Framework

Overview

The Land and Resource Management Plan of the Malheur National Forest (Forest Plan, USDA 1990) represents the preferred alternative of the Final Environmental Impact Statement – Malheur National Forest, approved May 1990, and provides direction for management of the Forest and general discussions of associated environmental impacts. This EA tiers to the Malheur National Forest Land and Resource Management Plan Final Environmental Impact Statement and Record of Decision (1990) and incorporates by reference the accompanying Land and Resource Management Plan (LRMP, also called the Forest Plan) (1990), as amended. Amendments include, but are not limited to, the Regional Forester's Eastside Forest Plan Amendment 2 (USDA 1995a), the Inland Native Fish Strategy (INFISH, USDA 1995b), and The Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plan Program (2005). Forest Plan amendments are those analyses documented in the R6 2005 Invasive Plant FEIS and ROD; and environmental assessments for INFISH and Eastside Screens. The Forest Plan provides the basic direction and standards for management of the Malheur National Forest. It was developed under authority of the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA), and regulations implementing NFMA. In keeping with the Forest Plan, this project is framed to be consistent with all other laws or policies governing national forest management generally and Forest Service operations on lands administered by the Malheur National Forest in particular. These other laws (as amended) or policies include the Air Quality and Clean Air Act of 1977, Oregon State Smoke Management Plan, the Clean Water Act of 1972, the Endangered Species Act of 1973, and the National Historic Preservation Act of 1966, among others.

Environmental review of the proposal, including this assessment, is being conducted as required by the National Environmental Policy Act of 1969 (NEPA). This includes compliance with NEPA-implementing regulations of the Council on Environmental Quality (CEQ) at 40 CFR Part 1500 and application of the following guidance: CEQ's Guidance on the Consideration of Past Actions in Cumulative Effects Analysis, June 24, 2005; and 36 CFR 220.6 (former Forest Service Handbook 1909.15 — Environmental Policy and Procedures Handbook).

Regional Forester's Sensitive Species List (Update): On January 31, 2008, Regional Forester Linda Goodman released an updated Sensitive Species List which includes federally listed, federally proposed and sensitive species lists. In the cover letter for the updated species list (Regional Forester Linda Goodman, January 31, 2008) the Regional Forester states that projects initiated prior to the date of this letter may use the updated sensitive species list or the list that was in effect when the project was initiated. The Responsible Official (District Ranger) for the project has authority to decide which list to use. "Initiated" means that a signed and dated document such as a project initiation letter, scoping letter, or Federal Register Notice for the project exists. The Knox Project meets the criteria for "initiated" because the Project Initiation Letter (PIL) was signed on February 14, 2007. Consequently, the 2004 Regional Forester's Sensitive Species list in effect at that time was used for field reconnaissance and all Biological Evaluations.

Desired Conditions

The following sections outline desired conditions as directed by public policy and as further developed through project-level planning for reduction of fuel hazards and bark-beetle risk. Further details concerning desired conditions for particular forest resources are compiled, displayed, and discussed in specialist reports underlying and supporting this EA. These reports are located in the Knox Project record at the Prairie City Ranger District Office (see contact information on inside cover page).

Direction from the Forest Plan

The Forest Plan indicates desired conditions through goals for management areas (MAs). A management area is a designation to which geographic parts of the forest are assigned; it describes the forest uses and benefits to be emphasized at these locations, in combination with other compatible uses or benefits. The project area comprises parts of five MAs; Goals for these management areas have been amended since the Record of Decision was signed in 1990. Primary goals and desired forest conditions for each of these MAs are as follows (in order of abundance):

- **MA-1 — General Forest and MA-2 — Rangeland (10,021 acres):** The primary goal is sustained-yield timber production involving a distribution of forest age-classes, each growing in a healthy condition, and to provide forage for livestock grazing.
- **MA-4A — Big Game Winter Range (7,749 acres):** The primary goal is to maintain usable forage for elk and deer.
- **MA-13 — Dedicated Old Growth and Replacement Old Growth (798 acres):** The primary goal is for wildlife and plant habitat, ecosystem diversity, and aesthetic quality.
- **MA-3A/RHCA — Non-Anadromous Riparian Areas (789 acres):**
    - **MA-3A/RHCAs — Non-Anadromous Riparian Areas (469 acres):** The primary goal is protection or enhancement of water quality, fish habitat, and wildlife habitat near water, including conservation of both the land and water features and the naturally occurring tree and plant cover that contributes to these qualities.

      INFISH introduced Riparian Habitat Conservation Areas (RHCAs) as interim management direction that overlays and supersedes the Forest Plan direction for managing non-anadromous riparian areas. RHCAs are portions of watersheds where riparian dependent resources receive primary emphasis, and management activities areas subject to specific standards and guidelines. RHCAs include established riparian corridors, wetlands, intermittent streams, and perennial streams that help maintain the integrity of aquatic ecosystems.
    - **Upland (RHCAs) (320 acres):** The primary goal is to enhance and protect microclimates such as seeps, springs, wet meadows, and hardwood habitats.

Direction from Regional Forester's Eastside Forest Plan Amendment 2

Adding to basic direction from the 1990 Forest Plan is the 1995 Regional Forester's Eastside Forest Plan Amendment 2: Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales. This policy expands and more clearly defines the protection areas bordering streams or other water bodies; it also introduces desired conditions for

wildlife habitat, including stands formed or structured with the characteristics of late and old stages of forest succession. Additionally, special forest cover areas for wildlife between late and old structure areas, called connection corridors, are required.

How much, and where, these wildlife-related conditions should occur is determined by reviewing the "historic range of variability" (HRV) for the area. This is an assessment of the physical growing sites represented, and the patterns of forest vegetation that historically occurred there. It includes consideration of site differences (warm and dry, cool and moist, etc.) and associated disturbance factors such as fire, insects, and diseases that affect the establishment and natural development of forest stands. With the HRV assessment in hand, the current assortment of conditions can be compared to their historic range of variability, or occurrence. Projects can then be planned to either maintain current condition patterns — if they are within the desired historic ranges — or change them to imitate historic patterns by increasing or decreasing various conditions through timber harvest, burning, or other treatments.

Proposed Action Overview

The proposed action is an alternative developed early in the NEPA planning process to accomplish stated purposes, needs, and goals based on the best information available at the time. It is the first alternative offered and is used to identify issues and develop other alternatives for further study. Alternative 2 described below and in Chapter 2 outline the activities included in the proposed action that was mailed to interested parties during public scoping in May of 2007. The proposed action (Alternative 2) was modified after public scoping by removing the thinning treatment in the six acres of satisfactory cover, thus eliminating the need for a Forest Plan amendment. It was also modified by removing treatment of aspen within RHCAs to address significant issue #2 and to allow biomass utilization on commercial and precommercial thinning areas.

The Prairie City Ranger District proposes to treat approximately 7,236 of the 20,147 acre project area. The modified proposed action (Alternative 2) includes the following activities:

Harvest Activities

- Commercial Thinning – 1,734 acres
- Precommercial Thinning – 1,128 acres
- Biomass Utilization – 1,102 acres

Fuel Treatments

- Prescribed Burning – 6,557 acres
- Hand Pile – 90 acres
- Machine Slash Treatment – 1,038 acres
- Whole Tree Yarding – 1,787

Aspen Restoration

- Aspen Release with Lop and Scatter – 95 acres
- Aspen Release with Commercial Removal – 55 acres in uplands
- Aspen Caging – 3 acres

Transportation System

- Temporary Roads – 1.5 miles
- Road Maintenance – 63 miles
- Road Closures – 26.3 miles
- Road Decommissioning – 11.7 miles

Chapter 2 contains a complete description of the proposed action, including specific project design elements and monitoring requirements that are proposed to implement this project. This proposal was developed by Forest Service personnel. All figures are approximate. Note that there may be minor variations throughout this document due to rounding and differences in methodology used to generate maps and tables.

Issues

Scoping[1] is used to identify issues that relate to the effects of the proposed action. An issue is an un-resolved conflict or public concern over a potential effect on a physical, biological, social, or economic resource as a result of implementing the proposed action and alternatives to it. An issue is not an activity; instead, the projected effects of the proposed activity create the issue. Issues are generated by the public, other agencies, organizations, and Forest Service resource specialists and are in response to the proposed action. Issues provide focus for the analysis of environmental effects and may influence alternative development, including development of mitigation measures. In this document, issues are tracked and are used to display differing effects of the proposed action and the alternatives.

The issues were separated into several groups for the purpose of this analysis: significant issues, analysis issues and issues eliminated from detailed study. The Council for Environmental Quality (CEQ) NEPA regulations give guidance (40 CFR Sec. 1501.7) to "…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 are defined as those directly or indirectly caused by implementing the proposed action; however, the effects cannot be reduced by normal Best Management Practices (BMPs) or Project Design Elements (PDEs) and an alternative was developed to address the issue.
- Analysis issues are defined as those directly or indirectly caused by implementing the proposed action; however, the effects could be reduced with normal BMPs and PDEs, and an alternative was usually not developed to address these analysis issues. However, these analysis issues will be tracked in the relevant resource area effects analysis in Chapter 3 and in the Comparison of Alternatives in Chapter 2. Most of the issues for the Knox Project fall into this category.

[1] Scoping is defined as the procedure by which a Federal Agency identifies important issues and determines the extent of analysis necessary for an informed decision on a proposed action. Scoping is an integral part of environmental analysis. Scoping includes refining the proposed action, determining the responsible official and lead and cooperating agencies, identifying preliminary issues, and identifying interested and affected persons. The results of scoping are used to identify public involvement methods, refine issues, select an interdisciplinary team, establish analysis criteria, and explore possible alternatives and their probable environmental effects.

- Issues eliminated from detailed study are 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 (CEQ) NEPA regulations require identification and elimination from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3).

The interdisciplinary team identified and carried through the analysis the significant issues and the analysis issues in order to fully develop and allow further comparison of the proposed action and alternatives. The environmental consequences of the proposal are disclosed in Chapter 3 for each resource affected by these issues. Each issue has indicators to allow members of the public and the Responsible Official (District Ranger) to determine how well issues are addressed by the alternatives (See Comparison of Alternatives Table in Chapter 2 for effects of the alternatives on issues). A complete issue identification summary is in the project record files. A discussion of all issue groups and its indicators is given below.

Significant Issues

Table 1 on the following page lists the significant issues considered for this analysis generated from public comments and/or the project interdisciplinary team.

Table 1. List of Significant Issues.

Issue Topic	Cause and Effect
1. Thinning in Stands with a High Fir Component	Some stands are densely stocked and also contain higher than historic proportions of fir trees as a result of past management actions. The fuel loads need to be reduced to lower fire hazards and risks and to return stands to a historical species composition and structure where fire-tolerant species are predominant. ▪ Alternative 3 was developed to address this issue. A group selection prescription would be implemented in areas that historically did not contain a heavy fir component. Indicator: 1. Percent fir component retained in treated stands 2. Acres treated with Group Selection Harvest 3. Percent change in areas with high to extreme crown fire potential (in 20 years)
2. Water Quality/ RHCAs	Thinning activities have the potential to remove trees within Riparian Habitat Conservation Areas (RHCAs) that provide shade to streams and maintain stream temperature. Trees in riparian areas should be retained to reduce effects on water quality, RHCAs, headwaters and tributaries. ▪ Treatments within RHCAs have been removed from Alternative 2: Proposed Action to address this issue. Some RHCA treatments are included in Alternative 3 with proposed project design elements to address water quality concerns. Indicator: 1. Acres treated in riparian areas

Issue Topic	Cause and Effect
3. Treatment Priorities and Low Economic Value	Some areas proposed for commercial thinning have lower stand densities and/or average stand diameters. These areas are lower priority for treatment and have low economic value. Unemployment levels are high in the surrounding communities. Economically viable timber sales are important to local communities. ▪ Alternative 3 was developed to address this issue. Alternative 3 excludes commercial harvest in lower priority treatment areas. Some of these areas would be precommercially thinned only. ▪ These impacts are discussed in Chapter 3, in the Economics effects section. Indicators: 1. Present net sale value 2. Jobs from commercial or non-commercial project activities 3. Volume of economically viable timber harvest (cubic feet)

Analysis Issues

Table 2. List of Analysis Issues.

Issue Topic	Cause and Effect
4. Snag and Down Wood Retention	Harvesting and prescribed fire have the potential to reduce snags and down wood within the project area which may affect trees with important characteristics for wildlife (hollow boles, forked or broken tops). ▪ All existing snags would be retained, with acknowledgment that some may be felled during harvesting and burning activities for safety reasons. Underburning would likely create some snags in all diameter classes. Indicator: 1. Snags per acre in 10 years (Greater than 21" dbh)
5. Old Growth / Mature Trees	Thinning activities have the potential to remove trees that exhibit old growth characteristics or provide important value to wildlife. Trees that exhibit old growth characteristics regardless of species or size should be retained as fundamental components of the areas forest ecosystem. ▪ Project design elements were developed to address this issue. Some trees with these characteristics would be retained, but not all. A balance between leaving a healthy stand and wildlife habitat components is needed to meet project objectives. Trees with older form, and thicker bark appearance would be retained, with the exception of trees near private lands or trees with an abundance of mistletoe. Indicator: 1. Acres OFMS converted to OFSS (Warm Dry/Hot Dry PAG) 2. Percent OFSS Warm Dry/Hot Dry in 50 years 3. Percent OFMS Warm Dry/Hot Dry in 50 years
6. Soils	Ground-based logging could have adverse impacts on soil. Detrimental soil disturbance from thinning activities could increase soil compaction, decrease site productivity, accelerate erosion, and increase sediment delivery to streams. ▪ Project design elements were developed to address this issue and reduce impacts to the soils resource. Indicators: 1. Percent of area with detrimental soils impact (Standard not to exceed 20%)

Issue Topic	Cause and Effect
7. Invasive Species (Noxious Weeds)	Noxious weeds and other invasive species may be introduced into the project area as a result of ground-disturbing activities. ▪ Project design elements were developed to address this issue and to reduce the risk of invasive species being introduced in the project area. Indicator: 1. Estimated acres of ground disturbing activities (includes commercial thinning, group selection, and biomass removal inside precommercial thinning units). 2. Risk of spread
8. Road Density	Open road densities exceed Forest Plan standards and have resulted in spatially fragmented wildlife habitat. Motorized vehicle use on and off roads may impact big game security areas particularly during hunting seasons. Re-opening closed (level 1) system roads for timber harvest activities may impact wildlife from temporary increases in open-road density, and may also channelize water, cause erosion, and provide an avenue for the spread of invasive weeds. ▪ Project design elements were developed to address this issue. Any roads closed prior to harvest activities would be closed post activities. Project design elements are proposed to reduce the risk of invasive species being introduced into the project area. Indicator: 1. Open road density big game summer range 2. Open road density big game winter range
9. Nesting Birds and Raptors	Harvesting and burning activities may impact active nesting habitats for raptors and their fledglings. Seasonal restrictions on thinning should be employed, prohibiting thinning and hauling during nesting and fledging periods for avian species. Avoid spring burning unless before reproduction season ▪ Project design elements were developed to minimize disturbance during bonding, nesting and fledgling periods and to protect nesting habitat of raptors. Indicator: 1. Wildlife impact determination for nesting birds 2. Wildlife impact determination for nesting goshawks and other raptors
10. Wildlife Cover	The loss of cover for wildlife with extensive understory removal and thinning is a potential concern. The project area is used by deer and elk as a transition zone from summer to winter ranges and for fawning and calving habitat. Reducing stocking densities may have detrimental effects to wildlife by reducing hiding cover for adults and fawns, or calves, increased susceptibility to predation, loss of thermal-cover, and increased susceptibility to harassment by people. The harassment of elk on the forest may cause an increase in movement of elk to adjacent private lands and increase agricultural damage complaints. Treatments should be patchy and leave behind more structure, utilizing strategically placed land area treatments. Use variable density thinning techniques to establish a variety of microhabitats and break up fuel continuity. ▪ Project design elements were developed to strategically place treatments across the landscape with patchy, variable thinning densities and structural stages to maintain diversity for wildlife hiding cover. Indicator: 1. Big Game Cover Analysis (summer range) Satisfactory and Marginal cover 2. Big Game Cover Analysis (winter range) Satisfactory and Marginal cover

Issues Eliminated from Detailed Study

Table 3. List of Issues Eliminated from Detailed Study.

Issue Topic	Reason for Determination as a Non-Issue
11. Proximity to Roadless Areas	Road building in National Forests and other public lands threaten the existence of roadless areas. ▪ Management activities are not proposed in lands that meet potential wilderness inventory criteria or roadless area criteria found in Forest Service Handbook (FSH) 1909.12 Chapter 70- Wilderness Evaluation (71.1 – Inventory Criteria).
12. Removal of Trees Greater Than 16 Inches	Cutting bigger (greater than 16",) fire resistant trees will increase fuels. Logging conifer stands could make fire hazards worse by moving hazardous fuels to the ground, opening the canopy (making the stand hotter and drier) and expose and impair the soil. ▪ Retaining all trees greater than 16" dbh would not meet the fuel and vegetation purpose and need.
13. Grazing on the Forest	Reduce the impacts of livestock grazing to allow establishment of ecological processes that will allow streams to recover. ▪ Changes in livestock grazing will not be considered in this analysis, since it is outside the scope of this analysis however, the effects of grazing will be considered in the cumulative effects analysis. Some adjustment in grazing may be necessary after prescribed burning to ensure adequate vegetation recovery. The Malheur Post Fire Grazing guidelines would be followed to determine when to resume grazing on areas treated with prescribed fire. These guidelines determine the minimum time-frames that an area would be rested from grazing following prescribed fire.

Project Record Availability

This EA hereby incorporates by reference the project record. The project record contains Specialist Reports and other technical documentation used to support the analysis and conclusions in this EA. These Specialist Reports are for Forest Fire Hazards, Fuels and Air Quality; Forest Vegetation; Terrestrial Wildlife; Soils Resources; Hydrology; Fisheries Resources; Engineering; Range Resources and Noxious Weeds; Recreation Resources and Visuals / Scenery; Botany Resources; Heritage Resources; and Economics / Social Resources. Relying on Specialist Reports and the Knox Project record helps implement the CEQ Regulations' provision that agencies should reduce NEPA paperwork (40 CFR 1500.4). The objective is to furnish enough site-specific information to demonstrate a reasoned consideration of the environmental impacts of the proposed action, without repeating detailed analysis and background information available elsewhere. The project record is available for review at Prairie City Ranger District in Prairie City, Grant County, Oregon.

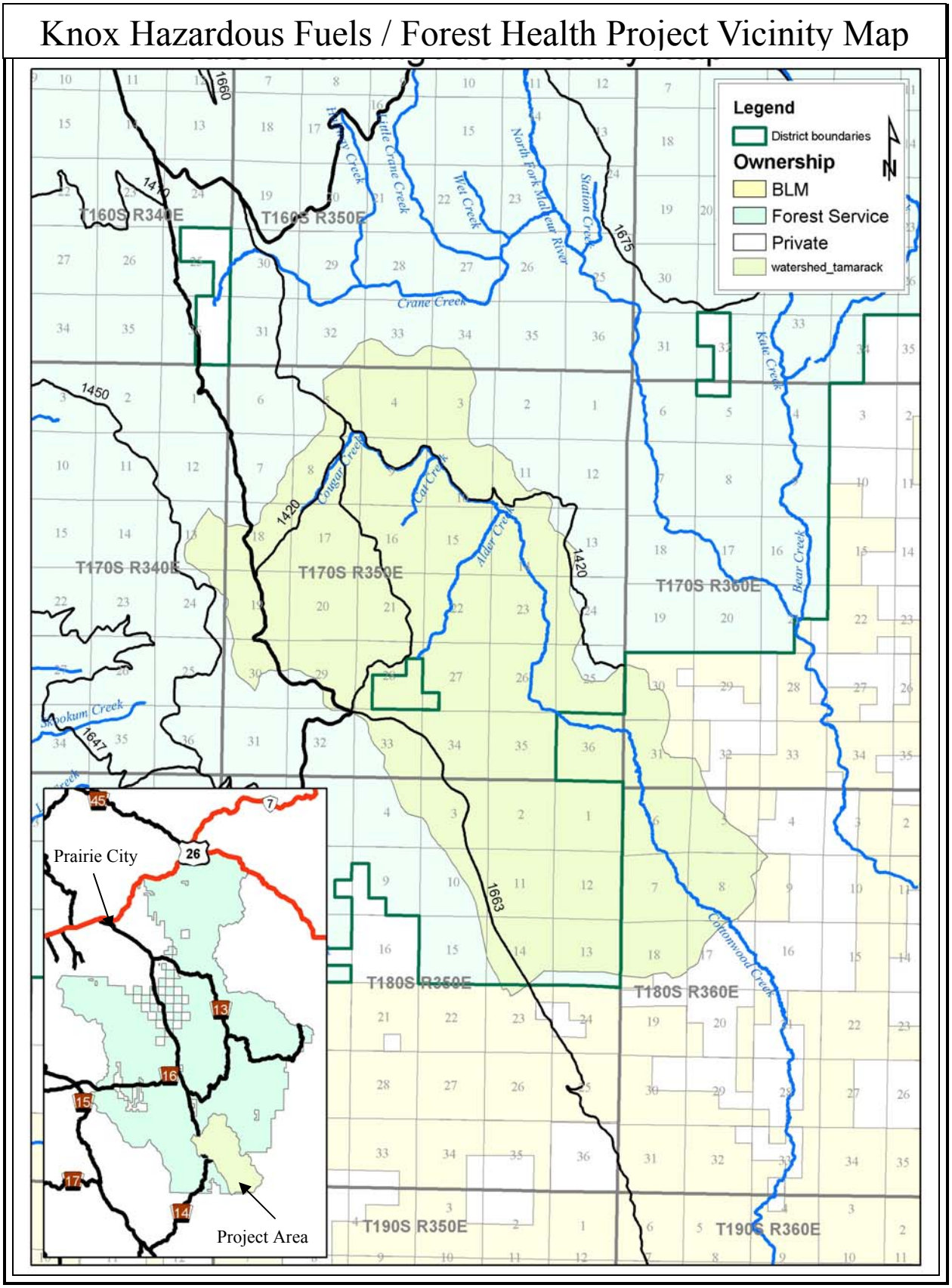


Figure 1. Vicinity Map of the Knox Hazardous Fuels / Forest Health Project.

Chapter 2: Proposed Action and Alternatives

Alternative Development Process

This chapter of the EA describes in detail the no-action and two action alternatives to manage land and resources in the Knox Project Area to meet the purpose and need as stated in Chapter 1. These alternatives were developed from public scoping comments, direction given by the Responsible Official, and by incorporating Forest Plan direction and amendments, existing State and Federal laws, and Forest Service direction.

Each action alternative analyzed in detail discloses environmental effects associated with its implementation thereby facilitating a comparison of alternatives. This comparison of effects along with projected environmental consequences is detailed in Chapter 3 and provides the Responsible Official with information needed to make an informed choice between alternatives.

Alternatives Considered but Eliminated from Detailed Study

Through the National Environmental Policy Act (NEPA) interdisciplinary process and public scoping, several alternatives may be investigated before settling upon those to be pursued through full analysis. Alternatives may be found to be beyond the scope of the project, impractical, or may require amendments that the Responsible Official does not want to pursue with the action. The following are descriptions of alternatives considered but eliminated from detailed study and the rationale for why they were not analyzed.

Restrict Commercial Harvest to Trees less than 16" dbh

The interdisciplinary team considered restricting cutting limits to trees less than 16" diameter breast height (dbh) to protect trees with dominant, old growth, or mature characteristics. Although removal of trees greater than 16" dbh would not be necessary in all proposed treatment areas, it would be necessary in some areas to meet the stated purpose and need to reduce existing fuel components that increase the risk of intense fire, remove encroaching conifers that are preventing aspen stand regeneration, reduce stand densities to reduce the risk of bark beetles, and capture the economic value of the trees.

The interdisciplinary team recognized that cutting smaller diameter trees and underburning alone could reduce surface and lower-canopy fuel hazards in the project area; yet to reduce upper-canopy density and crown-fire potential to the desired level some commercial cutting must be added to these treatments. There are many studies that support using a combination of thinning, surface fuel treatment, and the use of prescribed fire to reduce fuels. Studies show that thinning reduces ladder fuels and decreases the tree crown density thereby reducing fire severity.

Require Winter Logging

The interdisciplinary team considered restricting ground skidding to frozen soil or snow covered conditions to lessen soil impacts. This alternative was eliminated from detailed study because winter logging would require plowing haul roads that are snowmobile routes and this activity would conflict with snowmobile use. The cost of snowplowing would also be prohibitive, especially with the small average stand diameters proposed for removal and the several miles of haul roads that would need to be continually plowed. Project design elements for potential soil

impacts from ground skidding equipment would maintain total soil disturbance within Forest Plan thresholds.

No New Roads or Temporary Roads Are Proposed

The interdisciplinary team considered restricting the use of temporary roads since the Tamarack Creek Subwatershed is over the Forest Plan standards for big game winter and summer range road density. The alternative was eliminated from detail study since the project proposes no new permanent roads and less than 2 miles of temporary roads which would be decommissioned upon project completion. Temporary roads would be located outside of RHCAs and project design elements would apply to ensure that activities meet best management practices for controlling run-off and erosion. The objective of decommissioning is to restore the hydrologic function and ensure that the roadbed is no longer drivable. Decommissioning may include subsoiling and seeding as necessary.

No Spring Burning Is Proposed

The interdisciplinary team considered restricting prescribed burning operations to only fall burning to protect raptors and potential nesting areas. The Forest Service acknowledges that there may be some potential impacts from spring burning to nesting avian species. These impacts are disclosed in the analysis. The alternative was eliminated from detailed study since fuels are often too dry in the fall to meet project objectives or to burn safety. A combination of spring and fall underburning is proposed depending on the season that would best meet project objectives. Design elements were developed to address protection of active raptor nest sites.

Utilize Only Low Intensity Fire and Precommercial Thinning

The interdisciplinary team considered restricting treatment activities to only include low-intensity fire and precommercial thinning to minimize impacts on soil. Specifically, this alternative would not conduct commercial thinning, but would propose prescribed fire and pre-commercial thinning activities. The alternative was eliminated from detailed study since it would not meet the purpose and need of reducing fire risk and capturing economic value of trees surplus to other resource needs. Without commercial thinning, crown fuels and ladder fuels would not be reduced to the level desired to reduce hazardous fuels from the area.

Alternatives Considered in Detail

The alternatives were developed based on varying responses to the significant issues discussed in Chapter 1. The actions and project design elements developed in each alternative respond to meeting the purpose and need and also relate to the issues and public concerns. Three alternatives were considered, fully developed, and analyzed. They are summarized here and described in further detail below:

- Alternative 1 – No Action
- Alternative 2 – Proposed Action – The proposed action was modified by removing six acres of commercial thinning in satisfactory cover, thus eliminating the need for a Forest Plan amendment. Satisfactory cover is limited in the project area and is providing valuable wildlife habitat. Biomass utilization is included in commercial and precommercial thinning areas. To address significant issue #2 (Water Quality / RHCAs) aspen

treatments within RHCAs were deleted in this alternative. Aspen treatments in upland areas remain in the Proposed Action (Alternative 2).

- Alternative 3 – Alternative to the proposed action – In this alternative the prescription was changed from commercial thinning to group selection on approximately 507 acres to address significant issue #1 (Stands with High Fir Component). Group selection would occur in stands that have a high proportion of grand fir to move the areas towards a more historical species composition. Proposed aspen treatments in RHCAs identified in original proposed action during scoping were retained in this alternative to provide for commercial removal opportunities. To address significant issue #2 (Water Quality / RHCAs) project design elements were added to protect riparian areas during harvest, which includes limiting skidding equipment (including OHVs) to designated roads in RHCAs.

  Approximately 586 acres of commercial thinning in low priority/low value units were deleted to improve the economic viability of this alternative. An additional 102 acres were changed from commercial thinning to precommercial thinning. These changes were made to address issue #3 (Treatment Priorities and Low Economic Value). Actions proposed in Alternative 2 for road closures, road decommissioning, and underburning are the same in this alternative.

Specific project design elements and monitoring requirements for the alternatives are listed at the end of this chapter. A listing of each unit with activity treatments can be found in Appendix A and maps for the project are located in Appendix B.

Alternative 1 – No Action

The No Action Alternative means the proposed project (which includes all activities identified in the proposed action) would not take place at this time. This alternative indicates changes that would occur in the human environment if the project did not take place. The effects of "no action" establish a point of reference for the analysis, against which the proposed action can be measured and compared for its environmental impacts—whether beneficial, benign, or adverse.

This alternative proposes no timber harvesting, precommercial thinning, or fuels reduction treatments in the project area at this time. It does not preclude activities in other areas at this time or from the project area at some time in the future.

Ongoing management practices and activities such as fire suppression, firewood cutting, recreation activities, maintenance of forest roads would continue in the project area.

Alternative 2 – Proposed Action

Alternative Formulation

This alternative was designed to meet the purpose and need for action. The development rationale is included in Chapter 1. The following are Alternative 2 activity descriptions.

Proposed Activities

The Prairie City Ranger District proposes to treat approximately 7,236 of the 20,147 acre project area.

Harvest Activities

- Commercial Thinning – 1,734 acres

Commercial thinning prescriptions would be completed using ground based harvest systems. The commercial thinning prescription promotes ecologically appropriate compositional and structural conditions in order to increase resiliency and promote development of structural and wildlife habitat conditions, currently lacking across the subwatershed. It also reduces fuel loads which decreases the risk for a large crown fire. Commercial thinning would harvest merchantable trees in immature forest stands by thinning from below to reduce stocking levels to enhance tree growth and to allow for the reintroduction of fire. This treatment would thin small/medium size trees (9 to 20.9" dbh [diameter at breast height]) at variable spacing. An additional objective in mixed species stands would be to retain primarily fire tolerant species, such as ponderosa pine and western larch. Other species would be retained as minor stand components to contribute to species diversity. This is designed to reduce the competition among trees for sunlight, water, and nutrients resulting in more vigorous, healthier forest stands, and to reduce ladder fuels.

- Precommercial Thinning – 1,128 acres

Following commercial thinning, 498 acres in areas with remaining high densities would be thinned by further removal of small diameter trees (generally less than 9" dbh) to achieve desired stand conditions. This small diameter material would be available for biomass removal and would be removed concurrently with commercial sized material. Felling of this material would be either by mechanical harvester or chainsaw. 631 acres of the total precommercial thinning would not have any commercial thinning beforehand. The precommercial thinning prescription would be recommended where the small trees to be cut are not merchantable saw-log sized material.

- Biomass Utilization – 1,102 acres

Small diameter material would be available for biomass removal. Woody biomass includes the trees, limbs, tops, needles, and other woody parts, grown in a forest, woodland, or rangeland environment, that are the by-products of forest management. Felling of this biomass material may be either by mechanical harvester or chainsaw. The material would be forwarded to a landing by low ground pressure equipment. The objective is to reduce ladder fuels by reducing the amount of live or dead fuels, and reduce stand densities to improve tree growth and vigor.

Fuel Treatments

- Prescribed Burning – 6,557 acres

Prescribed burning (underburning) would occur on approximately 6,557 acres within the 20,147 acre project area. Within the 6,557 acres, not all acres would be burned and there are different objectives for areas with resource concerns (i.e. aspen release, reduction of fuel loads). Burning would be accomplished in the spring and fall seasons when weather and moisture conditions are appropriate and after much of the mechanical work is completed. Multiple prescribed burning entries may be needed to reduce the ladder and surface fuels to reach the desired fuel composition, which has increased beyond historical conditions, and allow for future management of natural ignitions.

Within the 6,557 acre burn boundary, approximately 80% is within the warm-dry plant association group and approximately 9% is within the hot-dry plant association group. All of which is fire regime 1, historically with low intensity, frequent fire. With this proposal,

approximately 1,689 acres would be commercially and/or precommercially thinned prior to burning.

The objectives of using prescribed fire are to reduce surface fuels, reduce litter and duff depth, and increase canopy base height. Prescribed fire is not being used to change the structural stage of any the stands. Some tree mortality is expected and acceptable in forested stands. Acceptable mortality ranges are as follows:

- Trees 0 to 1 inch dbh, tree mortality is expected to range from 30 to 70%.
- Trees 1 to 5 inch dbh, tree mortality is expected to range from 5 to 15%.
- Trees 5 to 10 inch dbh, tree mortality is expected to range from 5 to 10%.
- Trees 10 to 20 inches and larger dbh, tree mortality is expected to range from 1 to 5%.

Within the 6,557 acres of underburning, lighting would not occur, but fire would be allowed to back into approximately 500 acres of non-forested stands such as grass or scablands. The non-forested acres typically have minimal fuel loads which are discontinuous and therefore rarely burn.

Ignition for underburning would occur within some site specific segments of RHCAs to reduce fuels and to stimulate hardwood development. In other areas fire would be allowed to back into RHCAs. Past district experience has shown that when fire is allowed into RHCAs the effects are dependent on the existing vegetation. As soon as vegetative species and moisture regimes within the RHCA change and become more shaded with more moisture and higher humidity, the fire would not burn, so riparian vegetation is rarely affected. Shrubs and conifers providing stream-side shade and riparian vegetation are rarely affected since they do not burn with enough intensity to cause mortality.

- Hand Pile – 90 acres

Slash generated from precommercial thinning would be hand piled in units on slopes greater than 35%. Piles would be generally 6 foot by 6 foot and placed away from the remaining trees. The hand piles would be burned when the ground is very wet to minimize fire spread from the pile location.

- Machine Slash Treatment – 1,038 acres

Slash generated from precommercial thinning would be mechanically treated by a low ground pressure machine on slopes less than 35%. This treatment would only occur in areas were slash loading is above levels considered safe for future underburning. The piles would be generally 6 foot by 20 foot and placed away from the remaining trees. The piles would be burned when the ground is very wet to minimize fire spread to the pile location.

- Whole Tree Yarding – 1,787 acres

Commercial sized cut trees would be skidded to the landing with their limbs and tops attached. At the landing, the limbs and tops would be removed and placed in a pile for future utilization or burning.

Aspen Restoration

- Aspen Release with Lop and Scatter – 95 acres

Conifers encroaching on aspen stands would be thinned and left on site. Slash generated from aspen release treatments is expected to be fairly light and would be lopped and scattered.

- Aspen Release with Commercial Removal – 55 acres in Uplands, 0 acres in RHCAs

Some upland aspen stands would be commercially thinned and trees or other woody biomass would be removed (whole tree yarding or mechanically treated) after other resource needs have been met (i.e. down wood needs). Commercial removal would occur under the project design elements and whole trees would be yarded to a landing or to a road surface. In aspen stands outside of RHCAs, logging and skidding would occur over dry or frozen soils on designated trails. Commercial removal would not occur in RHCAs in this alternative.

- Aspen Caging – 3 acres

The proposed action would protect 3 acres of at-risk aspen stands by exclosures or cages, and other stands would be monitored for browsing to determine the need for additional protection. Exclosures may consist of a variety of fencing types including: four wire, buck and pole, and wire big game fences.

Transportation System

- Temporary Roads – 1.5 miles

No new permanent roads would be constructed however, approximately 1.5 miles of temporary roads may be needed to support timber harvest, and this includes temporary roads built from adjacent subwatersheds to reach harvest units. All temporary roads would be decommissioned after use. Decommissioning would eliminate future use of the road with the objective of restoring hydrological function. This would include subsoiling and seeding as necessary.

- Road Maintenance – 63 miles

With this alternative there would be an opportunity to perform road maintenance on up to 63 miles of forest roads commensurate with any commercial uses associated with project activities. Roads used within the sale area would receive road maintenance at a level commensurate with use. Road maintenance includes several activities that potentially result in sedimentation from the road prism to the ditch line, or the adjacent slope. Typical road maintenance activities could include: blade and shape road including existing drainage dips, grade sags, and waterbars, repair damaged culverts, place rock in some existing drainage dips and grade sags, place rock in wet areas of road, brushing, remove hazard trees, and dust abatement.

- Road Closures – 26.3 miles / Decommissioning – 11.7 miles

To improve big game security and to protect other resources (such as fish, cultural heritage, and private property) approximately 26.3 miles of roads would be closed and 11.7 miles of road would be decommissioned within the subwatershed. Approximately 1.5 miles of the decommissioned roads would be in RHCAs.

Alternative 3 – Alternative to the Proposed Action

Alternative Formulation

Following public review of the proposal, the interdisciplinary team added Alternative 3. The alternative to the proposed action was based on both additional internal review and consideration of relevant external comments. Alternative 3 was added to ensure that the project would serve the stated purpose and forest-management needs in a manner consistent with applicable standards, or to avoid or reduce potential adverse effects to certain environmental values.

Proposed Activities

The Prairie City Ranger District proposes to treat approximately 7,668 of the 20,147 acre project area.

Harvest Activities

- Commercial Thinning – 513 acres

Commercial thinning prescriptions would be completed using ground based harvest systems. The commercial thinning prescription promotes ecologically appropriate compositional and structural conditions in order to increase resiliency and promote development of structural and wildlife habitat conditions, currently lacking across the subwatershed. It also reduces fuel loads which decreases the risk for a large crown fire. Commercial thinning would harvest merchantable trees in immature forest stands by thinning from below to reduce stocking levels to enhance tree growth and to allow for the reintroduction of fire. This treatment would thin small/medium size trees (9 to 20.9" dbh [diameter at breast height]) at variable spacing. An additional objective in mixed species stands would be to retain primarily fire tolerant species, such as ponderosa pine and western larch. Other species would be retained as minor stand components to contribute to species diversity. This is designed to reduce the competition among trees for sunlight, water, and nutrients resulting in more vigorous, healthier forest stands, and to reduce ladder fuels.

- Group Select – 507 acres

Group selection would occur in stands that have a high proportion of grand fir, but still have a mix of species including ponderosa pine, western larch, and Douglas-fir. The objective of this treatment is to move stands towards a more historical species composition, where fire-tolerant species were predominant. A portion of each of the stands would be thinned with a commercial thinning prescription emphasizing removal of the grand fir and retention of all other species. There are areas within these stands that are entirely or almost entirely grand fir. This prescription allows for removing the grand fir from these areas, creating openings throughout the stand with a focus on providing sufficient light to stimulate development of understory vegetation and regeneration of shade-intolerant species. Openings would not exceed 2 acres.

- Precommercial Thinning – 1,269 acres

Following commercial thinning and group selection treatments, 504 acres in areas with remaining high densities would be thinned by further removal of small diameter trees (generally less than 9 inch dbh) to achieve desired stand conditions. 766 acres of precommercial thinning would not have any commercial thinning beforehand. The precommercial thinning prescription would be recommended where the small trees to be cut are not merchantable saw-log sized material.

- Biomass Utilization – 1,102 acres

Small diameter material would be available for biomass removal. Woody biomass includes the trees, limbs, tops, needles, and other woody parts, grown in a forest, woodland, or rangeland environment, that are the by-products of forest management. Felling of this biomass material may be either by mechanical harvester or chainsaw. The material would be forwarded to a landing by low ground pressure equipment. The objective would be to reduce ladder fuels by reducing the amount of live or dead fuels, and reduce stand densities to improve tree growth and vigor.

Fuel Treatments

- Prescribed Burning – 6,557 acres

Prescribed burning (underburning) would occur within an approximate 6,557 acre area of the 24,485 acre subwatershed. Within the 6,557 acres, not all acres would be burned and there are different objectives for areas with resource concerns (i.e. aspen release, reduction of fuel loads). Burning would be accomplished in the spring and fall seasons when weather and moisture conditions are appropriate and after much of the mechanical work is completed. Multiple prescribed burning entries may be needed to reduce the ladder and surface fuels to reach the desired fuel composition, which has increased beyond historical conditions, and allow for future management of natural ignitions.

Within the 6,557 acre burn boundary, approximately 80% is within the warm-dry plant association group and approximately 9% is within the hot-dry plant association group. All of which is fire regime 1, historically with low intensity, frequent fire. With this proposal, approximately 1,178 acres would have a mechanical treatment prior to burning.

The objectives of using prescribed fire are to reduce surface fuels, reduce litter depth, and increase canopy base height. Prescribed fire is not being used to change the structural stage of any the stands. Some tree mortality is expected and acceptable in forested stands. Acceptable mortality ranges are as follows:

- Trees 0 to 1 inch dbh, tree mortality is expected to range from 30 to 70%.
- Trees 1 to 5 inch dbh, tree mortality is expected to range from 5 to 15%.
- Trees 5 to 10 inch dbh, tree mortality is expected to range from 5 to 10%.
- Trees 10 to 20 inches and larger dbh, tree mortality is expected to range from 1 to 5%.

Within the 6,557 acres of underburning, lighting would not occur, but fire would be allowed to back into approximately 500 acres of non-forested stands such as grass or scablands. The non-forested acres typically have minimal fuel loads which are discontinuous and therefore rarely burn.

Ignition for underburning would occur within some site specific segments of RHCAs to reduce fuels and to stimulate hardwood development. In other areas fire would be allowed to back into RHCAs. Past district experience has shown that when fire is allowed into RHCAs the effects are dependent on the existing vegetation. As soon as vegetative species and moisture regimes within the RHCA change and become more shaded with more moisture and higher humidity, the fire would not burn, so riparian vegetation is rarely affected. Shrubs and conifers providing stream-side shade and riparian vegetation are rarely affected since they do not burn with enough intensity to cause mortality.

- Hand Pile – 117 acres

Slash generated from precommercial thinning would be hand piled in units on slopes greater than 35%. Piles would be generally 6 foot by 6 foot and placed away from the remaining trees. The hand piles would be burned when the ground is very wet to minimize fire spread to the pile location.

- Machine Slash Treatment – 1,153 acres

Slash generated from precommercial thinning would be mechanically treated by a low ground pressure machine on slopes less than 35%. This treatment would only occur in areas were slash

loading is above levels considered safe for future underburning. The piles would be generally 6 foot by 20 foot and placed away from the remaining trees. The piles would be burned when the ground is very wet to minimize fire spread from the pile location.

- Whole Tree Yarding – 1,037 acres

Commercial sized cut trees would be skidded to the landing with their limbs and tops attached. At the landing, the limbs and tops would be removed and placed in a pile for future utilization or burning.

Aspen Restoration

- Aspen Release with Lop and Scatter - 60 acres

Conifers encroaching on aspen stands would be thinned and left on site. Slash generated from aspen release treatments is expected to be fairly light and would be lopped and scattered.

- Aspen Release with Commercial Removal – 55 acres in Uplands, 35 acres in RHCAs

Some upland aspen stands would be commercially thinned and trees or other woody biomass would be removed (whole tree yarding or mechanically treated) after other resource needs have been met (i.e. down wood needs). Commercial removal would occur under the project design elements and whole trees would be yarded to a landing a road surface. Commercial removal is proposed in RHCAs where feasible to reach from existing designated roads. Skidding equipment (including OHVs) would not be allowed off designated roads in RHCAs. Removal may be achieved by methods that allow for one-end suspension of the logs. In aspen stands outside of RHCAs, logging and skidding would occur over dry or frozen soils on designated trails.

- Aspen Caging – 3 acres

The proposed action would protect at-risk aspen stands by exclosures or cages, and other stands would be monitored for browsing to determine the need for additional protection. Exclosures may consist of a variety of fencing types including: four wire, buck and pole, and wire big game fences.

Transportation System

- Temporary Roads – 1.1 miles

No new permanent roads would be constructed however, approximately 1.1 miles of temporary roads may be needed to support timber harvest, and this includes temporary roads built from adjacent subwatersheds to reach harvest units. All temporary roads would be decommissioned after use. Decommissioning would eliminate future use of the road with the objective of restoring hydrological function. This would include subsoiling and seeding as necessary.

- Road Maintenance – 48 miles

With this alternative there would be an opportunity to perform road maintenance on up to 48 miles of forest roads commensurate with any commercial uses associated with project activities. Roads used within the sale area would receive road maintenance at a level commensurate with use. Road maintenance includes several activities that potentially result in sedimentation from the road prism to the ditch line, or the adjacent slope. Typical road maintenance activities could include: blade and shape road including existing drainage dips, grade sags, and waterbars, repair damaged culverts, place rock in some existing drainage dips and grade sags, place rock in wet areas of road, brushing, remove hazard trees, and dust abatement.

- Road Closures – 26.3 miles / Decommissioning – 11.7 miles

To improve big game security and to protect other resources (such as fish, cultural heritage, and private property) approximately 26.3 miles of roads would be closed and 11.7 miles of road would be decommissioned within the subwatershed. Approximately 1.5 miles of roads in RHCAs would be decommissioned.

Integrated Design Elements and Monitoring Requirements

Impacts on components of the human environment were analyzed with consideration of design features or conservation measures that are built into the proposed action to ensure consistency with applicable standards. In the same way, the analysis considered any special monitoring requirements that have been prescribed to avoid, reduce, or control potential adverse effects the proposed action.

Table 7. Integrated Design Elements, Conservation Measures, and Monitoring Requirements.

Design Elements	Alternative	Objective	Responsible Person
Watershed			
RHCAs for Category 1, 2, and 4 streams and for Category 3 and 4 wetlands shall be consistent with INFISH. (50-300')	2 and 3	Protect fish bearing, perennial, and intermittent streams w/ INFISH buffers.	Fisheries Biologist, Hydrologist
Ephemeral draws will have site specific, no-cut buffers (10-50' on each side), unless vegetation management prescription is for the benefit of the aquatic ecosystem, such as aspen release.	2 and 3	Protect ephemeral draws.	Sale Administrator, Timber Layout Forester, Fisheries Biologist, Hydrologist
Equipment will be permitted in ephemeral draw buffers only at designated crossings. If skidding across draw bottoms that show signs of water flow, skid only when the soil in the draw is dry or frozen, and place slash or other ground cover on the skidtrail after use with approval of aquatic specialist.	2 and 3	Protect ephemeral draws and reduce erosion- sediment transport.	Sale Administrator, Aquatic Specialist
In RHCAs commercial harvest in aspen stands is allowed but only for removal of trees that can be reached from existing designated roads. Skidding equipment (including OHVs) will not be allowed off designated roads in RHCAs. Removal may be achieved by methods that allow for one-end suspension of the logs. In aspen stands outside of RHCAs, logging and skidding would occur over dry or frozen soils on designated trails	3	Protect RHCAs.	Fisheries Biologist, Hydrologist,
Activities associated with removal, replacement, improvement or addition of culverts in RHCAs and ephemeral draws will be completed during dry conditions or after consultation with fish biologist and hydrologist or their designate. Cease all work if storm events occur and increase stream flows. During installation, efforts are taken to prevent the escapement of soil into streams.	2 and 3	Reduce sediment; protect perennial and fish-bearing streams.	Fisheries Biologist, Hydrologist, Engineering Representative
Use erosion control measures (i.e., sediment filters, straw bales) to protect streams from construction sediment, where needed.	2 and 3	Reduce sediment transport to streams.	Sale Administrator, Maintenance

Design Elements	Alternative	Objective	Responsible Person
			Engineering Representative
Danger trees felled adjacent to or directly contributing to stream function will not be removed.	2 and 3	Maintain stream function.	Sale Administ-rator, Hydrolo-gist, Fish Bio
Cross drains and other drainage structures should be spaced appropriately for the terrain. For roadwork, operate machinery only on road prism.	2 and 3	Reduce erosion and sedimentation.	Sale Administrator, Engineering Representative
Temporary roads will be located outside of sediment delivery zones (as determined by soil type, ground vegetation, and slope), will meet Best Management Practices for controlling surface run-off and erosion, and will be hydrologically closed. Machinery used to build temporary roads shall remain within approved roadway.	2 and 3	Reduce erosion/sediment ation potential.	Sale Administrator, Engineering Representative
Decommission/obliterate temporary roads by some combination of the following: recontouring slopes; subsoiling compacted soils to a depth of 16" (unless prevented by bedrock or rock content of soil); pulling berm; pulling slash (where available); planting or seeding disturbed areas to achieve a minimum of 35% ground cover; restoring natural drainage patterns (may include pulling waterbars) and waterbarring as needed; and /or disguising the first hundred yards of travel way with large pieces or organic material such as cull logs and tops of trees. Methods for individual roads will be determined in consultation with the District Hydrologist, Fisheries Biologist, or Soil Scientist.	2 and 3	Reestablishment of natural drainage. Decompaction of travel way. Restoration of ground cover. Preventing access to decommissioned roads. Prevent/ reduce potential fo erosion and sedimentation.	Sale Administrator, Hydrologist, Fisheries Biologist, Soil Scientist, Silviculturist.
The Forest Service will require a Hazardous Substances Plan and a Prevention of Oil Spill Plan from contractor to be reviewed and approved prior to implementation of activities including prescribed fire.	2 and 3	Prevent petroleum products or other deleterious materials from entering streams	Sale Administrator, Project Engineer, Burn Boss, COR
Treat fuels in RHCAs and ephemeral draw buffers by hand. Avoid placing hand piles in RHCAs except when fuels treatments (e.g. precommercial thinning) are implemented in RHCAs. Hand piles in RHCAs shall be located at least 50 feet away from live and intermittent stream channels and not in riparian vegetation. Distribute ignition of closely spaced piles (less than 75 ft. apart) in RHCAs over a minimum of 2 yrs; an alternative schedule of ignition may be implemented after consulting with soil scientist, hydrologist, or fish bio.	2 and 3	Reduce erosion/ sedimentation transport.	Sale Administrator, COR
Avoid commercial or precommercial thinning within 30 ft of the intermittent stream channels or within 60 ft of the live stream channels, unless such thinning benefits the aquatic ecosystem. On a case-by-case basis with close involvement of fisheries biologist and/or hydrologist these areas may be entered. Do not directionally fall trees into the no cut zone.	2 and 3	To maintain stream bank stability during high water events.	COR, Fisheries Biologist, Hydrologist
Fisheries			

Design Elements	Alternative	Objective	Responsible Person
Need pump containment kit and to screen water pump intakes with appropriate size mesh (3/32") to prevent entrapping fish	2 and 3	To prevent fuel & oil spills & avoid entrapping fish in pumps.	Engineering Representative
Keep refueling and fuel storage at least 150 feet away from live streams.	2 and 3	To prevent fuel and oil spills.	Engineering Representative
Avoid fire lines within RHCAs. This will ensure that there is a vegetated area where sediment and water can settle prior to entering a live or intermittent stream channel. Properly rehab hand fire lines i.e., waterbar, scatter woody debris, etc.	2 and 3	Control amount of sediment entering streams.	Burn Boss, Fish Biologist
Minimize consumption of more than 4" dbh course wood near stream channels.	2 and 3	Protect/maintain stream channels during high water or floods.	Burn Boss, Fish Biologist
Wildlife			
To conserve habitat for primary cavity excavators, which are management-indicator species of the Malheur National Forest, proposed treatments would manage dead tree (snag) habitat to provide 100% of the potential populations of primary excavator species throughout stand rotation as per Forest Plan Standards. Since conditions are generally below Forest Plan standards all "Commercial harvest and precommercial thinning activities would retain existing snags greater than or equal to 12" dbh except where they create a safety hazard. Standing dead trees, which present a safety hazard, would be felled and left in place."	2 and 3	To provide habitat to the diverse primary cavity excavators species.	District Wildlife Biologist
To conserve habitat of the goshawk, a featured species of the Malheur National Forest known to use habitats of mature and old forest structure, no treatments involving timber harvesting or other cutting are proposed in suitable nesting habitat around existing goshawk nests. Specifically, 30 or more acres of the most suitable nesting habitat surrounding each active and historical nest tree are deferred from any cutting. Additionally, 400-acre post-fledging areas surround-ing goshawk nests would be under-burned only so as to enhance goshawk prey conditions and advance these stands toward late or old structure conditions. Project activities would be prohibited in occupied goshawk territories, (fledgling areas and within ½ mile of a known occupied nests), between April 1 and September 30 to avoid possible disturbance of goshawk pairs while bonding and nesting.	2 and 3	To conserve habitat for goshawk.	District Wildlife Biologist
To conserve nesting habitat of raptors (birds of prey), a biologist would be consulted to establish a nest zone buffer around any raptor nest discovered prior to or during project layout, and, if appropriate, to restrict activities within the nest area during occupancy, according to requirements of the species involved.	2 and 3	To conserve nesting habitat for raptors (birds of prey).	District Wildlife Biologist
Maintain the nest trees of active raptor nests and habitat immediately surrounding and mitigate potential adverse Impacts from management activities during the nesting season. Protection measures will be developed based on	2 and 3	To conserve nesting habitat for raptors (birds of prey).	District Wildlife Biologist

<table>
<tr><th>Design Elements</th><th>Alternative</th><th>Objective</th><th>Responsible Person</th></tr>
<tr><td>site characteristics and biological needs of the species. Where possible, retain trees with inactive nests that may be important to secondary nesters (e.g. great gray owl).</td><td></td><td></td><td></td></tr>
<tr><td>Protection of large logs would be an objective during underburning. Prescribed fire parameters would be designed to limit the burning of large down logs to a point where their diameter is reduced by no more than a total of 3”.</td><td>2 and 3</td><td>To provide foraging habitat for woodpeckers species.</td><td>District Wildlife Biologist</td></tr>
<tr><td>In all treated areas the minimum woody-debris ground cover listed in the table on the following page would be retained through all phases of the project where they currently exist. Since much of the landscape is deficient in down logs, most existing large down logs (logs greater than 12”) would be retained during harvest and grapple piling activities.
<table>
<tr><th>Forest Type</th><th>Minimum Diameter</th><th>Number of Logs/ Acre</th><th>Minimum Length</th><th>Total Linear Feet/Acre</th><th></th></tr>
<tr><td>Ponderosa Pine</td><td>12 inches</td><td>3-6</td><td>6 ft</td><td>20-40 ft</td><td></td></tr>
<tr><td>Mixed Conifer</td><td>12 inches</td><td>15-20</td><td>8 ft</td><td>120-160 ft</td><td></td></tr>
</table>
</td><td>2 and 3</td><td>To provide abundant foraging habitat for woodpeckers species, such as pileated.</td><td>District Wildlife Biologist</td></tr>
<tr><td>To conserve habitat of big game species including elk, a management-indicator species of the Malheur National Forest, standards of habitat-effectiveness index and satisfactory 1 and marginal 2 cover would be met.</td><td>2 and 3</td><td>To conserve habitat of big game species including elk.</td><td>District Wildlife Biologist</td></tr>
<tr><td>Horizontal hiding cover will be provided by retaining non-thinned patches of forest trees as necessary throughout the project area and on relatively flat topography. It would be desirable to leave these clumps around existing snags for further protection.</td><td>2 and 3</td><td>To conserve habitat of big game species including elk.</td><td>District Wildlife Biologist</td></tr>
<tr><td>Connectivity corridors between late and old structure (LOS) stand conditions and between all Forest Plan designated “old growth” will be maintained to meet the Regional Forester’s Eastside Forest Plan Amendment 2 Wildlife Standard. Amendment 2 gives direction for maintaining connectivity between these habitats to allow the free movement of old growth associated species of terrestrial wildlife species. LOS and Dedicated Old Growth stands are distributed throughout the analysis area.</td><td>2 and 3</td><td>To conserve habitat of big game species, wide ranging carnivores, and other wildlife species.</td><td>District Wildlife Biologist</td></tr>
<tr><td>To conserve potential LOS stand conditions in the project area and connectivity between such stands both within and adjacent to the project area, proposed thinning or burning in stands exhibiting LOS or connection-corridor potential would be specifically designed and controlled to enhance and accelerate the development of LOS values. There will be no net loss of LOS as the result of activities.</td><td>2 and 3</td><td>To provide for late and old structure obligate species.</td><td>District Wildlife Biologist</td></tr>
<tr><td>Canopy closures within treated connectivity corridors will be maintained within the top one-third of site potential.</td><td>2 and 3</td><td>To provide habitat for wildlife species</td><td>District Wildlife Biologist</td></tr>
<tr><td>Temporary roads would be located outside of riparian habitat conservation areas (areas near streams or other water) and rehabilitated and closed upon completion of treatments for which they are used.</td><td>2 and 3</td><td>To maintain and enhance hardwood species.</td><td>District Wildlife Biologist, Engineer</td></tr>
</table>

Design Elements	Alternative	Objective	Responsible Person
If any existing roads in the area that are currently grown over or closed by earth berms are used for firelines or temporary access of workers or equipment, they would be rehabilitated and re-closed upon completion of treatments for which they are used.	2 and 3	To prevent increased access to big game species.	District Wildlife Biologist, Burn Boss
Under the Malheur Forest Plan standard and guides (Chapter IV, item #57), aspen stands are to be maintained and enhanced using clearcutting and prescribed fire as the principal means of regeneration where appropriate.	2 and 3	To enhance hardwood species such as aspen.	District Wildlife Biologist
Soils Resources			
Skidtrail locations shall be designated and approved prior to logging. On areas where existing skidtrails spaced 100-140 ft apart can be reused, reuse the old skidtrails. Otherwise, space skidtrails about 120 ft apart where practical, using existing skidtrails where possible and appropriate. Draw bottoms are not appropriate. Skid-trails should average < 14 ft wide.	2 and 3	Keep soil impacts as small as practical and keep detrimental soil impacts to < 20% of the area of each sub-unit.	Sale Administrator / Purchaser
Skidders shall not be allowed off skidtrails unless the soil is frozen to a depth of 4" or more. Directional felling and/or tractor winching will be used where necessary.	2 and 3	Limit soil damage.	Sale Administrator / Purchaser
Low ground-pressure equipment (≤8.5 psi) can be allowed off skidtrails on dry, frozen, or snow covered soil. "Dry" means July through September, or obviously dry to a depth of 4" during other months. "Snow covered" means sufficient snow depth and strength to prevent soil disturbance and compaction. "Frozen" means frozen to a depth of 4" or more.	2 and 3	Limit soil damage.	Sale Administrator / Purchaser
Avoid skidding downhill on slopes steeper than 35%, where feasible, using directional felling and tractor winching. There shall be no skidding on any slope steeper than 45%.	2 and 3	Limit soil damage.	Sale Administrator / Purchaser
Avoid skidding uphill on slopes steeper than 25% for ash soils and 35% for non-ash soils.	2 and 3	Limit soil damage.	Sale Administrator / Purchaser
No skidding will be done under wet soil conditions, when ruts 6" or deeper would form on a continuous 50 feet or more of skidtrail. Subsoiling of skidtrails (or winter logging) will be used in several stands.	2 and 3	Limit soil damage.	Sale Administrator / Purchaser
Erosion from skidtrails and tractor winch furrows shall be controlled by the use of cross drains or comparable measures. Outfalls of the cross drains shall be clear and located on soil where water will infiltrate, not on shallow or impermeable soil. Cross drains on skidtrails should be spaced appropriately for the terrain.	2 and 3	Limit soil damage.	Sale Administrator / Purchaser
Re-use existing landings where feasible and where they are away from "scab" soil and ephemeral draws unless approved by a hydrologist, soil scientist, or fisheries biologist.	2 and 3	To prevent excessive soil damage.	Hydrologist, Soil Scientist, Fish Biologist
Underburning would be conducted under conditions such that Forest Plan ground cover standards will be met.	2 and 3	To prevent excessive soil damage.	Soil Scientist, Burn Boss
Range Resources			
Grazing may resume in the area of the burn without any timing restriction if burning occurs before vegetative green-up. If burn occurs after green-up, grazing may occur after	2 and 3	Minimize the affects of project activities on the	Sale Administrator, Contractor,

Design Elements	Alternative	Objective	Responsible Person
range has been determined to be ready (verified by resource personnel) or in the fall September to October without a range readiness determination.		permittee's grazing operations.	Range Conservationist, COR
If areas are deemed to be in need of protection, grazing may resume in the grazing unit if areas can be adequately protected from grazing (i.e., electric fencing, placing supplements away from burned areas, or other protection methods).	2 and 3	To prevent livestock damage to sensitive areas.	Sale Administrator, Contractor, Range Conservationist, COR
If burns occur in areas not suitable for grazing as determined by the range resource specialist, grazing may continue in the remainder of the unit that was not affected by the burn if it is suitable for grazing.	2 and 3	Minimize the affects of project activities on the permittee's grazing operations	Sale Administrator, Burn Boss, Range Conservationist
If burned areas cannot be protected as described in above design features, then livestock may need to be moved to another allotment or unit. The purchase of supplemental feed to replace the affected forage loss may also be considered.	2 and 3	Minimize the affects of project activities on the permittee's grazing operations.	Sale Administrator, Burn Boss, Range Conservationist
All fences damaged because of project activities would be repaired prior to returning grazing animals to the project area. Repair to any damaged, developed springs would also occur.	2 and 3	Protect government and permittee investments.	Sale Administrator, Range Conservationist
Noxious Weeds			
Noxious weed surveys would be done 1 to 5 years after the project on all open and closed system and temporary roads affected by the project activities.	2 and 3	Detect new infestations of noxious weeds.	District Weed Specialist
Heavy equipment would be cleaned prior to coming on National Forest System Lands. Specifically, equipment used within known locations of noxious weed infestations should be cleaned prior to moving to another site within the forest or area treated last.	2 and 3	Reduce the introduction, establishment and spread of noxious weeds.	Sale Administrator, Project Engineer, COR
Seed, straw, and other materials used for road decommission and erosion control would be free of noxious weed seed.	2 and 3	To prevent the spread of noxious weeds.	Sale Administrator, Project Engineer
Use only gravel, fill, sand, and rock that are judged to be weed free by District weed specialists if needed for project.	2 and 3	Detect new infestations of noxious weeds.	Sale Administrator, Project Engineer
All disturbed roads, landings, and skid trails would be seeded with a native seed mix after activities occur.	2 and 3	To prevent the spread of noxious weeds.	District Weed Specialist
Native plant materials are required for re-vegetation unless accepted extenuating circumstances are identified.	2 and 3	To prevent the spread of noxious weeds.	District Weed Specialist
Recreation Resources and Visuals / Scenery			
If any recreation special use permits are issued for the project area during treatment operations, users would be informed of operations in the vicinity and possible hazards that may be encountered through proper signage or other means.	2 and 3	Public safety	Zone Recreation Specialist
In order to blend treatment units and create free-form vegetative patterns that mimic natural patterns, straight lines and geometric shapes would be avoided or minimized	2 and 3	Reduce evidence of management activity.	Sale Administrator

Design Elements	Alternative	Objective	Responsible Person
for unit boundaries.			
Tree or shrub islands of various shapes and sizes would be retained in a random distribution pattern where possible to provide a characteristic vegetative appearance while meeting objectives for fuel reduction and bark-beetle risk reduction.	2 and 3	Reduce evidence of management activity.	Sale Administrator
Any snowmobile routes that conflict with project activities will be signed with proper signage and alternate routes will be utilized during the implementation of the project. Coordination of signage will be done with the local snowmobile club.	2 and 3	Limit impacts on snowmobiling.	Zone Recreation Specialist, Sale Administrator
The Malheur National Forest Road Rules will apply during commercial haul. These rules will be included in the timber contract, and regulate conditions to which the road must be maintained.	2 and 3	Comply with the Malheur National Forest Road Rules.	Zone Recreation Specialist, Sale Administrator
Heritage Resources			
Sites will be identified as Areas to Protect (ATP) during all timber harvest activities, and/or the boundaries of harvest units will be configured so that they do not include sites.	2 and 3	Site protection.	Zone Archaeologist, Sale Administrator
All NRHP eligible and potentially (unevaluated) sites will be avoided/protected from any ground disturbing impacts during all timber harvest activities.	2 and 3	Site protection.	Zone Archaeologist, Sale Administrator
There will be no piling, hand or with ground-based machines, within any boundaries of a site; all hand piling and burning of slash or fuel concentrations will take place outside of the site boundaries.	2 and 3	Site protection.	Zone Archaeologist, Sale Administrator
All eligible and potentially (unevaluated) eligible historic properties with structural remains or other wooden feature types will be avoided/protected during all burning activities. Eligible historic remains will be identified on the ground and proper protection measures will be conducted during the burning activities.	2 and 3	Site protection.	Zone Archaeologist, Sale Administrator
Under the terms of the Management Strategy for the Treatment of Lithic Scatter Sites (Keyser et al., 1988), *low intensity* burning will have no effect on the prehistoric lithic assemblages.	2 and 3	Site protection.	Zone Archaeologist, Burn Boss
If cultural resources are located during implementation of the action alternative, work will be halted and the Zone Archaeologist will be notified. The cultural resource will be evaluated and a mitigation plan developed in consultation with the Oregon SHPO, if necessary.	2 and 3	New site protection	Zone Archaeologist, Sale Administrator
Fire Hazard, Fuels, and Air Quality			
Firelines needed to conduct the proposed treatments shall consist of natural breaks, existing roads, or hand-constructed lines. Hand-constructed firelines may be used to keep fire out of sensitive areas such as historic sites or private property.	2 and 3	Protect private property.	Fuels Planner, Burning Crew
Private property will be avoided and protected from prescribed fire by isolating or separating it from areas to be treated. This may be accomplished by constructing firelines, planning ignitions to stop at effective control	2 and 3	Protect private property.	Fuels Planner Burning Crew

Design Elements	Alternative	Objective	Responsible Person
points such as roads or natural barriers, staging firefighters or firefighting equipment at strategic points, or other means.			
The Forest Service will take steps to notify adjacent landowners in advance of planned burn operations.	2 and 3	Protect private property.	Fuels Planner Burning Crew
In the event of fire moving onto private property, aggressive fire suppression tactics will be used.	2 and 3	Protect private property.	Fuels Planner Burning Crew
As part of the plan for retention of logs and snags, protection measures shall be used during prescribed underburning to reduce consumption of these large woody fuels needed for wildlife habitat and hydrologic stability. Total consumption of large down wood shall be > 3" of the circumference.	2 and 3	Protect snags and down wood.	Fuels Planner Burning Crew
In compliance with the Clean Air Act, burning of any kind will not occur unless prior approval is granted by the Oregon Department of Forestry.	2 and 3	To comply with state air quality regulations.	Fuels Planner Burning Crew
No burning will occur during the visibility-protection periods of July 1st – September 15th for Class 1 airsheds that may cause haziness and reduced visibility of the Strawberry Mountain Wilderness.	2 and 3	To comply with state air quality regulations.	Fuels Planner Burning Crew
Burning shall be planned for times when transport winds and mixing heights are sufficient to displace much of the smoke from the area.	2 and 3	To comply with state air quality regulations.	Fuels Planner Burning Crew
Use biomass utilization as much as possible to reduce emissions from burning.	2 and 3	Reduce emissions.	Fuels Planner Burning Crew
Botany Resources			
Harvest operations and vehicles and heavy machinery shall avoid sensitive plant locations.	2 and 3	Protect sensitive plants.	Sale Administrator
Slash and fuels shall not be piled and burned on or immediately adjacent to sensitive plant locations.	2 and 3	Protect sensitive plants.	Burn Boss

Best Management Practices Specific to this Project

The Forest Service's responsibilities under the Clean Water Act are described in a May 2002 Memorandum of Understanding (MOU) between the Oregon Department of Environmental Quality and the Forest Service. The Forest Service is directed to comply with State requirements in accordance with the Clean Water Act for protection of waters of the State Of Oregon (OAR chapter 34041) through planning, application, and monitoring of Best Management Practices (BMPs), which are recognized as the primary means to control non-point source pollution on National Forest lands. BMPs specific to the project are listed on the following page (the full text of these can be found in the project record) and apply to the proposed action. The Blue Mountain Ranger District hydrologists and fish biologist, and sale administrators and harvest inspectors assigned to the project monitor BMPs. The MOU also directs that the Forest Service cannot further degrade water quality impaired streams. As shown in the Effects section, the proposed action would not raise temperature in Alder or Cottonwood creeks that are the only two 303(d) listed water bodies in the project area.

Table 8. 12.11 Timber Management Practices.

Practice	Number
Timber Sale Planning Process	1-1
Timber Harvest Unit Design	1-2
Use of Sale Area Maps and/or Project Maps for Designating Water Quality Protection Needs	1-4
Limiting Operating Period of Timber Sale Activities	1-5
Streamside Management Zone Designation	1-7
Determining Tractor Loggable Ground	1-8
Tractor Skidding Design	1-9
Suspended Log Yarding in Timber harvesting	1-10
Log Landing Location	1-11
Erosion Prevention and Control Measures During Timber Sale Operations	1-12
Revegetation of Areas Disturbed by Harvest Activities	1-14
Log Landing Erosion	1-15
Erosion Control on Skid Trails	1-16
Stream course and Aquatic Protection	1-18
Erosion Control Structure Maintenance	1-19
Acceptance of Timber Sale Erosion Control Measures Before Sale Closure	1-20
Modification of the Timber Sale Contract for Environmental Protection	1-23

Table 9. 12.21 Road and Facility Management.

Practice	Number
Erosion Control Plan	2-2
Stabilization of Road Prism and Disposal Area	2-4
Control of Road Drainage	2-7
Timely Erosion Control Measures on Incomplete Road and Stream Crossing Projects	2-9
Servicing and Refueling Equipment	2-12
Control of Construction and Maintenance Activities Adjacent to SMZs	2-13
Controlling In-Channel Excavation	2-14
Stream Crossings on Temporary Roads	2-16
Installation of Bridges, Culverts, and Other Stream Structures	2-17
Disposal of Right-of-Way and Roadside Debris	2-19
Water Source Development Consistent with Water Quality Protection	2-21
Maintenance of Roads	2-22
Road Surface Treatment to Prevent Loss of Materials	2-23
Traffic Control During Wet Periods	2-24
Snow Removal and Storage to Avoid Resource Damage	2-25
Obliteration or Decommissioning of Roads	2-26

Table 10. 12.51 Vegetation Manipulation Practices.

Practice	Number
Slope Limitations for Mechanical Equipment Operation	5-2
Tractor Operation Limitation in Wetlands and Meadows	5-3
Revegetation of Disturbed Areas	5-4
Disposal of Organic Debris	5-5
Soil Moisture Limitations for Tractor Operations	5-6

Table 11. 12.61 Index for Fire Suppression and Fuels Management Practices.

Practice	Number
Consideration of Water Quality in Formulating Fire Prescriptions	6-2
Protection of Water Quality from Prescribed Burning Effects	6-3

Comparison of Alternatives

This section provides a tabular comparative summary of the activities (Table 12) proposed to meet the purpose and need as described in Chapter 1 and the effects of implementing each alternative based on the significant and analysis issues (Table 13) as derived from the Chapter 3 effects analysis.

Table 12. Comparison of Alternatives: Purpose and Need.

Purpose and Need	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
1. Reduce Risk of Intense Fire Behavior			
▪ Commercial Thinning	0 acres	1,734 acres	513 acres
▪ Group Select	0 acres	0 acres	507 acres
▪ Precommercial Thinning	0 acres	1,128 acres	1,269 acres
▪ Biomass Utilization	0 acres	1,102 acres	1,102 acres
Return Stands to Consistent Fire Return Interval			
▪ Prescribed Burning	0 acres	6,557 acres	6,557 acres
▪ Hand Pile	0 acres	90 acres	117 acres
▪ Machine Slash Treatment	0 acres	1,038 acres	1,153 acres
▪ Whole Tree Yarding	0 acres	1,787 acres	1,037 acres
2. Reduce Conifer Encroachment in Aspen			
▪ Aspen Release w/Lop and Scatter	0 acres	95 acres	60 acres
▪ Aspen Release w/Commercial Removal in Uplands	0 acres	55 acres	55 acres
▪ Aspen Release w/Commercial Removal in RHCAs	0 acres	0 acres	35 acres
▪ Aspen Caging	0 acres	3 acres	3 acres
▪ Total Aspen Treatments	0 acres	153 acres	153 acres
3. Reduce Stand Densities and Species Composition			
▪ Stand Structure Changes OFMS to OFSS (acres)	0 acres	216 acres	216 acres
4. Capture Economic Value			
▪ Volume Harvested (MBF)	0	3,180	5,634
5. Reduce Road Densities and Road Impacts			
Road Activities from Timber Harvest			
▪ Temporary Roads	0 acres	1.5 miles	1.1 miles
▪ Road Maintenance	0 acres	63 miles	48 miles
Road Restoration			
▪ Road Closures	0 acres	26.3 miles	26.3 miles
▪ Decommissioning	0 acres	11.7 miles	11.7 miles
▪ Decommissioning in RHCAs	0 acres	1.5 miles	1.5 miles

Table 13. Comparison of Alternatives: Issue and Indicator.

Issue	Alternative 1	Alternative 2	Alternative 3
1. Thinning in Stands with a High Fir Component			
- Percent fir component retained in treated stands	No change	Greater than 25%	Less than 25%
- Acres treated with Group Selection Harvest	0 acres	0 acres	507 acres
- Percent change in areas with high to extreme crown fire potential (in 20 years)	8% increase	19% decrease	17% decrease
2. Water Quality / RHCAs			
- Acres treated in riparian areas	0 acres	0 acres	35 acres
3. Treatment Priorities and Low Economic			

Issue	Alternative 1	Alternative 2	Alternative 3
Value			
- Present net sale value	0	$41,847	$90,000
- Jobs from commercial or non-commercial project activities	0	15	26
- Volume of economically viable timber harvest (cubic ft)	0	3,180	5,634
4. Snag and Down Wood Retention			
- Snags per acre in 10 years (Greater than 21" dbh)	.97	1.1	1.1
5. Old Growth / Mature Trees			
- Acres OFMS converted to OFSS (Warm Dry/Hot Dry)	0	425 acres	425 acres
- Percent OFSS Warm Dry/Hot Dry in 50 years	6% / 18%	12% / 35%	13% / 22%
- Percent OFMS Warm Dry/Hot Dry in 50 years	37% / 32%	39% / 20%	39% / 30%
6. Soils			
- Percent of area with detrimental soils impact (Standard not to exceed 20%)	No impacts	No units exceed 20% Threshold	No units exceed 20% Threshold
7. Invasive Species (Noxious Weeds)			
- Estimated acres of ground disturbing activities (includes commercial thinning, group selection, and biomass removal inside precommercial thinning units).	0	2,836	2,122
- Risk of spread	No Change	Low possibility	Low possibility
8. Road Density (miles per square mile)			
- Open road density big game summer range	3.94	2.96	2.96
- Open road density big game winter range	4.13	2.51	2.51
9. Nesting Birds and Raptors			
- Wildlife impact determination for nesting birds	No Impact	Limited short term impact, no long term impact. Burning and thinning treatments conducted in spring can affect landbirds during the breeding season.	Limited short term impact, no long term impact. Burning and thinning treatments conducted in spring can affect landbirds during the breeding season.
- Wildlife impact determination for nesting goshawks and other raptors	No Impact	Limited short term impact, no long term impact. Management activities would be prohibited within ½ miles of occupied nest sites from April 1 to September 30 to avoid disturbing goshawk during breeding season.	Limited short term impact, no long term impact. Management activities would be prohibited within ½ miles of occupied nest sites from April 1 to September 30 to avoid disturbing goshawk during breeding season.
10. Wildlife Cover			
- Big Game Cover Analysis (summer range) S / M cover	5% / 21.6%	5% / 17.4%	5% /17.2%
- Big Game Cover Analysis (winter range) S / M cover	1.2% / 20%	1.2 / 18.4%	1.2% / 19.2%

Forest Fire Hazards, Fuels, and Air Quality

Affected Environment

Introduction

This section describes terms relevant to understanding fire and fuels management, the regulatory framework for fire management, historic and desired conditions, analysis methods, existing condition, and the environmental consequences of the alternatives on condition class, fire type and behavior, access for fire suppression and smoke management.

Definition of Terms

Fire Risk - Fire risk is defined as the potential and frequency for wildfire ignitions. Fire risk is often defined as the number of fires per 1,000 acres per decade. Areas that have a fire start every 1 to 10 years are considered to have a high fire risk. The Knox Project Area has a moderate to high fire risk based on past starts. The majority of fire starts for this area are from lightning.

Fire Hazard - Fire hazard for any particular forest stand or landscape reflects the potential magnitude of fire behavior and effects (severity) as a function of fuel condition. Fuels have been traditionally characterized as crown fuels (live and dead material in the canopy of trees), surface fuels (grass, shrubs, litter, and wood in contact with the ground surface), and ground fuels (organic soil horizons or "duff"), and buried wood (Peterson et al. 2004).

Wildland Fires - Wildland fires can be classified into two different types, surface fires and crown fires. Crown fires are often divided into two different types also, passive and active. Passive crown fire exhibits torching of individual trees or groups of trees. Active crown fire occurs when fire moves through the tree crown, burning all crowns in the stand.

> ***Surface Fires*** - Surface fires burn in surface fuels and ground fuels. The size, arrangement, loading, and moisture of the surface fuels and ground fuels along with weather and topography dictate fire intensity and rate of spread. Surface fuel sizes from 0-3 inches are the primary contributors to fire spread and intensity. Fire intensity can be measured in terms of flame length. Flame lengths of less than 4 feet are considered to be a low enough intensity that direct fire control efforts by hand crew can still be effective. Flame lengths greater than 4 feet indicate the need for machine constructed fireline or an indirect suppression strategy will be required to control the fire by handcrews.
>
> ***Crown Fires*** - Crown fires are generally considered the primary threat to ecological and human values. Crown fires occur when surface fires create enough energy to preheat and combust fuels well above the surface (Agee 2002). Crown fires pose the greatest threat to firefighter safety from increased fire line intensities and long distance spotting. These risks force the firefighter to an indirect suppression strategy, which increases acres burned and thus increases fire severity on the landscape.
>
> ***Fuels Management*** - Surface and crown fuels can be manipulated in several different ways to affect their size, arrangement, density, and loading to affect fire behavior. Two primary treatments were considered for this project: thinning from below combined with activity fuel treatment and late- or early-season underburning.

Thinning From Below - Thinning from below removes trees with smaller diameters, usually intermediate and suppressed trees. It has the effect of raising the canopy base height and decreasing canopy bulk density, both of which reduce the potential for crown fires. Canopy base height (CBH) is the height from the ground at which there is sufficient fuel in the form of needles and limbs to sustain torching. The higher the number, the less likely the potential is for torching. Canopy bulk density (CBD) is the highest average fuel loading in the canopy. The higher the CBD, the greater the potential is for stand replacing crown fire. Surface fuels created from the thinning may need to be treated or they would negate the benefits of thinning by increasing flame lengths and igniting the canopy. Slash on steep slopes is generally treated by hand piling and burning or jackpot burning. On gentler slopes, slash can be treated by biomass removal, machine piling and burning or jackpot burning. Lop and scattering of fuels works well when activity slash loads are light.

Late or Early-season Underburning - Late- or early-season underburning reduces surface and ground fuels, primarily in the 0-3" size class. It also has the effect of raising canopy base height by scorching lower branches and killing smaller trees and less fire adapted species. The effects from underburning vary widely depending on the weather and fuel conditions at the time of the burn and the skill of the fire manager in directing how the fire will burn. Generally spring burning has better results when mortality in small diameter trees is desired. Several burn entries may be needed to meet the objectives for an area. The combined effects of reduced surface fuels and increased canopy base height reduce the overall fire hazard and potential for crown fire.

Fire Regime - A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human intervention, but including the influence of aboriginal burning (Agee 1993, Brown 1995). Coarse scale definitions for natural (historical) fire regimes have been developed by Hardy et al. (2001) and Schmidt et al. (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001). The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation. These five regimes include:

- I – 0-35 year frequency and low (surface fires most common) to mixed severity (less than 75% of the dominant overstory vegetation replaced);
- II – 0-35 year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);
- III – 35-100+ year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced);
- IV – 35-100+ year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);
- V – 200+ year frequency and high (stand replacement) severity.

Fire Regime III areas are further classified by fire frequency depending on plant association groups. In Eastern Oregon, these mixed severity regimes generally have a fire frequency of less than 50 years and lower severity.

Condition Class - A fire regime condition class (FRCC) is a classification of the amount of departure from the natural regime (Hann and Bunnell 2001). Coarse-scale FRCC classes have been defined and mapped by Hardy et al. (2001) and Schmidt et al. (2001). They include three condition classes for each fire regime. The classification is based on a relative measure describing the degree of departure from the historical natural fire regime. This departure results in changes to one (or more) of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (e.g. insect and diseased mortality, grazing, and drought).

All wildland vegetation and fuel conditions or wildland fire situations fit within one of three classes. The three classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural (historic) regime (Hann and Bunnell 2001, Hardy et al. 2001, Schmidt et al. 2002). The central tendency is a composite estimate of vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated natural disturbances. Low departure is considered to be within the natural (historic) range of variability, while moderate and high departures are outside.

Characteristic vegetation and fuel conditions are considered to be those that occurred within the natural (historic) fire regime. Uncharacteristic conditions are considered to be those that did not occur within the natural (historic) fire regime, such as invasive species (e.g. weeds, insects, and diseases), "high graded" forest composition and structure (e.g. large trees removed in a frequent surface fire regime), or repeated annual grazing that maintains grassy fuels across relatively large areas at levels that will not carry a surface fire.

Determination of amount of departure is based on comparison of a composite measure of fire regime attributes (vegetation characteristics; fuel composition; fire frequency, severity and pattern) to the central tendency of the natural (historical) fire regime. The amount of departure is then classified to determine the fire regime condition class. Descriptions of the fire regime condition classes and associated attributes are provided in the Table A-1.

Table A-1. Condition Class.

Condition Class	Description	Potential Risks
Condition Class 1	Within the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances	Fire behavior, effects, and other associated disturbances are similar to those that occurred prior to fire exclusion (suppression) and other types of management that do no mimic the natural fire regime and associated vegetation and fuel characteristics. Composition and structure of vegetation and fuels are similar to the natural (historical) regime. Risk of loss of key ecosystem components (e.g. native species, large trees, and soil) are low.
Condition Class 2	Moderate departure from the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances	Fire behavior, effects, and other associated disturbances are moderately departed (more or less severe). Composition and structure of vegetation and fuels are moderately altered. Risk of loss of key ecosystem components are moderate.

Condition Class	Description	Potential Risks
Condition Class 3	High departure from the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances	Fire behavior, effects, and other associated disturbances are highly departed (more or less severe). Composition and structure of vegetation and fuels are highly altered. Risk of loss of key ecosystem components are high.

Regulatory Framework

Malheur Forest Plan and the Malheur Fire Management Plan

The Malheur National Forest Land and Resource Management Plan (Forest Plan), (USDA 1990) includes Forest-wide fire management direction consistent with other resource goals. The Malheur National Forest Fire Management Plan (FMP), (USDA 2007) is an annually updated operational guide.

The Forest Plan provides forest-wide standards and identifies management direction for the management of fire:

- Initiate initial suppression action that provides for the most reasonable probability of minimizing fire suppression costs and resource damage. These suppression actions should be consistent with probable fire behavior, resource impacts, safety, and smoke management considerations.
- Identify, develop and maintain fuel profiles that contribute to the most cost-efficient fire protection program consistent with management direction (Forest Plan IV-4).

The Forest Plan further describes Forest-Wide Standards for Fire Management and Residue Management:

- Manage residue profiles at a level that will minimize the potential of high intensity, catastrophic wildfires and provide for other resource objectives in individual management areas.
- Utilize the Regional fuels analysis process as a guide to determine the most cost effective fuel profile for fire protection purposes. Finance treatment beyond the level needed for fire protection by the requesting or benefiting function.
- Use all methods of fuel treatment as prescribed by site-specific analysis to achieve resource management objectives. Encourage utilization of wood residue as a priority treatment consistent with long-term site productivity and wildlife habitat needs (Forest Plan IV-44).

The Fire Management Plan (FMP) is a working document and is updated annually or as policy or the Forest Plan changes. The FMP defines how the Fire/Fuels Management Programs will be implemented on the Malheur National Forest. The Fire/Fuels Management Program is based on achieving resource objectives defined in the Forest Plan.

National Fire Plan

The National Fire Plan (USDA Forest Service & USDI Bureau of Land Management 2001) provides national direction for hazardous fuel reduction, restoration, rehabilitation, monitoring, applied research, and technology transfer. The USDA Forest Service and Department of Interior (DOI) are developing a common strategy for reducing fuels and restoring land health in fire-

prone areas. The USDA Forest Service prepared a document outlining strategies for protecting people and the environment by restoring and sustaining land health; Protecting People and Sustaining Resources in Fire-adapted Ecosystems – A Cohesive Strategy (USDA Forest Service 2000). The purpose of the strategy is to:

- Establish national priorities for fuel treatment; ensuring funding is targeted to the highest risk communities and ecosystems.
- Evaluate tradeoffs between programs that emphasize wildland urban interface and those emphasizing ecosystem restoration and maintenance.
- Measure the effectiveness of strategic program options at different funding levels.
- Recommend a strategic program to best achieve national fuel treatment objectives for community protection and ecosystem restoration and maintenance.
- Emphasize landscape-scale, cross-boundary treatments that reduce hazards while providing benefits to other ecosystem values.

The strategy will emphasize improved working relationships between federal land managers, as well as with multiple key disciplines inside the various land management and regulatory agencies and bureaus across geographic scales. Applicable National Fire Plan goals and objectives include:

- Reducing the number of small fires that become large
- Restoring natural ecological systems to minimize uncharacteristically intense fires
- Creating new jobs in both the private and public sectors
- Improving capabilities of state and volunteer fire organizations
- Reducing threats to life and property from catastrophic wildfire

Air Quality Laws and Regulations

Activities that will create smoke emissions must follow the State of Oregon Smoke Management Plan (SSMP).

The Strawberry Mountain Wilderness is a Class I airsheds. The Strawberry Wilderness is approximately 12 air miles northwest of the project. In class I areas, only very small increments of new pollution above already existing air pollution levels are allowed. The State has designated visibility protection periods for class 1 airsheds from July 1st to September 15th for all of Oregon.

The surrounding communities of John Day, Burns, and Baker City are listed in the SSMP as Smoke Sensitive Receptor Areas and thus protected by the highest standards in the plan.

The prevailing winds are from the southwest and west. During the day, diurnal heating forces air up valley and up slope out of the area. During the night, air follows the drainages in the area downstream. Inversions affect air quality the most during the winter months, but during the rest of the year inversions sometimes develop in the morning hours and dissipate by noon.

Currently, air quality in surrounding sensitive areas is limited to short term impacts. These impacts result from wood burning, prescribed burning, and field burning to the west. The greatest impact to the wilderness area is from field burning in the Willamette Valley and Central Oregon and from summer wildfires that occure to the south and west. These sources affect haziness and can last for several days in the spring and summer.

In compliance with the Clean Air Act, prescribed burning of any kind will not occur unless prior approval is granted by Oregon Department of Forestry. The Clean Air Act sets air quality standards for particulate matter (PM) for particles less than 10 microns in diameter (PM 10) and less than 2.5 microns in diameter (PM 2.5). All amounts of PM10 and PM 2.5 emissions will be calculated using the CONSUME software in the Fasttracks reporting system, which is also submitted with planned burn operations to the Oregon Department of Forestry to determine compliance with the Clean Air Act. State smoke forcasts which predict wind direction and smoke mixing height, will be obtained prior to all burning to insure smoke intrusions will not occure in the local smoke sensitive receptor areas.

Historic Condition

Fire Return Interval - The historic fire regime for the Tamarack Creek Subwatershed was one of high frequency, low severity fires. A study completed by Emily Heyerdahl, in an adjacent subwatershed, found the historic fire return interval to be approximately 12 years. Frequent lightning and tribal burning contributed to these frequent fires. The frequency of wildfires changed drastically in the late 1800s. The change to low frequency fire return intervals may be due to a dramatic increase in sheep and cattle grazing during the 1870s and 1880s, which significantly reduced the fine fuels. (Heyerdahl and Agee 1996). Other factors that reduced the overall frequency of wildfire on the landscape are fire suppression improvements and increased access as more roads were constructed.

A separate study was completed by Diana Olson in 2000 to assess fire history and return intervals within riparian habitats. Using the same fire history data from Heyerdahl's study along with sample plots within riparian areas, Diana found similar fire return intervals within the riparian areas as that found in the upland forested areas (Olson, 2000). These frequent fires burned with low severity. She concluded that keeping fire out of the riparian ecosystem will continue to alter structure and vegetation composition.

Biophysical Environment and Fire Regime - In 2004 the Blue Mountain Forests ecologist assigned one of the five fire regimes to each biophysical environment based on historic fire return intervals and vegetation type. The biophysical environment for each stand was gathered from stand exam data and photo interpretations and assigned to each stand in the analysis area. A majority of the subwatershed is classified as Warm Dry. The natural fire regime for the Warm Dry Biophysical Environment is one of frequent, low intensity, non-stand replacement fire (Fire Regime 1). Mortality from fire would be light and patchy. Table A-2 shows the percent of the Tamarack Creek Subwatershed by fire regime and biophysical environment.

Table A-2. Fire Regimes for Each Biophysical Environment in the Tamarack Creek Subwatershed.

Biophysical Environment	Fire Regime	Acres	Percent Of Tamarack Creek Subwatershed
Warm Dry	1	14,503	74%
Hot Dry	1	1,068	5%
Hot Moist Juniper Woodland	3	764	3%
Grass and Non-vegetated	2	3,812	19%

Condition Class - Fire, from both natural and human-caused ignitions, was an integral part of stable and healthy ecosystems within this project area. Fires served to maintain seral vegetation species, maintain stand densities, and maintain forage and browse for wildlife. Under these

conditions the fire regime 1 areas would be maintained by fire in condition class 1 or 2. The fire regime 2 and 3 areas are grassland and juniper woodlands. The grasslands would have burned frequently, killing conifer and juniper encroaching into the grasslands. The juniper woodlands would have burned with less frequency and a mosaic of fire effects. Fires would have burned with a mixed severity, creating a mosaic of condition classes at any one time. These areas include the more rocky, scab areas on the east and north edges of the project area.

The riparian habitat and upland aspen areas would have burned with slightly less frequency in a mosaic and with lower severity than the adjacent upland Warm Dry stands. These fires would have helped maintain the hardwood component of alder and aspen by knocking back conifer encroachment and inducing sprouting of new vigorous hardwoods.

Desired Condition

Fire Hazard – Wildfires will always be apart of the landscape in the dry forest types found in the Knox Project Area. Numerous lightning strikes occur every year in the project area and it's considered to have a high fire risk. The desire is that as fire suppression resources respond to these fires, they have an area where fuel conditions are such that the resistance to controlling the fire is fairly low. If fuel conditions are not in the desired condition, then the hope is that there is an area close by that is. Heavy pockets of surface fuels, and large areas of dense canopy with ladder fuels are not desirable conditions for firefighters due to the potential for high fire intensity, long range spotting and crown fire. The desire is that as summer wildfires pass through the remaining old forest stands of ponderosa pine, western larch and Douglas fir, mortality in the large trees is minimal.

Fire Regime and Condition Class – Stands that are classified as being in Fire Regime 1 would be at or near condition class 1. Vegetation and fuels would be near the historic range for the high frequency low severity regime. Prescribed fire can be used to maintain the condition class without the need for costly mechanical fuel treatments. Through a mosaic of prescribed underburning, much of the higher severity regimes within the project area would be maintained at condition class 1 or 2.

Surface Fuels - The desired maximum surface fuel load for Fire Regime 1 is 5-15 tons per acre depending where in the natural fire cycle the area was. The 3" plus size class of fuels would make up a majority of the loading. Duff accumulations would be fairly low due to frequent low intensity fire at the base of trees and across the landscape. With these relatively low loadings, the expected severity to soils and vegetation would be minimal. Heat from a passing fire would be short lived in the fine fuels with very little long lasting smoldering, which causes the most damage to soils.

For much of the Warm Dry Biophysical Environment the closest representative photo to show desired surface fuel conditions is (2-PP-3) from the Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest, PNW-105 (May 1980). This photo indicates that the desired surface fuels would have been less than 10 tons per acre with disturbance from the natural fire regime (Table A-3).

Table A-3. Desired Surface Fuel Conditions for Fire Regime 1 (from Photo Series 2-PP-3).

Size Class	Loading
0"- 0.25"	0.03 Tons per Acre (Approx.)
0.26" – 1"	0.9 Tons per Acre (Approx.)
1.1" – 3"	2.0 Tons per Acre (Approx.)
3" +	3.5 Tons per Acre (Approx.)
Total	**6.43 Tons per Acre (Approx.)**

Canopy Fuels – Canopy base height (CBH) and canopy bulk densities (CBD) are the best measures for helping predict crown fire potential. CBH would be maintained at sufficient height from frequent fires that only occasional torching in less fire adapted trees would occur. CBD, the weight of tree crowns over an area, would be sufficiently low that even if surface flame lengths were high enough to reach the crown, fire wouldn't spread in a stand replacing type of crown fire. Crown fire potential in Fire Regime 1 would be minimal.

Fire Behavior – Over much of the project area, fire behavior during extreme weather would show the character of a fire modeled with fuel model 2, 8, or 9. Fire intensity would be dependant on the fine fuels, grasses, pine needles and small down wood and would vary across the landscape. Fire would remain primarily as a surface fire, with potentially high rates of spread but exhibiting low severity to the larger fire dependent trees and soils. Fires would have short spotting distances and would show much less resistance to control compared to a passive or active crown fire.

Road Density – Roads have both a positive and negative effect on wildland fire suppression and fuels management. As a benefit, road networks provide access to water sources, lookouts, heli-spots, and other fire resources used in fire suppression and fuel management activities. In roaded areas, response time is reduced, thereby increasing firefighter efficiency and effectiveness in suppressing both human and natural fires. Roads also provide barriers or fire breaks for fire suppression and fuels activities. From a safety standpoint, roads provide anchor points for construction of fire-lines, escape routes, and safety zones. Forest roads and other forms of transportation systems also have negative impacts, such as an increased risk of human-caused fires, which have a random distribution along roadways throughout most of the forest.

Air Quality – Future wildland fires would burn with less severity in the fire regime 1 areas due to less available fuels. Smoke particulate matter produced from these fires would be reduced from that of fires in stands that are further removed from the historic fire return interval. Smoke created from prescribed fires would continue to be monitored for compliance with the clean air act through the State Implementation Plan with Oregon Department of Forestry.

Analysis Method

The four primary direct and indirect effects analyzed in this report are condition class, fire type and behavior, road closure effects to suppression resources and smoke management. The analysis area is the Tamarack Creek Subwatershed excluding private lands.

- To assess fire condition class and the effects of treatments, landscape scale Fire Regime Condition Class (FRCC) will be calculated for the Tamarack Creek Subwatershed using Integrated Forest Management System (INFORMS) data. Stand level FRCC will be

calculated from the landscape scale analysis. Acres of FRCC improvement will be compared to each alternative using INFORMS modeling of proposed treatments.

- To assess fire type and behavior, INFORMS Fuels Reduction Analysis will be modeled for the analysis area. To calculate fire behavior, data for 90th percentile weather will be used, and fuels data obtained from INFORMS, Most Similar Neighbor (MSN) and photo series. INFORMS and MSN use past stand exam data and satellite imagery to impute stand attributes into stands without existing data. Measure for comparison of alternatives will be fire type (Surface, Passive Crown, and Active Crown fires).
- To assess road closure effects on fire suppression effectiveness, proposed road densities and maximum distance from an open road will be compared by alternative.
- To assess smoke management, differences in smoke emissions that are required to be monitored, (PM 10, PM2.5) will be compared by alternative.

To assess the cumulative effects, fuels modification activities from past, present and future projects in the Tamarack Creek Subwatershed will be considered (refer to Appendix C).

Existing Condition

Fire Hazard

- ***Topography and Weather –*** Most of the Knox Project Area has gentle terrain with slopes less than 30%. The main exception being the Cottonwood Creek drainage which has slopes up to 60%. Elevation ranges from 6400 feet at Antelope Lookout to 4800 feet where Cottonwood Creek leaves the project area. Using data from the closest Remote Automated Weather Station (RAWS) which is at Antelope Lookout, past weather data can be summarized. This data was used to calculate the 90th percentile weather for fire behavior calculations. Winds in this area are generally out of the southwest. This portion of the forest is drier than most other areas due to lower elevation and minimal topography. Average precipitation is 20-28 inches per year.
- ***Fire History –*** Using past fire history information from 1986 to 2006, the probability of a large fire, 100 acres or larger, occurring in the next 20 years within the Tamarack Creek Subwatershed is 1.4. In other words it is likely that there could be 1 or 2 large fires in the subwatershed in the next 20 years. The largest fire in recent history close to the Knox Project, the Powder Fire, occurred in 1994. The Powder Fire burned nearly 6,000 acres in very similar forest types as found in the Knox Project Area, with high mortality in the forested vegetation. In the years 1998 through 2001, the Cottonwood Prescribed Burn Project was implemented. This project underburned approximately 5,500 acres within the Knox Project Area. The severity and intensity of the burns varied greatly with most areas receiving very low severity. Approximately 300 acres between Alder Creek and Cat Creek burned with moderate to high severity.
- ***Improvements and Structures –*** Antelope Lookout is on the southern edge of the project area. Structures include the lookout, a garage and an outhouse. The Antelope Weather Station is located just to the south of the lookout.
- ***Late and Old Structure –*** Old forest structure in the Knox Project Area is on the decline due to past overstory removals and mortality due to stress from overstocking in the understory. Many of the remaining old forest stands are at risk to high mortality in

the event of a wildfire. While large ponderosa pine, western larch and Douglas fir are resistant to mortality from fire when in there natural condition class, these trees have become susceptible. Duff has accumulated to depths of nearly 1 foot deep around the base of large trees during the absence of fire. During a wildfire this duff smolders for long periods of time, killing some of the cambium and shallow roots. The combination of stresses on these trees from summer drought, overstocking in the understory and damage to the cambium is often enough to kill otherwise normally fire resistant trees.

Fire Regime and Condition Class – An analysis of the fire regime and existing condition class for the subwatershed was completed using the Forest Vegetation Simulator, Informs, and Photo Interpreted data. Table A-4 shows the results of that analysis. Most of the fire regime 1 areas are considered to be in condition class 2 based primarily on stand characteristics such as tree size, tree spacing, fuel load and a higher component of less fire dependent species such as white fir and lodgepole.

Table A-4. Fire Regime and Existing Condition Class.

Fire Regime	Condition Class	Percent of Tamarack Creek Subwatershed
Fire regime 1 Hot Dry and Warm Dry	1 - Least Departure 2 - Moderate Departure 3 - Most Departure	10 58 10
Fire Regime 3 Hot Moist	1 - Least Departure 2 - Moderate Departure 3 - Most Departure	2 1 0
Fire Regime 2 Grass and Non Veg.	Not Calculated	19

Fuels – Current fuel conditions in the project area are a result primarily of the exclusion of fire over the past 75 to 100 years, past silviculture treatments and livestock grazing. By missing as many as seven fire events in the past century, the area has experienced a build up of surface and ground fuels along with a higher proportion of less fire dependent tree species. Nearly all stands within the project area have had some form of active management in the past 50 years. Past silviculture treatments targeted larger trees for removal, primarily ponderosa pine, leaving many stands now, with the exclusion of fire, overstocked with small diameter ponderosa pine or in the more mixed conifer stands, with higher dominance of white fir. Many of the pure ponderosa pine stands have been thinned in the past, but have now grown to become overstocked again. Grazing has reduced the fine fuels in the form of grasses which reduces the rate of spread and thus, the size fires reach before they are contained. The combination of these management activities has changed the natural composition, arrangement and size of the surface fuels and crown fuels.

- ***Surface Fuels –*** Surface fuels vary wildly across the project area. An inventory of surface fuels was completed in the summer of 2007. The photo series method was used. Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest (GTR-PNW-105) was used for this inventory. Most stands (>75%) have light surface fuel loads. These areas are best represented with photo 2-PP-3. Fuel models 2 or 9 are best to model fire behavior in these areas. Many of these light fuel load stands are within the Cottonwood prescribed underburn area. The moderate concentrations of surface fuels found in some stands (<20%), is from insect induced mortality and past harvest activities. Photo 8-PP-3 is the photo used to represent these

moderate fuel areas and fuel model 10 is the best model for fire behavior predictions. These moderate fuel load areas are scattered throughout the project area. Areas with high fuel loads (<5%) are best represented with photo (4-PP-3) and the most accurate fire behavior predictions are gained by using fuel model 11. Duff levels over much of the project area range from .25" to 1" in depth. The exception is directly under the larger ponderosa pine trees. Bark from ponderosa pine constantly flakes off and accumulates within the first few feet of the bole of the tree. With the exclusion of fire over the past century these bark flakes have reached depths of up to 12" under much of the larger ponderosa pine. When these duff mounds burn completely, under low moisture conditions, high stress can be placed on the tree.

- ***Crown Fuels –*** Through past harvest activities and the effects of fire exclusion, stand structure over much of the project area has moved from primarily single storied stands with large trees to overstocked stands with multiple stories of mid size and small trees. Many stands have converted to higher proportions of white fir which is much less fire resistant than ponderosa pine and Douglas fir. Canopy base height is low enough and canopy bulk density is high enough in many forested stands that with current surface fuel conditions, there is potential for passive crown fire on 40% of the area and active crown fire on approximately 11% of the area. Much of the larger ponderosa pine and western larch in the project area have smaller grand fir and Douglas fir growing as ladder fuels underneath.

Expected Fire Behavior – Fire behavior was modeled using potential extreme weather day variables with existing vegetation and surface fuel data. Crown fire behavior is calculated based on surface fuel loads, canopy bulk density, canopy base height, slope, surface and foliar fuel moisture and wind. Using these variables predictions on crown fire initiation can be made for each stand for a particular weather scenario. Stands with a crown fire initiation of low to medium are expected to burn primarily as a surface fire. Stands with a crown fire initiation of high to extreme are expected to burn with some amount of canopy fire involvement.

Currently 51% of the project area can be expected to burn with either passive or active crown fire. This is uncharacteristic for the historical fire regime of much of the project area. Long range spotting can be expected along with flame lengths that exceed the suppression capabilities of the initial attack firefighters. Surface fires are predicted on 49% of the area, even under extreme fire weather conditions. In the Warm Dry Biophysical Environment, fire that burns primarily as a surface fire is the desired fire type. For these areas to remain in this condition, prescribed fire is needed every 10-15 years to maintain the stands. Fire maintains these stands by killing some of the regeneration and reducing accumulations of surface fuels and duff. Without maintenance burning, these stands will quickly become susceptible to crown fire. Many of the stands that are modeled predicting surface fires may still exhibit high mortality in the overstory. These stands still have fairly high surface fuel loads and a higher percentage of non fire dependent tree species.

Road Density – Current open road density in the Tamarack Creek Subwatershed is 4.01 miles per square mile. The greatest distance from any open road within the subwatershed is less than a half mile. At this road density, access and response times are expected to be very good for fire suppression personnel.

Table A-5. Existing Condition Crown Fire Initiation Potential.

Crown Fire Initiation	Percent of Tamarack Creek Subwatershed
Extreme	0%
Very High	11%
High	40%
Medium	19%
Low	11%
Non Forest	19%

Table A-6. Existing Condition Fire Type.

Fire Type	Percent of Tamarack Creek Subwatershed
Active Crown Fire	11%
Passive Crown Fire	40%
Surface Fire	49%

Air Quality – The amount of hazardous particles generated from any burning increases as available fuels increase. Wildfires that burn during the dry summer months in stands with uncharacteristically high fuel loads will produce hazardous smoke particles that exceed PM 10 and PM 2.5 emission levels described as unhealthy in the State Implementation Plan of the Oregon Smoke Management Plan. Fires that burn in the tree canopy generates the highest amounts of hazardous smoke particles compared to fires that burn on the surface. Smoke produced from other burning, such as prescribed fire, is monitored and managed by the State of Oregon to meet the requirements of the Clean Air Act.

Proposed Fuels Treatments

Fuel treatment activities proposed for both action alternatives are designed primarily to (1) Reduce horizontal and vertical loading, and continuity of hazardous fuels, in an effort to reduce the risk of high severity wildland fire to the Tamarack Creek Subwatershed, (2) Reduce surface and canopy fuel loading and continuity within RHCAs including aspen stands to historical levels and (3) Reduce stand density in stands with a high risk for bark-beetle and other insect attacks. To meet objective 1, potential fire behavior needs to be reduced to levels where fire fighters can safely contain a fire within the project area and in the event of an active crown fire approaching the project area, the continuity of hazardous fuels will be fragmented enough that fire type will become primarily a surface fire. Mechanical and burning treatments are not proposed on every stand in the project area that was diagnosed as needing treatments. To meet cover needs for big game and habitat requirements for sensitive wildlife species, many stands within the project are not being proposed for treatment. Mechanical treatments are scattered strategically throughout the project to help breakup the continuity of ladder and crown fuels. Underburning is proposed on large blocks to reduce surface fuels and begin the process of reintroducing fire into the ecosystem. The management tools being proposed for this project are, thin from below of trees less than 21”diameter at breast height (dbh), group selection, and low intensity underburning.

Thin From Below – This treatment is proposed for both action alternatives. Goals for thinning treatments involve reducing bark beetle risk, and pushing stands toward achieving the Historic Range of Variability in stand structures as soon as possible. This treatment will result in variable spacing of the larger trees in treated stands. Following treatments, canopy bulk density and ladder fuels will be reduced to varying degrees and will reduce the potential for crown fire and increase the overall health and vigor of the stands. In general, the thinning treatments would

involve cutting trees less than 21" dbh and would favor retaining the larger trees of a seral species over climax species.

Material generated from this treatment may be removed by mechanical methods as saw logs, chip or other biomass. Slash left in the units following this treatment that exceed levels considered safe for underburning will have further treatments as described below.

Group Selection – This treatment is proposed for Alternative 3 only. Group selection is being proposed in Alternative 3 in stands that have a high proportion of grand fir, but still have a mix of species including ponderosa pine, western larch, and Douglas-fir. The objective of this treatment is to move stands towards a more historical species composition, where fire-tolerant species were predominant. A portion of each of the stands would be thinned as with a commercial thinning prescription emphasizing removal of the grand fir and retention of all other species. There are however, areas within these stands that are entirely or almost entirely grand fir. This prescription allows for removing grand fir from these areas, creating openings through-out the stand with a focus on providing sufficient light to stimulate development of understory vegetation and regeneration of shade-intolerant species. Openings would not exceed 2 acres.

Material generated from thinning and group selection treatments may be removed by mechanical methods as saw logs, chip or other biomass. Slash left in the units following this treatment that exceed levels considered safe for underburning will have further treatments as described below.

Aspen Release – This treatment is proposed for both action alternatives. Goals for aspen release treatments are to reduce competition for light and nutrients from conifers in aspen stands. Conifers less than 21" dbh will be felled and trees in excess of large down wood needs would be removed where feasible. Alternative 2 does not propose any commercial removal within RHCA buffers while Alternative 3 does. Felled trees that remain on site will have the tops and limbs lopped and scattered. The boles of the trees will remain in total length. If a conifer is removed for commercial purposes, the whole tree including tops and limbs will be moved to a landing. Many aspen stands will be underburned following conifer removal to introduce the disturbance needed to induce suckering. Each aspen stand will then be assessed for the need for protection from browse and may be fenced.

Slash generated from the thinning, group selection and aspen release treatments, will be treated by the following methods. These fuels treatments are proposed in both action alternatives.

FMT – Mechanical fuel treatments will consist or either moving the material to a landing for future utilization or grapple piling of activity fuels using a low ground pressure excavator with a grapple head. Mechanical fuel treatments will only occur on slopes less than 35%. This treatment is planned when the levels of activity fuels are expected to exceed levels safe for underburning. In areas where slash is piled, the piles are approximately 10 feet by 16 feet in size. The piles are then burned in the early winter to minimize fire spread and reduce scorching on the residual stand.

FHB – Handpiling of activity fuels. This treatment is planned for units with slopes greater than 35%. Handpiles are approximately 6 feet by 6 feet in size. These piles are then burned when the ground is wet to minimize fire spread.

LS – Lop and scatter of activity fuels. Fuels are scattered so that underburning can be safely applied with low severity and intensity.

FUB – Fuels Reduction Underburn. In this treatment, low intensity prescribed fire (flame lengths < 2') would be used to reduce downed woody fuel loadings, reduce stocking in small diameter trees, and raise crown heights by killing lower tree branches.

Direct mortality from low intensity underburning will be highest in the non fire dependent species such as grand fir and lodgepole, and to a lesser extent Douglas fir. Mortality may be seen in grand fir up to 12" dbh. Mortality in the more fire dependent species, such as ponderosa pine and western larch will primarily occur in the 6" dbh and smaller size classes. As dead trees begin to fall, they will begin to contribute to the surface fuel load.

This treatment will result in increasing canopy base height, reducing surface fuel loads and reducing duff depth.

Road Closures – The road closures are proposed for both action alternatives. This project proposes to close (26.3 miles) or decommission (11.7 miles) for a total of 38 miles of road. The average length of road to be closed is .46 miles with the longest being 1.97 miles.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Fire Hazard – The effect of no action would be to see increased potential for uncharacteristic, crown fire behavior across the project area. With increases in ladder fuels from the high stocking levels in the understory, low canopy base height, and high canopy bulk density, the expected fire behavior for much of the project area is not of low severity surface fires, as it was historically but has the potential for high severity effects to the vegetation and soils.

If a wildfire occurs, the hazard of erosion would greatly increase on severely burned areas due to inadequate ground cover and possibly hydrophobic soil. In addition nutrients and organic matter would be lost.

Large ponderosa pines would continue to be vulnerable to mortality from wildfires due to deep accumulations of duff that has built up and would continue to build around the base of the boles and due to ladder fuels. They are also threatened by the current overstocking. This overstocking would increase under this alternative. Forested areas on Douglas-fir and grand fir sites that historically were dominated by ponderosa pine would continue toward their climax vegetation. Native shrubs and other native ground vegetation in the project area are adapted to low severity fire. The absence of low severity fire has had adverse effects on these plants that have also been adversely impacted by the shading and competition from conifers. When wildfires occur, the severity would be greater with this alternative, possibly killing plants that would otherwise have the ability to sprout after a low severity fire.

Fire Regime and Condition Class – 78% of the project area is classified as fire regime 1. Of this, most of the area is at some level removed from its historic condition for low severity with high frequency fire. The effect of no action would be to continue the departure from historic conditions of species composition, stocking levels, fuel loads and median tree sizes and ages in all of the fire regime 1 stands. In the long term the potential for increased tree mortality from bark beetle attacks, increasing ground fuel loads, will add to the departure from the historic

condition. This departure leaves the project area at high hazard for uncharacteristically high severity fires.

Table A-7. Change in Condition Class (No Action) in 20 Years.

Fire Regime	Condition Class	Percent of Tamarack Creek Subwatershed (2009)	Percent of Tamarack Creek Subwatershed (2029)	Percent Change in 20 Years
Fire regime 1 Hot Dry and Warm Dry	1 - Least Departure	10%	3%	-7%
	2 - Moderate Departure	58%	47%	-11%
	3 - Most Departure	10%	28%	+18%
Fire Regime 3 Hot Moist	1 - Least Departure	2%	2%	0%
	2 - Moderate Departure	1%	1%	0%
	3 - Most Departure	0%	0%	0%
Fire Regime 2 Grass & Non Veg	Not Calculated	19%	19%	0%

As seen in Table A-7, 18% of the area moves from condition class 1 or 2 into condition class 3 over the next 20 years under the No Action Alternative.

Fuels – Surface fuels are expected to continue to increase over the next 10 to 20 years from natural pruning of lower limbs, needle fall, insects, disease, and wind damage. Depending on the amount of mortality from future bark beetle attacks, overall surface fuel loading may increase significantly. Duff levels around the larger ponderosa pine will remain at high levels.

Canopy fuels and ladder fuels will continue to increase with less fire adapted species such as white fir, and over stocking of Douglas fir and ponderosa pine seedlings and saplings. There will be a continued buildup of ladder fuels under the larger ponderosa pine. Canopy base height will become lower and canopy bulk density will continue to increase.

Expected Fire Behavior – The effect of no action will be to see increased potential for uncharacteristic, crown fire behavior. With increases in ladder fuels from the high stocking levels in the understory, low canopy base height, and high canopy bulk density, the expected fire behavior for much of the project area is not of low severity surface fires, as it was historically but has the potential for high severity effects to the vegetation and soils. The following Tables, A-8 and A-9 show the change in crown fire initiation potential and expected fire type with no action.

Table A-8. Crown Fire Initiation Potential with No Action in 20 Years.

Crown Fire Initiation	Percent of Tamarack Creek Subwatershed Current Condition	Percent of Tamarack Creek Subwatershed 2029	Percent Change in 20 Years
Extreme	0%	4%	+4%
Very High	11%	25%	+14%
High	40%	30%	-10%
Medium	19%	18%	-1%
Low	11%	4%	-7%
Non Forest	19%	19%	0%

Table A-9. Fire Type with No Action in 20 Years.

Fire Type	Percent of Tamarack Creek Subwatershed Current Condition	Percent of Tamarack Creek Subwatershed 2029	Percent Change in 20 Years
Active Crown Fire	11%	29%	+18%
Passive Crown Fire	40%	30%	-10%
Surface Fire	49%	41%	-8%

Road Density – No changes from existing condition. At this road density, access and response times are expected to be very good for fire suppression personnel.

Air Quality – Due to continued increase in available canopy fuels, duff and surface fuels, smoke produced from a large wildland passive crown fire exceeds PM 10 and PM 2.5 emission levels described in the State Implementation Plan of the Oregon Smoke Management Plan as unhealthy.

Alternative 2 – Proposed Action

Fire Hazard – In this alternative, 7,236 acres are treated to reduce fire severity and intensity and improve overall forest health with a combination of thin from below and low intensity under-burning. While treatments do not treat all of the high fire severity stands, the stands that are treated, break up the continuity of hazardous fuels across the project area. There are still many stands that have the potential to burn with a high severity crown fire. The treatments proposed with this alternative including the maintenance of past thinning and underburning reduces the overall fire hazard.

Approximately 1,140 acres of late and old structure stands are treated with a combination of thin from below and/or underburning. These treatments reduce the understory competition and duff accumulations reducing the stress placed on these trees from a potential summer wildfire.

Aspen release treatments will have little effect on overall fire hazard due to the small size of each of the aspen stands.

Fire Regime and Condition Class – Table A-10 shows there is 15% change in condition class of stands in condition class 3 towards condition class 1 and 2 across the Tamarack Creek Subwatershed. The modeling for this project does not include future underburning at 10-15 year intervals which is needed to continue moving the condition class towards condition class1.

The areas treated with this alternative begin to further depart from the desired condition class within the first 10-15 years due to regeneration without some form of maintenance treatment.

Table A-10. Change in Condition Class (Alternative 2) in 20 Years.

Fire Regime	Condition Class	Percent of Tamarack Creek Subwatershed No Action 2029	Percent of Tamarack Creek Subwatershed Alternative 2 2029	Percent Change in 20 Years
Fire regime 1 Hot Dry and Warm Dry	1-Least Departure 2-Moderate Departure 3-High Departure	3% 47% 28%	8% 57% 13%	+5% +10% -15%
Fire Regime 3 Hot Moist	1-Least Departure 2-Moderate Departure 3-High Departure	2% 1% 0%	2% 1% 0%	0% 0% 0%
Fire Regime 2 Grass and Non-Veg.	Not Calculated	19%	19%	0%

Surface Fuels – In the short term (1-5 years) surface fuel loads will become closer to historic conditions within the 6,557 acres treated with underburning. Following activity-fuel treatments and prescribed underburning, surface fuel loadings are expected to be within 5 to 10 tons per acre within treated stands. Larger size classes of down woody fuels will make up a majority of the total fuel loading but will be greatly reduced from current loading. The resulting fuel model used to predict surface fire behavior, in treated areas, would best be described as either fuel

model 8 or fuel model 2. Fuel model 8 has the least surface fire intensity of all of the fuel models. Fuel model 2 is a grass model that may have high fire intensities depending how soon the grasses and forbs respond under the residual tree canopy and the effect of continued livestock grazing. Fall burning will better meet objectives to reduce 0"- 3" surface fuel loads as fuel moistures are generally lower than in the spring, allowing near full consumption of the 0"- 3" size fuels. Fall burning will also consume more of the larger size classes of downed woody fuels. As part of the mitigation for retention of logs and snags, protection efforts during prescribed underburning will be used to reduce consumption of these large woody fuels needed for wildlife habitat.

Grasses and forbs are expected to increase after the first season. In late summer, as these plants cure, they become available as fine fuels in the event of wildfire. These fuels tend to burn with high intensity but with lower severity than dead woody fuels.

Duff depths are expected to decrease by as much as 50% following the underburning. Fall burning generally consumes more duff than spring burning as the duff layer has much higher moisture content in the spring. Stands with a large component of "old growth" trees will be burned in the spring or duff under large ponderosa pine trees will be assessed prior to burning and may be manually racked back from the base of the trees to reduce the risk of excessive cambium and fine root kill.

In the mid to long term (5-15 years), as small trees and limbs killed by the underburning begin to fall, surface fuel loads will start to increase again and would need to be managed with future underburning.

Canopy Fuels – In the short term, the combined effect of reducing the stand density in the thinned and underburned stands will greatly increase canopy base height (CBH) and reduce canopy bulk density (CBD). Ladder fuels, under residual stand will be reduced. The residual stand will consist of a higher proportion of fire dependant and adapted tree species.

The stands that receive underburning only will have an increased CBH, due to mortality in small diameter trees (ladder fuels) and scorching of lower limbs on residual stand. Mortality in small trees following spring underburning is generally higher than with fall underburning. In the spring, during bud burst, small trees are more susceptible to heat damage. A spring burn will better meet the objective to reduce small tree stocking. Fall burning generally exhibits increased consumption of surface fuels and duff.

In the long term with continued maintenance underburning and increased growth of residual stand, CBH will further increase and CBD will begin to decrease. Without continued maintenance burning, ladder fuels from natural regeneration of trees will begin reducing CBH.

Fire Behavior – In many stands, fire intensity is reduced after completion of the treatments. Areas with expected very high and high fire intensity are broken into smaller scattered areas. Future fire intensity will continue to decrease if maintenance underburning treatments continue.

In stands that receive the most canopy thinning, surface fire intensity and rate of spread may increase due to increased fine flashy fuels (cured grasses) and increases in effective wind speed. In the short term, fires occurring during extreme weather conditions will be primarily surface fires. Direct attack from ground forces will be more effective in most of the project area from reduced crowning potential. Fire severity will be much lower, with less mortality in the residual stand, and reduced soil impacts due to lower duff depths.

The proposed treatments in Alternative 2 move nearly 20% of the forested acres within the project area from some form of canopy fire to primarily a surface fire.

Table A-11. Crown Fire Initiation Potential (Alternative 2) in 20 Years.

Crown Fire Initiation	Percent of Tamarack Creek Subwatershed No Action (2029)	Percent of Tamarack Creek Subwatershed Alternative 2 (2029)	Percent Change From No Action
Extreme	4%	2%	-2%
Very High	31%	17%	-14%
High	37%	34%	-3%
Medium	22%	36%	+14%
Low	6%	11%	+5%

Table A-12. Fire Type with No Action in 20 Years.

Fire Type	Percent of Tamarack Creek Subwatershed No Action (2029)	Percent of Tamarack Creek Subwatershed Alternative 2 (2029)	Percent Change From No Action
Active Crown Fire	35%	19%	-16%
Passive Crown Fire	37%	34%	-3%
Surface Fire	28%	47%	+19%

Road Density – Alternative 2 proposed to close or decommission approximately 38 miles of currently open road. The roads proposed for closure are scattered throughout the project area and a majority of them are short, dead end spur roads. Access to most areas within the project area will only be minimally impacted for fire fighting resources. The greatest distance from any open road within the project area increases from the existing condition of less than a half mile to slightly more than a half mile. The open road density in the Knox Project Area will change from 4.01 miles per square mile to 2.8 miles per square mile. At this road density, access and response times are still expected to be very good for fire suppression personnel.

Air Quality – Smoke intrusions are not expected to impact the neighboring communities as a result of the prescribed burning. The prevailing winds are from the southwest, and will force the smoke to the northeast. The town of Unity, the closest community down wind is 30 air miles to the northeast of the project area, and is not expected to be impacted adversely since most of the smoke will be diluted. A west or northwest wind would be ideal to avoid any potential impacts. Burning should be planned for times when transport winds are sufficient to displace much of the smoke from the area. Smoke generated form pile burning is expected to only affect the surrounding area. These impacts are expected to be short lived. All burning will occur outside designated visibility protection periods set for Class I Wilderness Areas of July 1st to Sept. 15th. The following seven items the EPA felt should be addressed in NEPA documents if prescribed fire is planned for fuel treatment. (Regional guidance letter: June 1992). (Appendix VII, A, 3)

a. Describe alternative fuel treatments considered and reasons why they were not selected over prescribed fire.

Biomass will be utilized on approximately 1,102 acres of slash that otherwise would be piled and burned. The remaining 26 acres of slash cannot be utilized either due to slope restrictions or access. All landing piles will be available for chipping.

b. Quantify fuels to be burned (acres, tons, types).

There will be 6,557 acre of prescribed landscape burning, approximately 1,128 acres of handpile and grapple pile burning (if utilization does not occur). After commercial harvest, there will also be landing piles to be burned.

c. Describe types of burns (broadcast, piles, understory, etc.)

6,557 acres of prescribed landscape burning, approximately 1,128 acres of handpile and grapple pile burning (if utilization does not occur) landing pile burning

d. Describe measures taken to reduce emissions (fuels moisture content, site preparation, removal of some debris (PUM, YUM, whole tree yarding, etc).

Biomass can be utilized from approx. 1,102 acres. Piles will be burned after moisture has fallen to minimize spread and emissions. Landings will be available for utilization.

e. Quantify the amount of PM10 and PM2.5 emissions to be released. (Fastracs, consume)

Approximately 100-140 lbs/acre of PM2.5 and 120-180 lbs/acre of PM10 emissions produced from prescribed burning

f. Describe the regulatory/permit requirements for burning.

FASTRACS will be used to meet our requirement to report prescribed fire smoke management information to the State of Oregon. Registering, planning and reporting accomplishment of prescribed fire activities will be accomplished using FASTRACS.

g. Provide a description of air quality impacts of burning activities; focusing on new or increased impacts on down wind communities, visibility impacts in Class I Wilderness, etc.

Short term impacts are expected only in the surrounding area. The closest community is 30 miles from the project area and much of the smoke will be dissipated.

The proposed action would have a positive effect on the carbon cycle and climate change. The biomass that has accumulated is prone to be released back into the atmosphere by either combustion in a wild fire or by decomposition. Converting a portion of it into durable products like lumber or into paper that would eventually either be recycled or buried in a landfill would take that portion out of the atmosphere. Additionally, any biomass used for power generation would allow that amount of fossil fuels to remain sequestered in the ground.

Alternative 3

Fire Hazard – In this alternative, 7,668 acres are treated to reduce fire severity and intensity and improve overall forest health with a combination of thin from below, group selection and low intensity underburning. While treatments do not treat all of the high fire severity stands, the stands that are treated break up the continuity of hazardous fuels across the project area. There are still many stands that have the potential to burn with a high severity crown fire. The treatments proposed with this alternative including the maintenance of past thinning and underburning reduces the overall fire hazard.

Approximately 1,140 acres of late and old structure stands are treated with a combination of thin from below or group selection and/or underburning. These treatments reduce the understory competition and duff accumulations reducing the stress placed on these trees from a potential summer wildfire.

Aspen release treatments will have little effect on overall fire hazard due to the small size of the aspen stands.

Fire Regime and Condition Class – Table A-13 shows there is 15% change in condition class of stands in condition class 3 towards condition class 1 and 2 across the Tamarack Creek Subwatershed. The modeling for this project does not include future underburning at 10-15 year intervals which is needed to move the condition class towards condition class 1.

The areas treated with this alternative begin to further depart from the desired condition class within the first 10-15 years due to regeneration without some form of maintenance treatment.

Table A-13. Fire Regime – Change in Condition Class in 20 Years (Alternative 3).

Fire Regime	Condition Class	Percent of Tamarack Creek Subwatershed No Action 2029	Percent of Tamarack Creek Subwatershed Alternative 3 2029	Percent Change in 20 Years
Fire Regime 1 Hot Dry and Warm Dry	1 - Least Departure	3%	9%	+6%
	2 – Moderate Departure	47%	56%	+9%
	3 - Most Departure	28%	13%	-15%
Fire Regime 3 Hot Moist	1 - Least Departure	2%	2%	0%
	2 - Moderate Departure	1%	1%	0%
	3 - Most Departure	0%	0%	0%
Fire Regime 2 Grass and Non Veg.	Not Calculated	19%	19%	0%

Surface Fuels – In the short term (1-5 years) surface fuel loads will become closer to historic conditions within the 6,557 acres treated with underburning. Following activity-fuel treatments and prescribed underburning, surface fuel loadings are expected to be within 5 to 10 tons per acre within treated stands. Larger size classes of down woody fuels will make up a majority of the total fuel loading but will be greatly reduced from current loading. The resulting fuel model used to predict surface fire behavior, in treated areas, would best be described as either fuel model 8 or fuel model 2. Fuel model 8 has the least surface fire intensity of all of the fuel models. Fuel model 2 is a grass model that may have high fire intensities depending how soon the grasses and forbs respond under the residual tree canopy and the effect of continued livestock grazing. Fall burning will better meet objectives to reduce 0”- 3” surface fuel loads as fuel moistures are generally lower than in the spring, allowing near full consumption of the 0”- 3” size fuels. Fall burning will also consume more of the larger size classes of downed woody fuels. As part of the mitigation for retention of logs and snags, protection efforts during prescribed underburning will be used to reduce consumption of these large woody fuels needed for wildlife habitat.

Grasses and forbs are expected to increase after the first season. In late summer, as these plants cure, they become available as fine fuels in the event of wildfire. These fuels tend to burn with high intensity but with lower severity than dead woody fuels.

Duff depths are expected to decrease by as much as 50% following the underburning. Fall burning generally consumes more duff than spring burning as the duff layer has much higher moisture content in the spring.

In the mid to long term (5-15 years), as small trees and limbs killed by the underburning begin to fall, surface fuel loads will start to increase again and would need to be managed with future underburning.

Canopy Fuels – In the short term, the combined effect of reducing the stand density in the thinned and underburned stands will greatly increase canopy base height (CBH) and reduce canopy bulk density (CBD). Ladder fuels, under residual stand will be reduced. The stands receiving the group selection prescription will have small clumps of the much less fire dependent species removed. The residual stand will consist of a higher proportion of fire dependant and adapted tree species and the small openings will begin to regenerate with more fire adapted species.

The stands that receive underburning only will have an increased CBH, due to mortality in small diameter trees (ladder fuels) and scorching of lower limbs on residual stand. Mortality in small trees following spring underburning is generally higher than with fall underburning. In the spring, during bud burst, small trees are more susceptible to heat damage. A spring burn will better meet the objective to reduce small tree stocking. Fall burning generally exhibits increased consumption of surface fuels and duff.

In the long term with continued maintenance underburning and increased growth of residual stand, CBH will further increase and CBD will begin to decrease. Without continued maintenance burning, ladder fuels from natural regeneration of trees will begin reducing CBH.

Fire Behavior – In many stands, fire intensity is reduced after completion of the treatments. Areas with expected very high and high fire intensity are broken into smaller scattered areas. Future fire intensity will continue to decrease if maintenance underburning treatments continue.

In stands that receive the most canopy thinning, surface fire intensity and rate of spread may increase due to increased fine flashy fuels (cured grasses) and increases in effective wind speed. In the short term, fires occurring during extreme weather conditions will be primarily surface fires. Direct attack from ground forces will be more effective in most of the project area from reduced crowning potential. Fire severity will be much lower, with less mortality in the residual stand, and reduced soil impacts due to lower duff depths.

The proposed treatments in Alternative 3 move 17% of the forested acres within the project area from some form of canopy fire to primarily a surface fire.

Table A-14. Crown Fire Initiation Potential (Alternative 3) in 20 Years.

Crown Fire Initiation	Percent of Tamarack Creek Subwatershed No Action (2029)	Percent of Tamarack Creek Subwatershed Alternative 3 (2029)	Percent Change From No Action
Extreme	4%	1%	-3%
Very High	25%	13%	-12%
High	30%	28%	-2%
Medium	18%	29%	+11%
Low	4%	10%	+6%
Non Forest	19%	19%	0%

Table A-15. Fire Type (Alternative 3) in 20 Years.

Fire Type	Percent of Tamarack Creek Subwatershed No Action (2029)	Percent of Tamarack Creek Subwatershed Alternative 3 (2029)	Percent Change From No Action
Active Crown Fire	29%	14%	-15%
Passive Crown Fire	30%	28%	-2%
Surface Fire	41%	58%	+17%

Road Density – Alternative 3 proposed to close or decommission approximately 38 miles of currently open road. The roads proposed for closure are scattered throughout the project area and a majority of them are short, dead end spur roads. Access to most areas within the project area will only be minimally impacted for fire fighting resources. The greatest distance from any open road within the project area increases from the existing condition of less than a half mile to slightly more than a half mile. The open road density in the Tamarack Creek Subwatershed will change from 4.01 miles per square mile to 2.8 miles per square mile. At this road density, access and response times are still expected to be very good for fire suppression personnel.

Air Quality – Smoke intrusions are not expected to impact the neighboring communities as a result of the prescribed burning. The prevailing winds are from the southwest, and will force the smoke to the northeast. The town of Unity, the closest community is 30 air miles to the northeast of the project area, and is not expected to be impacted adversely since most of the smoke will be diluted. A west or northwest wind would be ideal to avoid any potential impacts. Burning should be planned for times when transport winds are sufficient to displace much of the smoke from the area. Smoke generated form pile burning is expected to only affect the surrounding area. These impacts are expected to be short lived.

All burning will occur outside designated visibility protection periods set for Class I Wilderness Areas of July 1st to September 15th.

The following seven items the EPA felt should be addressed in NEPA documents if prescribed fire is planned for fuel treatment. (Regional guidance letter: June 1992). (Appendix VII, A, 3)

a. Describe alternative fuel treatments considered and reasons why they were not selected over prescribed fire.

Biomass will be utilized on approximately 1,102 acres of slash that otherwise would be piled and burned. The remaining 167 acres of slash cannot be utilized either due to slope restrictions or access. All landing piles will be available for chipping.

b. Quantify fuels to be burned (acres, tons, types).

There will be 6,557 acre of prescribed landscape burning, approximately 1,270 acres of handpile and grapple pile burning (if utilization does not occur). After commercial harvest, there will also be landing piles to be burned.

c. Describe types of burns (broadcast, piles, understory, etc.)

6,557 acre of prescribed landscape burning, approximately 1,270 acres of handpile and grapple pile burning (if utilization does not occur) landing pile burning

d. Describe measures taken to reduce emissions (fuels moisture content, site preparation, removal of some debris (PUM, YUM, whole tree yarding, etc).

Biomass can be utilized from approx. 1,102 acres. Piles will be burned after moisture has fallen to minimize spread and emissions. Landings will be available for utilization.

e. Quantify the amount of PM10 and PM2.5 emissions to be released. (Fastracs, consume)

Approximately 100-140 lbs/acre of PM2.5 and 120-180 lbs/acre of PM10 emissions produced from prescribed burning

f. Describe the regulatory/permit requirements for burning.

FASTRACS will be used to meet our requirement to report prescribed fire smoke management information to the State of Oregon. Registering, planning and reporting accomplishment of prescribed fire activities will be accomplished using FASTRACS.

g. Provide a description of air quality impacts of burning activities; focusing on new or increased impacts on down wind communities, visibility impacts in Class I Wilderness, etc.

Short term impacts are expected only in the surrounding area. The closest community is 30 miles from the project area and much of the smoke will be dissipated.

The proposed action would have a positive effect on the carbon cycle and climate change. The biomass that has accumulated is prone to be released back into the atmosphere by either combustion in a wild fire or by decomposition. Converting a portion of it into durable products like lumber or into paper that would eventually either be recycled or buried in a landfill would take that portion out of the atmosphere. Additionally, any biomass used for power generation would allow that amount of fossil fuels to remain sequestered in the ground.

Cumulative Effects

For large fire behavior and condition class, the area of consideration for cumulative effects of the proposed action is past activities (refer to Appendix C) within 12 years within the Tamarack Creek Subwatershed. The average historic fire return interval for the majority (78%) of the watershed is 12 years. The Tamarack Creek Subwatershed is the logical break for considering cumulative effects for fire behavior. Ridge lines are often used by fire suppression forces as locations to contain a large fire. The first primary ridge line separating the Tamarack Creek Subwatershed from adjacent subwatersheds will most likely be used to contain a large fire that starts in the project area. Current and future activities will include foreseeable actions that are expected to occur in the subwatershed.

Fire Behavior and Condition Class – Several past management practices including harvest, fuels treatment, underburning and grazing activities have occurred in the Tamarack Creek Subwatershed that affected the condition class and overall fire behavior. Fuels from harvest activities were treated primarily by machine or hand piling followed by burning of the piles. In small scattered areas activity fuels were treated with broadcast burning, in preparation for planting. The 5,087 acres of underburning that occurred nearly 10 years ago has helped moderate fire behavior over much of the project area. The effects of this underburning are starting to be erased with an increase in regeneration of seedlings and accumulations of natural fuels. Past grazing has had the effect of reducing fine fuels in the form of grasses by late summer when fire weather is at its peak. This has helped moderate fire spread and intensity on several fire starts over the years which helps firefighters contain the fires while they are still small. The combined effect of these treatments along with the exclusion of low intensity, frequent fire, places the Tamarack Creek Subwatershed in the current condition as seen in Table F4, Fire Regime – Condition Class.

The cumulative effects of past activities along with the proposed actions of the Knox Project will be to improve the overall condition class of the subwatershed.

The entire Tamarack Creek Subwatershed has active livestock grazing allotments. As long as grazing continues in the future, fine fuels in the form of cured grasses will be altered from historic conditions. This action will reduce fire intensity over much of the project area and subwatershed increasing fire suppression capabilities on surface fires. The combined effect of

continued grazing added with the proposed action is improved fire suppression capabilities across the entire subwatershed.

Air Quality – To asses the cumulative effects of air quality, areas where smoke from the proposed action and other forest burning may combine to increase levels beyond the previously mentioned will be considered. The Prairie City Ranger District maintains a target of approximately 3,000 acres of fuels reduction burning per year. Of this, approximately 2,500 acres is jackpot burning or underburning and the rest is pile burning. To have a cumulative effect, other forest burning would need to occur within a day or two of the Knox Project burning and be somewhat upwind or down wind from each other. Beyond two days, smoke dissipates enough to reduce the potential for negative impact. Other planned forest underburning that could occur during the same season as the Knox Project underburning is the 16 Road Project approximately 4 miles to the north or the North Fork Underburn Project which is approximately 4 miles to the northeast. In the event that either of these projects is implemented during the same season as the Knox Project, all underburning will be in compliance with the Clean Air Act.

Other pile burning will occur during the same time period as the pile burning planned for the Knox Project. All pile burning will also be in compliance with the Clean Air Act.

Burning of any kind will not occur unless prior approval is granted by Oregon Department of Forestry. All amounts of PM10 and PM 2.5 emissions will be calculated using the CONSUME software in the Fasttracks reporting system, which is also submitted with planned burn operations to the Oregon Department of Forestry to determine compliance with the Clean Air Act.

Irreversible and Irretrievable Commitments

There are no irreversible and irretrievable commitments to fuels resulting from the proposed action or alternatives.

Consistency with Direction and Regulations

Forest Plan and Fire Management Plan

The proposed actions and the effects of these actions meet the direction in the Forest Plan by managing fuel levels that will minimize the potential of high intensity, catastrophic wildfires and also results in a cost-effective protection program.

National Fire Plan

The proposed actions and the effects of these actions meet the direction in National Fire Plan primarily by reducing the threat to life and property from catastrophic wildfire and restoring natural ecological systems to minimize uncharacteristically intense fires.

Air Quality Regulations

State and federal air quality regulations will be followed. All burning will be done in accordance with the Oregon State Smoke Management Plan in order to ensure that clean air requirements are met.

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Fire Hazard, Fuels, and Air Quality Specialist Report located in the project record.

Forest Vegetation
Affected Environment

Introduction

This section describes terms relevant to understanding forested vegetation management and the effects of the proposed action on vegetation composition, density, and sustainability; structural stages; insect and disease; and aspen.

Definition of Terms

Mechanical Treatments – Vegetation changes done by mechanical cutting methods instead of by other means, such as prescribed burning.

Precommercial Thinning – Thinning in tree stands where the trees to be cut are not merchantable saw log sized material (1 to 9" dbh). The objective is to reduce ladder fuels, reduce the amount of live and dead fuels, and increase tree growth. Thinning would emphasize the retention of seral species, increasing their representation in some stands.

Commercial Thinning – This prescription would thin small/medium size trees (7 to 20.9" dbh) in immature forest stands by thinning from below to reduce stocking levels. The goal is to reduce canopy fuels, enhance individual tree growth, and to allow for the reintroduction of fire. Thinning from below means the majority of the trees to be cut are in the smallest diameter sizes (9 to 14" dbh) and relatively few trees would be cut in the medium diameters (15 to 20.9" dbh). Thinning would also emphasize the retention of seral species, increasing their representation in some stands.

Group Selection – Group selection is being proposed in stands that have a high proportion of grand fir, but still have a mix of species including ponderosa pine, western larch, and Douglas-fir. The objective of this treatment is to move stands towards a more historical species composition, where fire-tolerant species were predominant. A portion of each of the stands would be thinned as with a commercial thinning prescription emphasizing removal of the grand fir and retention of all other species. There are however, areas within these stands that are entirely or almost entirely grand fir. This prescription allows for removing the grand fir from these areas, creating openings throughout the stand with a focus on providing sufficient light to stimulate development of understory vegetation and regeneration of shade-intolerant species. Openings would not exceed 2 acres.

Biomass Utilization – Small diameter material is available for biomass removal. Felling precommercial trees by either mechanical harvester or chainsaw and taking the biomass material to a landing by a low ground pressure forwarder to then be utilized. The objective is to reduce ladder fuels by reducing the amount of live or dead fuels, and reduce stand densities to improve tree growth and vigor.

Aspen Treatments – Treatment of aspen stands includes the felling of conifers (less than 21" dbh) that are overtopping and shading out aspen of all sizes. Felled conifers would either be left on site or removed depending on location of the aspen stand as described under each Alternative description in Chapter 2.

Reference Condition - The vegetation resulting from conditions and disturbances that existed prior to European - American settlement, which began in the 1850s. Used as a baseline for "natural" conditions.

Current Condition - The current forest vegetation resulting from actions taken over the last 150 years, in combination with natural processes. Some of the actions include grazing, mining, logging, and fire suppression.

Desired Condition – Forest vegetation resilient to natural disturbances and where disturbances result in historic patch sizes.

Historic Range of Variation (HRV) – The percentage of each structural stage thought to have existed across the landscape before European - American settlement.

Plant Association Groups – (PAG) – Vegetation classification using similar moisture and temperature environments resulting in similar fire regimes.

Hot Dry Forest – Occupies low to mid elevations and mainly south slopes. Stands are composed primarily of ponderosa pine. Fire regime is low intensity, high frequency over most of the area, with small patches of mortality.

Warm Dry Forest – Occupy low to mid elevations and south slopes at higher elevations. Stands are composed of ponderosa pine, Douglas-fir, lodgepole, grand fir, and western larch. Fire regime is low intensity, high frequency (10-15 years) over most of the area, with small patches of mortality.

Warm Moist Forest – Similar to Warm Dry, but located in areas of more moisture with more shrubs such as ninebark, shrub maples, and oceanspray in the understory. Fire regime is low intensity, high frequency (10-15 years) over most of the area, with small patches of mortality. Not present in the Knox Project Area.

Cool Moist Forest – Occupy mid elevations, northerly aspects and cooler, wetter draw bottoms. Stands are composed of ponderosa pine, Douglas-fir, grand fir, lodgepole pine, western white pine, and western larch. Fire regime is mixed, with low intensity, high frequency (10-15 years) regime overlaid with a high intensity, low frequency (100-200 years) regime. Patch size would range from 200 to 2,000 acres. Not present in the project area.

Cool Dry Forest – Occupy mid to higher elevations, northerly aspects and cooler areas that are relatively dry. Stands are composed of ponderosa pine, Douglas-fir, grand fir, lodgepole pine, western white pine, and western larch. Fire regime is mixed, with low intensity, high frequency (10-15 years) regime overlaid with a high intensity, low frequency (100-200 years) regime. Patch size would range from 200 to 2,000 acres. Not present in the project area.

Cold Dry Forest – Occupy high elevation sites, northerly aspects, and colder, relatively dry areas. Stands are composed of Englemann spruce, subalpine fir, whitebark pine, and lodgepole pine and the fire regime is high intensity, low frequency (50-275+ years) with noticeable susceptibility to torching and crown fires. Not present in the project area.

Woodlands – Occupy dry sites at low to mid elevations, often on south slopes. Stands are historically open ponderosa pine savannahs and sparse western juniper.

Canopy base height – The lowest height above the ground at which there is a sufficient amount of canopy fuel to propagate fire vertically into the canopy.

Fire regime – A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human intervention, but including the influence of aboriginal burning (Agee 1993, Brown 1995). Coarse scale definitions for natural (historical) fire regimes have been developed by Hardy et al. (2001) and Schmidt et al. (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001). The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation.

Structural Stage – Classification of forest stands by developmental stage and size (Figure V-1).

Regulatory Framework

Malheur Forest Plan Direction and Standards

This section describes the Forest Wide Standards and Timber management constraints set forth in the Malheur National Forest Land and Resource Management Plan (Forest Plan), as amended.

Forest-Wide Standards

Forest Wide Standards and timber management constraints set forth in the Malheur National Forest Land and Resources Management Plan.

- Timber Management (Forest Plan, pgs IV-36-38)
- Unique and Sensitive Habitats - Aspen (Forest Plan, pg IV-31)

Regional Forester's Eastside Forest Plan Amendment 2

All timber sales will be designed to incorporate the interim riparian, ecosystem and wildlife standards as set forth in the Regional Forester's Eastside Forest Plan Amendment 2. These standards supersede previous Forest Plan and other management guidelines. The amendment incorporates three standards; riparian, ecosystem, and wildlife.

A Historic Range of Variability (HRV) analysis was completed for the Knox Project. Old Forest Single Stratum is not within HRV in any biophysical environment. OFMS is within HRV in both biophysical environments and is at the upper end of the range in the Warm Dry. Therefore, the Knox Project falls under Scenario A.

Under Scenario A, if one or both of the late and old structural (LOS) stages falls below HRV in a particular biophysical environment, then there should be no net loss of a LOS from that bio-physical environment. Timber sale activities are not allowed to occur within LOS stages that are below HRV. Some timber sale activities can occur within LOS stages that are within or above HRV in a manner that maintains or enhances LOS within that biophysical environment; or to manipulate one type of LOS to move stands into the LOS stage that is deficit, if this meets the historical condition.

Additional details on Regulatory Framework can be found in the Silviculture Specialist Report located in the project record.

Figure V-1: Description of Forest Structural Classes By Developmental Stage and Size.

Stand Initiation (SI). Following a stand-replacing disturbance such as wildfire or timber harvest, growing space is occupied rapidly by vegetation that either survives the disturbance or colonizes the area. Survivors literally survive the disturbance above ground, or initiate growth from their underground roots or from seeds stored on-site. Colonizers disperse seed into disturbed areas, the seed germinates, and then new seedlings establish and develop. A single canopy stratum of tree seedlings and saplings is present in this class.

Stem Exclusion (SECC or **SEOC)**. In this stage of development, vigorous, fast-growing trees that compete strongly for available light and moisture occupy the growing space. Because trees are tall and reduce sunlight, understory plants (including smaller trees) are shaded and grow more slowly. Species that need sunlight usually die; shrubs and herbs may become dormant. In this class, establishment of new trees is precluded by a lack of sunlight (**stem exclusion closed canopy**) or of moisture (**stem exclusion open canopy**).

Understory Reinitiation (UR). As a forest develops, new age classes of trees (cohorts) establish as the overstory trees die or are thinned and no longer fully occupy growing space. Regrowth of understory vegetation then occurs, and trees begin to develop in vertical layers (canopy stratification). This class consists of a sparse to moderately dense overstory with small trees underneath.

Young Forest Multi Strata (YFMS). In this stage of forest development, three or more tree layers are present as a result of canopy differentiation or because new cohorts of trees got established. This class consists of a broken or discontinuous overstory layer with a mix of tree sizes present (large trees are absent or scarce); it provides high vertical and horizontal diversity. This class is also referred to as "multi-stratum, without large trees" (USDA Forest Service 1995).

Old Forest (OFMS). Many age classes and vegetation layers mark this structural class and it usually contains large, old trees. Decaying fallen trees may also be present that leave a discontinuous overstory canopy. On Cool Moist sites without recurring underburns, multi-layer stands with large trees in the uppermost stratum may be present.

Old Forest (OFSS). Much age classes but only a single fairly distinct overstory layer marks this structural class and it usually contains large, old trees. Decaying fallen trees may also be present that leave a discontinuous overstory canopy. The diagram shows a single-layer stand of ponderosa pine that evolved with high frequency, low-intensity fire

Sources/Notes: Based on Oliver and Larson (1996) and O'Hara and others (1996). Modified, Tatum 2006

Analysis Method

Data for this report includes:

- Site visits by Prairie City Ranger District personnel during the fall and winter of 2006.
- Formal stand exam data collected by Prairie City Ranger District from 1988 to 2006. Exam data is located within the Field Sampled Vegetation (FSVeg) corporate dataset.
- 2005 National Agriculture Imagery Program 1 meter color resolution aerial photography.
- 2003 remotely sensed data (Landsat).
- Geographic Information System (GIS) layers for slope, aspect, elevation, Land and Resource Management Plan (Forest Plan) management areas, streams, riparian habitat conservation areas (RHCA), roads, property ownership, vegetation setting delineation, and past activity layers.
- The Malheur Land and Resource Management Plan (Forest Plan) including Regional Forester's Eastside Forest Plan Amendment Number 2.

Analysis includes:

- Stand attributes from sampled stands were imputed to non-sampled stands, treatment prescriptions developed, stand growth with and without treatments modeled, and potential fire intensities and severities modeled using INFORMS and the Forest Vegetation Simulator (FVS) programs.
- Forest vegetation found within Hot Moist Biophysical Environments is dominated by western juniper. Based on the juxtaposition of environmental gradients between forest vegetation found in the Hot Moist and Hot Dry forest type stands classified as Hot Moist will be analyzed with stands found in the Hot Dry forest types for the purpose of conducting a Historical Range of Variability analysis.
- The area for determining the Historic Range of Variation (HRV) is the 20,147 acres of National Forest System Lands within the 24,485 Tamarack Creek Subwatershed

Historic Conditions

Review of historical forest maps indicated that the Tamarack Creek Subwatershed was dominated by mature stands of ponderosa pine. A small portion of the subwatershed was occupied by immature pole size or seedling and sapling size pine while an even lesser portion was occupied by mature grand fir and lodgepole pine (Matz, 1927). Historical harvest activity occurred across the majority of the subwatershed between 1946 and 1970. Harvesting practices during this time period removed individual or small groups of mature ponderosa pine by using crawler-tractor machinery (Timber Management Atlas).

More recent harvest activities have occurred within the subwatershed between 1973 and 1996 where the majority of the stands were entered into with ground based harvesting systems. Harvest activities included clear cutting, overstory removal, salvage and commercial thinning activities. Stand tending activities have been limited to the reduction of harvest activity fuels with minimal entries for reforestation and timber stand improvements. The most recent management activity occurred between 1998 and 2001 with the application of prescribed fire in the northern portion of the subwatershed.

Warm Dry and Hot Dry Upland Forest Plant Association Groups

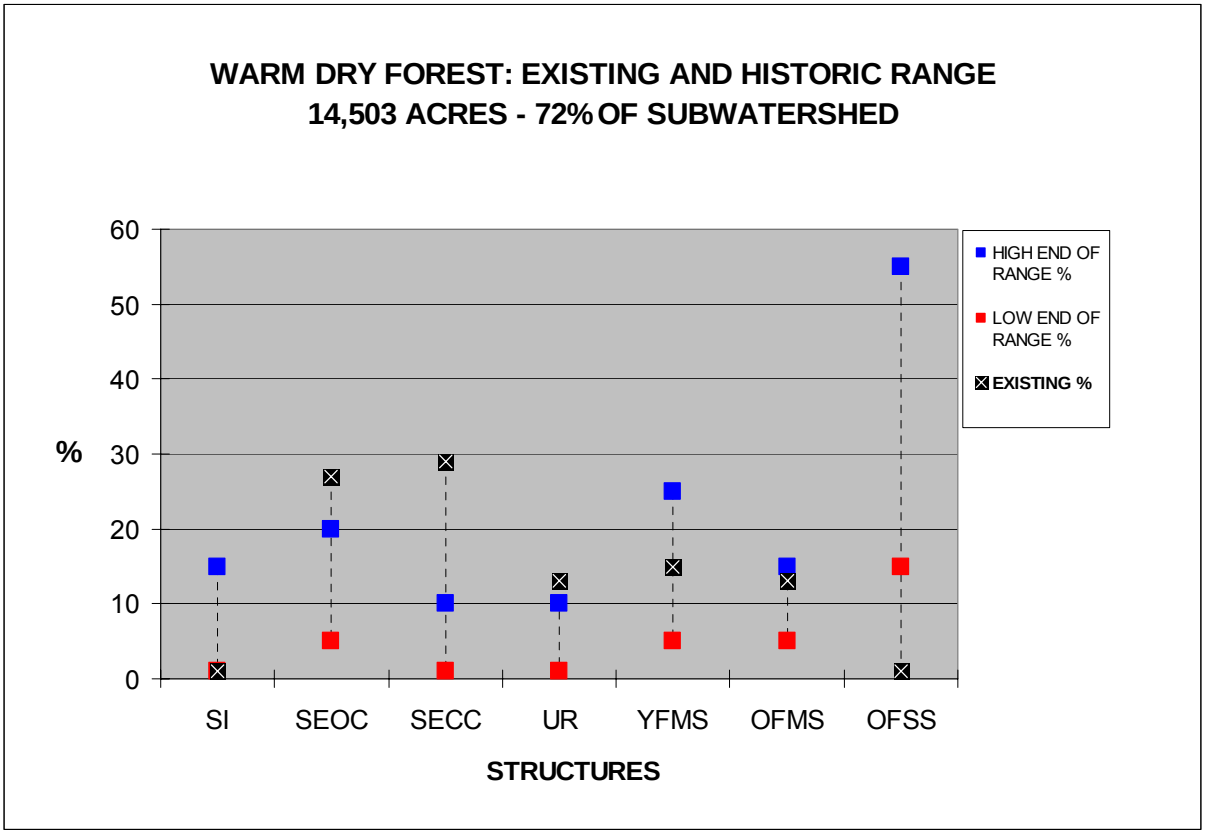
Biotic Conditions

The area for determining the Historic Range of Variation (HRV) is the 20,147 acres of National Forest System Lands within the 24,485 Tamarack Creek Subwatershed.

Table V-1. Forested and Non-Forested NFS Land within the Subwatershed

Vegetation Groups	Acres	Percent of Area	*Includes Hot Moist as described in the Analysis section above. Warm Moist, Cool Moist, Cool Dry and Cold Dry Forests are not present in the project area.
Warm Dry PAG	14,503	72%	
Hot Dry PAG*	1,830	9%	
Non-Forest Vegetation	3,811	19%	

Warm Dry and Hot Dry Plant Association Groups



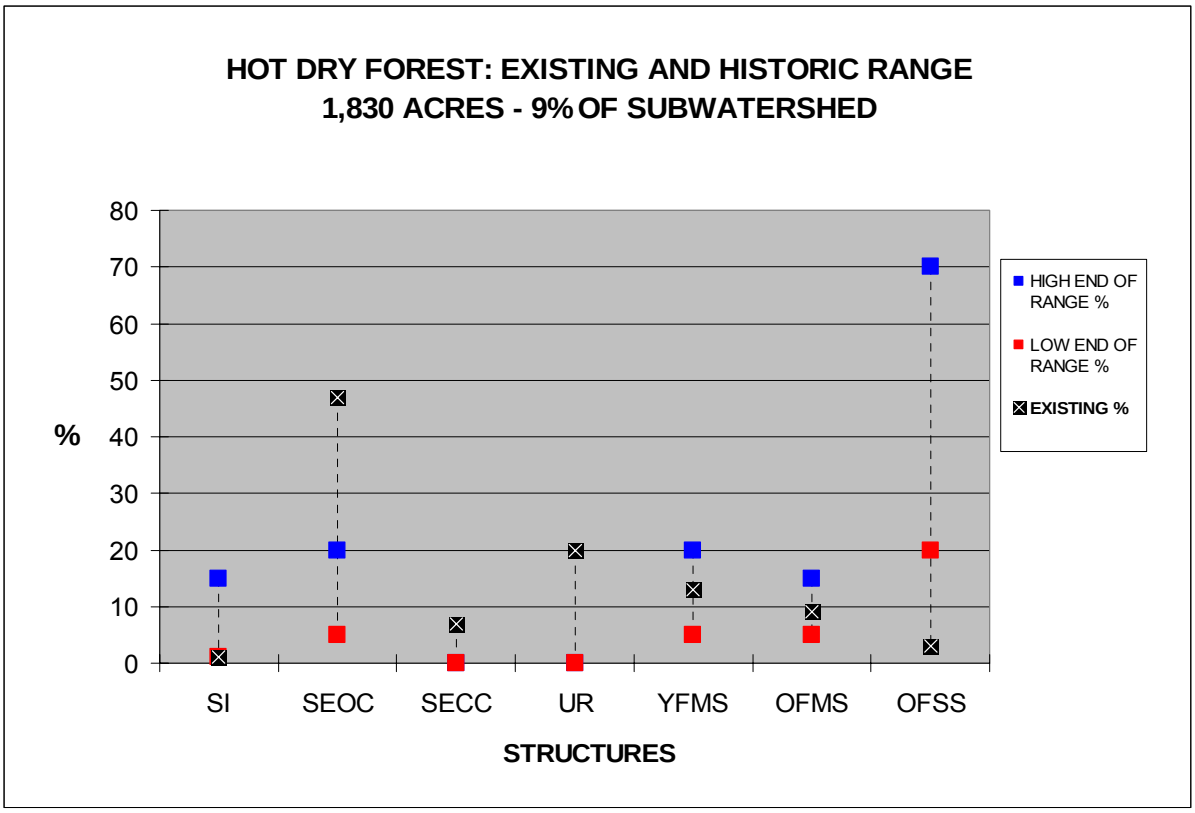
The structural stage characteristics of most importance displayed in the Warm Dry and Hot Dry HRV Graphs are:

- The OFSS structural stage is below HRV in both Plant Association Groups,
- The OFMS structural stage is within HRV in both Plant Association Groups,
- The SECC structural stage is above HRV in the Warm Dry PAG,
- The SEOC and UR structural stages are above HRV in the Hot Dry PAG.

Warm Dry forests are the most prevalent plant association group in the subwatershed. Hot Dry forests occupy far less area. Warm Dry forests occur on all aspects ranging from high to lower elevations. Hot Dry forests occur on southerly to flat aspects along mid to lower elevations.

Warm Dry forests are represented by an array of plant associations, indicating the wide range of environments they occupy. Species compositions range from nearly pure ponderosa pine to mixes of ponderosa pine, Douglas-fir, grand fir, western larch, and lodgepole pine. The Warm Dry forest includes most of the Douglas-fir plant associations and the drier grand fir plant associations (up to and including the grand fir/grouse huckleberry assoc.), since they all were subject to frequent, low intensity fires that maintained early seral species in the stands.

Species composition in Hot Dry forests include nearly pure stands of ponderosa pine to mixes where ponderosa pine is the dominant species and Douglas-fir, grand fir, western larch, and lodgepole pine occur in lesser amounts. The Hot Dry forests were subject to frequent, low intensity fires that maintained the ponderosa pine in the stands.



Species Compositions and Successional Development

The low intensity/high frequency disturbance regime common in these forest types favored fire resistant species (ponderosa pine, and to a lesser extent western larch and Douglas-fir) and development of more open stands with little vertical structure. Shade tolerant species (grand fir and Douglas-fir) were generally susceptible to these fires due to their thinner bark when young and persistent, low hanging crown characteristics. Smaller understory trees were vulnerable to periodic fires surviving in areas with too little fuels to carry a fire. The extent of these ground fires likely varied from small areas (less than 10 acres in size) to entire slopes covering thousands of acres depending upon the season, topography, and climatic conditions. The intensity also varied in response to vegetative conditions. Areas missed by frequent fires (wetter northerly aspects) developed conditions where subsequent fires could potentially be of moderate to high intensity, resulting in patches of stand replacement/regeneration.

Overall, the frequency of these fires made them an agent of stability in these forest ecosystems. They kept the ground vegetation dominated by fire adapted grasses (such as pine grass and elk sedge), while promoting and maintaining mature forest vegetation dominated by ponderosa pine.

Disturbance Processes

Warm Dry and Hot Dry forests have been affected by a variety of disturbances. These include: insects; diseases; fire; and human related disturbances such as timber harvest, fire suppression, and grazing. Fire is by far the major natural disturbance agent in dry forests. Other disturbance agents in this forest type include a variety of insects and diseases. In general, these disturbance agents added to the structural diversity of these stands by providing small areas/openings for understory vegetation to establish. Additional information about disturbance processes can be found in the Silviculture Specialist Report located in the project record.

Fire

Historic fire disturbance regimes in these forest environments can be best characterized as high frequency/low intensity. Fires started by natural ignition (i.e. lightning) or American Indian people burned in the form of underburns and small areas of lethal fires on a frequency of every 10-35 years in these forest types (Agee 1993, Hall 1977). Fire regimes have been identified for all plant associations occurring across the Blue Mountains. In addition, fire frequency with the percent of any fire that may be mixed severity or stand replacing has been identified. This acknowledges that the high frequency and low severity fire regime of the Warm Dry and Hot Dry Plant Association Groups included a component of mixed severity to stand replacing fire. The Fire and Fuels Section includes more information on fire regimes. These fires were agents of stability, helping to maintain stands with high proportions of fire tolerant species and large areas of relatively open park-like conditions. Small areas of denser forest patches occurred in areas missed or more resistant to fire (draws, spring seep areas, wetter aspects). The riparian habitat and upland aspen areas would have burned with slightly less frequency in a mosaic and with lower severity than the adjacent upland Warm Dry stands. These fires would have helped maintain the hardwood component of alder and aspen by knocking back conifer encroachment and inducing sprouting of new vigorous hardwoods.

Insects and Disease

Bark beetles are the most common insects present in the dry forests. The western pine beetle keys in on highly stressed larger overstory ponderosa pine. Denser stands with a high proportion of sapling to pole sized ponderosa pine have increased levels of mountain pine beetle and Ips beetle activity and associated mortality. Fir engraver activity is prevalent due to the combination of high stand densities and increased proportion of grand fir occupying these sites. At endemic levels, these forest insects play an important role in contributing to structural diversity, and providing dead wood habitat important for wildlife and soil productivity. Scattered individual tree mortality created small openings in stands where pockets of understory could establish. At epidemic levels, they create excessive dead fuel conditions that can lead to disturbance intensities outside the historic range.

The primary root diseases in dry forests are Annosus and Armillaria that result in small "centers" of mortality and associated gaps in the forest canopy. These areas provided openings for under-story vegetation (grasses, shrubs, and seedlings) to establish and added to structural diversity. Annosus root disease is most prevalent in stands previously entered with overstory and partial

overstory removal harvests. Annosus related mortality is usually associated with large old stumps and harvest related disturbance (skid trails). These past harvests resulted in varying degrees of disturbance to the soils and ground vegetation, facilitating the spread of Annosus root disease through wind-borne spores infecting large stumps. Mortality from the disease has been identified in both ponderosa pine and grand fir indicating that both the P-strain (pine strain) and S-strain (true fir strain) of the Annosus root disease are present.

Dwarf mistletoe is present in varying levels of infection. The brooms created by mistletoe infections predisposed the occasional tree to bark beetle attack or torching by fire. Thus, frequent fires likely helped keep overall levels of mistletoe low due to the "fire pruning" of infected branches and negative impacts of the heat and smoke on developing mistletoe plants.

Insects and diseases play an important role in creating structural diversity of snags and down logs, and providing important wildlife habitat and recycling nutrients ”locked up” in trees and logs to maintain soil productivity. At severe levels, these diseases can greatly inhibit the growth of trees and old forest structure.

Project Area Insect and Disease Review

The project area was reviewed by the Blue Mountains Entomologist. The recommendations are summarized below. The full report can be found in the project record.

- Because there is remnant large overstory ponderosa pine here, treat these stands as the highest priority. Thinning around the remnant trees will provide them with the moisture they need. The current overstocking around these trees has resulted in high risk of mortality from western pine beetles. Additionally, removing this material from around the trees will reduce the fuels and therefore the intensity of the inevitable fire around them that will enable them to survive.
- Thinning around intermediate pines will provide mature forests into the future. Some of these stands show evidence of previous fire and reintroducing fire will probably not be too difficult. Some of these densely stocked ponderosa pine stands have high hazard ratings for beetles and with mountain pine beetle populations increasing throughout the west, increased mortality where stands are overstocked could happen at any time.
- Reduce the proportion of budworm hosts, white fir and Douglas-fir, where they have replaced non-host pine to accomplish several things. If accomplished in the next 5-6 years it may reduce the impact of the current budworm outbreak and certainly will reduce that of the next one.
- Where dwarf mistletoes are present, intensity of infection must be evaluated. Western dwarf mistletoe in lower crowns of single-story stands of ponderosa pine has little effect on their growth and form. Western larch dwarf mistletoe can infect very young trees. Where over-story trees are moderately or severely infected, it is recommended that they be removed or girdled when understory larch has been established for about 7 years (Geils et al., 2002) to prevent heavier infections and earlier mortality occurring in the next generation. Douglas-fir dwarf mistletoe in multistoried stands generally indicates latent infection in the understory that will be expressed when the understory is exposed to higher light levels. These under-story trees cannot be relied on to provide the next generation of Douglas-fir. Where Douglas-fir dwarf mistletoe infections are heavy, conversion to other species may be the most viable option.

Aspen

Aspen is considered a shade-intolerant species and conifers have established and are overtopping the aspen in many stands. The aspen overstory of most aspen stands is single-storied and even-aged with many likely close to the end of their natural life cycle. Successful fire suppression has removed the disturbance agent that created a mineral soil seedbed and that limited conifer establishment. Many of the stands are still suckering but most suckers don't reach sapling size because of big game and cattle browsing.

These characteristics put most of the stands in the subwatershed in an OFSS structural stage (or a 80+ year old age class), the most prevalent on the Forest. The desired historic range of variation for this age class is just 5-10% of the landscape. The desired historic range of variation includes 45-50% of the landscape in 0 to 40 year age class (SI structural stage) and 45-50% of the landscape in 40-80 year age class (SE/UR/YF) structural stage.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

This alternative does not reduce or increase fuels by commercial harvest, precommercial thinning, mechanical surface fuel treatment, or prescribed fire. It does not change species composition, reduce stand density and the probability of insect caused mortality, or reduce conifers in aspen stands. The effects of no action include a continued shift away from the Historical Range of Variability (HRV) for most stand structures. There would be high amounts of multi-story structure in the dry forest. The current overstocking around the large ponderosa pine would continue leaving these trees at high risk of mortality from western pine beetles. Densely stocked ponderosa pine stands would continue to have a high hazard rating for beetles with increased potential for mortality. Stands that once had a high proportion of pine would continue to have a higher proportion of fir and as the budworm host; this would potentially affect the extent of the current budworm outbreak and any future outbreaks. Aspen would continue to disappear from the landscape as a result of conifer encroachment and browsing.

Composition, Density, and Sustainability

The effect of no action would be an increased potential for uncharacteristic, crown fire behavior. With increases in ladder fuels from the high stocking levels in the understory, low canopy base height, and high canopy bulk density, the expected fire behavior for much of the project area is not of low severity surface fires, as it was historically but has the potential for high severity effects to the vegetation and soils. The potential for an active crown fire increases by 18% over the next 20 years as described in Chapter 3, Fire Hazard, Fuels and Air Quality Section.

The forest is now mostly overstocked compared with historical levels except where recent management has thinned forest stands. Along with the overstocking, there has been a large increase in the proportion of Douglas-fir and true firs in both the Hot Dry and Warm Dry forest types due to both past harvest that removed the early seral species of large diameter and to the exclusion of fire that would have removed most of the fire susceptible species in favor of the fire resistant species of ponderosa pine and western larch.

Since there would be no treatment with Alternative 1 to reduce overstocking or to shift the species composition, the stands would continue to become more overstocked, growth would continue to slow, and the trees would become increasingly susceptible to disturbance from insects, disease, and fire. The more crowded and dense the timber stands become over time increases the likelihood and potential severity of disturbance events such as uncharacteristic wildfire. The overall resiliency to withstand natural disturbances would continue to decrease.

The sustainability of the forest would continue to decline and it would remain at risk to natural disturbances that have larger outcomes and are uncharacteristic of what occurred historically. Overstocked forest stands would continue to slow in growth and decrease in vigor as stand density continues to increase. Trees would slowly increase in size, but stands would remain multi-storied. The bulk of the stands which would grow into old forest would continue to be OFMS structural stage with very few growing into OFSS, continuing the imbalance compared to the HRV. In 50 years, OFMS structural stage would be above HRV in both the Warm Dry and Hot Dry PAGs as compared to this structural stage currently being within HRV in both PAGs. Late seral species would continue to increase occupancy in the mixed conifer stands. The quantity and vigor of grasses and shrubs in the understory would continue to decline due to the shading and competition for nutrients and water. The No Action Alternative does not address any of the recommendations of the Blue Mountains Service Center Entomologist. These recommendations are listed above under the Affected Environment discussion. The effects of not addressing the recommendations include reduced resiliency and sustainability of the large pine component the currently exists and of intermediate pines that are the future large tree component.

Structural Stages

In the Warm Dry and Hot Dry Plant Association Groups (PAG) there is currently a lack of old forest single story stand structure. Overstocked stands would result in slow growth rates, therefore the development of old forest stand structures would continue to develop slowly. In the Warm Dry PAG, Old Forest Single Strata increases from 1 to 6% and Old Forest Multi Strata increases from 13 to 37% in the next 50 years. In the Hot-Dry PAG, Old Forest Single Strata increases from 3 to 18% and Old Forest Multi Strata increases from 9 to 32% in the next 50 years.

Meanwhile, there is an increasing risk of large-scale, stand-replacing fires that would set back old forest development, resulting in large areas of young trees and longer time spans to develop old forest structures. Disturbances would continue to be at a larger scale than historically occurred, with “out of scale” adverse effects to water, fish, wildlife, vegetation, and other resources. Most structural stages would not be within the Historical Range of Variability (HRV). In the Warm Dry PAG, SEOC, UR, and YFMS would be within HRV in 50 years and in the Hot Dry PAG, only SEOC and YFMS would be within HRV. The old forest structural stages would still be outside of HRV in both the Warm Dry and Hot Dry PAGS.

Insect and Disease

Risk of attack by bark beetles would increase as the trees lose vigor and are less able to pitch out the beetles. Observations and research indicate that for some tree species and bark beetles, bark beetle activity is related to stocking levels and there is a critical stand density. Critical stand density differs by site; below this density bark beetle risk tends to be low and above this density, mortality can be serious (Cochran 1992, Cochran et al. 1994).

With no action, stocking levels would continue to be high and increasing. Stands currently considered at risk would continue to be at risk and more stands would reach the critical stand density. Where ponderosa pine is the dominant species in combination with heavily stocked stands, there is an elevated risk of mountain pine beetle and western pine beetle increasing to epidemic levels and killing large numbers of ponderosa pine trees in the subwatershed and project area.

Risk of outbreaks of defoliating insects would continue to increase as the stand composition continues to shift to more late seral species, as the late seral species like grand fir and Douglas-fir are much more susceptible to defoliating insects. Widespread defoliation and mortality would increase the fuel loads greatly. The dense, slow growing stands would remain a high risk for fir engraver attacks; further increasing mortality and fuel loading.

Dwarf mistletoe infections can be expected to increase as trees slow in height growth and the crowns grow closer together. Stem and root diseases would continue to spread in the host fir trees, causing increasing mortality and further adding to surface fuel loadings**.**

As mentioned above, The No Action Alternative does not address the recommendations of the Blue Mountains Service Center Entomologist. The effects of not addressing the recommend-dations include not reducing, and seeing an increase over time of the proportion of budworm hosts (white fir and Douglas-fir). The effects of not addressing the recommendations include; leaving the large ponderosa pine at high risk of mortality from western pine beetles, leaving densely stocked ponderosa pine stands at a high hazard rating for beetles with increased potential for mortality, and leaving fir dominated stands that are budworm hosts which would potentially affect the extent of the current budworm outbreak and any future outbreaks.

Aspen

The effect of no action would be a continued decline in aspen across the landscape. The majority of stands would continue to be in the older age class and OFSS structural stage, over representing this age class when compared to historic conditions. Conifers would continue to overtop the aspen and in time, they would disappear from these locations (Shirley et al. 2000). Aspen suckers would continue to be browsed by livestock and big game resulting in minimal successful development into larger size classes. Monitoring of aspen in the project area supports this as there has been a loss of two stands over the last few years.

Alternative 2 – Proposed Action

The proposed action is designed to; reduce the fire hazard by reducing surface, ladder, and crown fuels, improve stand health by reducing stand density and increasing early seral representation, and improve aspen health by reducing shading and competition by conifers. This alternative mechanically treats 12% of the forested area on National System Lands within the subwatershed to reduce fire hazard and improve forest health.

Commercial fuel reduction treatments would be accomplished by generally thinning the smaller diameter trees and retaining the larger trees at a variable spacing. There would also be some species conversion from fire and insect prone late seral species to more resistant early seral species both by selective thinning and by regeneration harvesting. The focus of the thinning would be largely on smaller diameter trees found either below the main forest canopy or within

the canopy where tree crown density would allow the spread of crown fire. Mechanical treatments would remove ladder fuels that carry fire into the tree crowns.

Non-commercial falling of small diameter trees would also reduce ladder fuels and the continuity of the tree crowns. This is proposed both within the areas treated by the commercial fuel reduction treatments and in areas where there is little commercial material but there is still a need to remove the smaller trees. Prescribed fire caused mortality and lower crown scorch would reduce ladder fuels. Conifer seedling mortality would reduce future ladder fuels and stand density.

Approximately 425 acres of OFMS (in both the Warm Dry and Hot Dry) would be converted to OFSS after activities of the Proposed Action. As a result of this conversion, 5% of the Hot Dry PAG would be OFSS and 4% of the Warm Dry PAG would be OFSS. This is still substantially below the HRV of 20-70% in the Hot Dry and 15-55% on the Warm Dry.

Composition, Density, and Sustainability

Commercial thinning in overstocked stands would enable the remaining trees to respond by increasing their crowns and roots, increasing their ability to utilize nutrients, sunlight, and water. Growth would increase and the trees would grow into old forest structural stages sooner. The increased vigor of the trees would decrease their susceptibility to disturbance from insects and disease; and lessen the likelihood and potential severity of bark beetle outbreaks and mistletoe infestation. Trees would be left at a varied spacing instead of a uniform spacing to enhance structural diversity while reducing fuel loadings. In addition, unthinned patches would be left within stands being treated. Higher tree density and unthinned areas should provide higher levels of security/hiding cover to wildlife in the short-term. These areas may also experience some level of insect mortality in the short to long term because of the higher density; however, any mortality would add snags. Lower density areas would open up forest stands, breaking up the fuel continuity. The overall decreased stand density, the increase in tree size, and the increase in the height to the bottom of the live crown would reduce the chances of torching and the potential of an active crown fire.

Mixed conifer stands would have a slightly higher proportion of early seral species as a result of the proposed action although fir would still be one of the predominant species. Species preference for removal is grand fir then Douglas-fir, moving stands closer to species composition before past harvest that removed the early seral species and before fire exclusion that would have removed most of the fire susceptible species. Since there would still be a high fir component and therefore spruce budworm host, this alternative partially addresses the objective of lowering the risk of spruce budworm.

Prescribed fire would occur on 6,557 acres. Prescribed burning activities would be low intensity and are not expected to change existing stand structures or canopy cover. Fire that burns primarily as a surface fire is the desired fire type. For these areas to remain in this condition, prescribed fire is needed every 10-15 years to maintain the stands. Fire maintains these stands by killing some of the regeneration and reducing accumulations of surface fuels and duff. Without maintenance burning, these stands would become susceptible to crown fire.

Prescribed fire would be ignited in some RHCAs and in others, low intensity fire may back into these areas during the burning operations from nearby uplands, since no fire lines are proposed along RHCAs. Past experience has shown that the different moisture regime in the RHCAs

moderates the fire behavior so that there are only minor effects to the streamside vegetation. Shrubs and conifers providing streamside shade are minimally affected since they do not burn with enough intensity to cause mortality. Some Category 4 RHCAs are almost entirely the same as the uplands and may burn the same as the uplands.

In the outer portions of the RHCAs where the moisture regime transitions into drier conditions similar to the surrounding uplands, the result is more of a mosaic of burned and unburned areas with some shrub and small conifer mortality. This creates an opportunity for more shrubs, which were adapted to sprout after frequent fires, to increase as the stands become more open.

Observations by Cram (2006) that mechanical treatment followed by prescribed fire (including pile burning) had the greatest influence toward mitigating fire severity. Specifically, as density and basal area decreased and mean tree diameter increased, fire severity decreased.

Structural Stages

Across the project area, structural stages would not show a great deal of change as a result of the proposed action as only 12% of the forested acres would be thinned. Additional acres identified as needing stocking levels or crown fire potential reduced, or acres identified with the potential to increase the early seral component were not included to meet other resource needs such as providing big game cover habitat. Proposed action treatment activities would result in increases in SEOC and UR keeping them above HRV but the improved growth of the treated stands would allow them to become OFSS sooner than if not treated. The percent of SECC and YFMS decreases as a result of the proposed action but these structural stages remain within HRV. Ladder fuels, crown fuels, and stand density are reduced in these treated stands. There is a 5% increase in OFSS as a result of thinning OFMS; however this LOS is still far below HRV in both PAGs.

Approximately 425 acres of OFMS (in both the Warm Dry and Hot Dry) would be converted to OFSS after proposed activities. As a result of this conversion, 5% of the Hot Dry PAG would be OFSS and 4% of the Warm Dry PAG would be OFSS. Thinning in 29 acres of OFMS would not result in a structural stage change but would enhance the larger trees by removing competing smaller trees. The structural diversity would be reduced in this stand and it would move towards OFSS. The OFMS would still be within HRV after the proposed activities. Precommercial thinning is 49 acres of OFSS would maintain the stands in their current structure. As a result of the proposed action, OFSS would still be far below HRV but higher than compared to the No Action Alternative.

The rest of the thinning treatments would not change the structural stage of the stands but would decrease stand density and increase tree growth rates. This would reduce the time required for stands to attain sufficient large trees to be considered late and old structure.

The increased tree growth from thinning would cause the development of old forest structural stages to accelerate, allowing the thinned stands to grow into the large size classes sooner as compared to the No Action Alternative. In the Warm Dry Plant Association Group, OFSS is projected to increase from 4 to 12% and OFMS from 11 to 39% in the next 50 years. At that point in time, OFSS would almost be within HRV and OFMS would be above HRV. In the Hot Dry PAG, OFSS is projected to increase from 5 to 35% and OFMS from 9 to 20% in the next 50 years. At that point, OFSS would be within HRV and OFMS would be above HRV.

Aspen

Aspen treatments include felling conifers under 21"dbh that are shading existing aspen including suckers. Commercial removal of conifers may occur in the upland aspen stands but would not occur in the aspen stands within RHCAs. As a result of the conifer felling, conifers would not be overtopping and shaded out the aspen. Felled trees would be left on site in RHCAs with tops and limbs being lopped and scattered. Within the upland aspen stands, conifer would either be removed or left on site with tops and limbs being lopped and scattered. Where removal occurs, fuel levels would be less than compared to when conifers are left on site. Commercial removal would improve the viability of the project. Underburning would occur in some of the aspen stands to stimulate suckering. Fencing the aspen stands when needed would protect them from browsing allowing the suckers to develop and the aspen stands to improve in health and vigor. These actions would enable the stands to reproduce and develop in an environment relatively free of competition from other more shade tolerant species. Across the subwatershed, there would be a wider representation of age classes and stand structures over time, moving closer to the HRV.

Insect and Disease

The additional light and warmth in thinned stands is inhospitable for bark beetles, providing an immediate degree of protection to the trees. As the trees respond with increased growth over the next several decades after the thinning, their increased vigor would allow them to withstand attempted beetle attacks by successfully pitching out the invading insects. As fewer attacks are successful, the population outbreaks would decrease to low levels, reducing the amount or size of pockets of mortality.

The host tree species for spruce budworm, tussock moth, and fir engraver would be reduced by thinning mixed conifer stands. Experience has shown that when late seral species make up less than 25% of the stand composition, defoliation is very light with little effect to tree growth or survival. Thinning in the mixed conifer stands would not reduce the fir component to less than 25% of the stand although the stands would have a higher proportion of early seral species as compared to No Action. Since there would still be a high fir component and therefore spruce budworm host, this alternative partially addresses the objective of lowering the risk of spruce budworm.

Alternative 3

This alternative is designed to; reduce the fire hazard by reducing surface, ladder, and crown fuels, improve stand health by reducing stand density and increasing early seral representation, and improve aspen health by reducing shading and competition by conifers. The differences between Alternative 3 and the Proposed Action Alternative include; change from commercial thinning to a group selection prescription on approximately 507 acres, change from commercial thinning to precommercial thinning on approximately 102 acres, change from commercial thinning to no treatment on approximately 586 acres, and allowing commercial removal of some of the conifers that are shading out the aspen within RHCAs. This alternative mechanically treats 11% of the forested area on National System Lands within the subwatershed to reduce fire hazard and improve forest health.

Commercial fuel reduction treatments would be accomplished by generally thinning the smaller diameter trees and retaining the larger trees at a variable spacing. There would also be some

created openings in group selection units of no more than 2 acres to reduce late seral species. The focus of the treatments thinning would be largely on smaller diameter trees found either below the main forest canopy or within the canopy where tree crown density would allow the spread of crown fire. Mechanical treatments would remove ladder fuels that carry fire into the tree crowns.

Non-commercial falling of small diameter trees would also reduce ladder fuels and the continuity of the tree crowns. This is proposed both within the areas treated by the commercial fuel reduction treatments and in areas where there is little commercial material but there is still a need to remove the smaller trees. Prescribed fire caused mortality and lower crown scorch would reduce ladder fuels. Conifer seedling mortality would reduce future ladder fuels and stand density.

The results of treatments in LOS stands are the same in this alternative as it is in the Proposed Action Alternative.

Composition, Density, and Sustainability

Treatments in overstocked stands would enable the remaining trees to respond by increasing their crowns and roots, increasing their ability to utilize nutrients, sunlight, and water. Growth would increase and the trees would grow into old forest structural stages sooner. The increased vigor of the trees would decrease their susceptibility to disturbance from insects and disease; and lessen the likelihood and potential severity of bark beetle outbreaks and mistletoe infestation. Trees would be left at a varied spacing instead of a uniform spacing to enhance structural diversity while reducing fuel loadings. In addition, unthinned patches would be left within stands being treated. Higher tree density and unthinned areas should provide higher levels of security/hiding cover to wildlife in the short-term. These areas may also experience some level of insect mortality in the short to long term because of the higher density; however, any mortality would add snags. Lower density areas would open up forest stands, breaking up the fuel continuity. The overall decreased stand density, the increase in tree size, and the increase in the height to the bottom of the live crown would reduce the chances of torching and the potential of an active crown fire.

Group selection in mixed conifer stands would remove all grand fir within no more than a 2 acre area. These openings would be in relation to existing early seral species to provide an area for natural regeneration of the early seral species. The rest of the stand would be thinned with a species preference for removal is grand fir then Douglas-fir. The group selection prescription would move stands closer to desired species composition than Alternative 2 as more fir would be removed. Seedbeds for natural regeneration of early seral species would be created and over time, the species composition would move even closer to the desired. This prescription also better addresses the objective of lowering the risk of spruce budworm because it removes more fir than Alternative 2. It is also consistent with the Blue Mountain Entomologist's recommend-dation to: reduce the proportion of budworm hosts, white fir and Douglas-fir, where they have replaced non-host pine. If accomplished in the next 5-6 years, it may reduce the impact of the current budworm outbreak and certainly would reduce that of the next one (Speigel, Schmitt 2008).

Prescribed fire would occur on 6,557 acres. Prescribed burning activities would be low intensity and are not expected to change existing stand structures or canopy cover. Fire that burns primarily as a surface fire is the desired fire type. For these areas to remain in this condition,

prescribed fire is needed every 10-15 years to maintain the stands. Fire maintains these stands by killing some of the regeneration and reducing accumulations of surface fuels and duff. Without maintenance burning, these stands would become susceptible to crown fire.

Prescribed fire would be ignited in some RHCAs and in others, low intensity fire may back into these areas during the burning operations from nearby uplands, since no fire lines are proposed along RHCAs. Past experience has shown that the different moisture regime in the RHCAs moderates the fire behavior so that there are only minor effects to the streamside vegetation. Shrubs and conifers providing streamside shade are minimally affected since they do not burn with enough intensity to cause mortality. Some Category 4 RHCAs are almost entirely the same as the uplands and may burn the same as the uplands.

In the outer portions of the RHCAs where the moisture regime transitions into drier conditions similar to the surrounding uplands, the result is more of a mosaic of burned and unburned areas with some shrub and small conifer mortality. This creates an opportunity for more shrubs, which were adapted to sprout after frequent fires, to increase as the stands become more open.

Observations by Cram (2006) that mechanical treatment followed by prescribed fire (including pile burning) had the greatest influence toward mitigating fire severity. Specifically, as density and basal area decreased and mean tree diameter increased, fire severity decreased.

Structural Stages

Across the project area, structural stages would not show a great deal of change as a result of Alternative 3 as only 11% of the forested acres would be mechanically treated. The structural stage changes are the same as under the proposed action even though this alternative treats approximately 586 fewer acres. Additional acres identified as needing stocking levels or crown fire potential reduced, or acres identified with the potential to increase the early seral component were not included to meet other resource needs such as providing big game cover habitat. Treatment activities would cause an increase in SEOC which would then be above HRV. Growth of the treated stands would increase, reducing the time to become OFSS than if not treated. The percent of SECC and YFMS decreases as a result of the proposed action but these structural stages remain within HRV. Ladder fuels, crown fuels, and stand density are reduced in these treated stands. There is a 2% increase in OFSS as a result of thinning OFMS; however this LOS is still far below HRV.

As in Alternative 2, approximately 425 acres of OFMS (in both the Warm Dry and Hot Dry) would be converted to OFSS after activities of the proposed action. As a result of this conversion, 5% of the Hot Dry PAG would be OFSS and 4% of the Warm Dry PAG would be OFSS. Thinning in 29 acres of OFMS would not result in a structural stage change but would enhance the old-growth trees by removing competing smaller trees. The structural diversity would be reduced in these stands and they would move towards OFSS, the treatment would not actually change structure. The OFMS would still be within HRV after the proposed activities. Precommercial thinning is 49 acres of OFSS would maintain the stands in their current structure. As a result of the Alternative 3, OFSS would still be far below HRV but higher than compared to the No Action Alternative.

The rest of the thinning treatments would not change the structural stage of the stands but would decrease stand density and increase tree growth rates. This would reduce the time required for stands to attain sufficient large trees to be considered late and old structure.

The increased tree growth from thinning would cause the development of old forest structural stages to accelerate, allowing the thinned stands to grow into the large size classes sooner as compared to the No Action Alternative. In the Warm Dry plant association group, OFSS is projected to increase from 4 to 12% and OFMS from 11 to 39% in the next 50 years. In the Hot Dry PAG, OFSS is projected to increase from 5 to 22% and OFMS from 9 to 30% in the next 50 years. At that point, OFSS would be within HRV and OFMS would be above HRV.

Aspen

Aspen treatments include felling conifers under 21"dbh that are shading existing aspen including suckers. More acres of commercially removal of conifers from aspen stands would occur under Alternative 3 than Alternative 2. Commercial removal of conifers would occur in the same upland aspen stands as Alternative 2 but also from some of the aspen stands within RHCAs. Within RHCAs, felled trees would be removed when design criteria are met and others would be left on site with tops and limbs being lopped and scattered. Within the upland aspen stands, conifer would either be removed or left on site with tops and limbs being lopped and scattered.

The effect of treating the aspen stands by felling conifers, whether removing them or leaving them on site, would be no overtopping and shading out of the aspen by conifers. This would likely result in a suckering response. Where removal occurs, fuel levels would be less than compared to when conifers are left on site. Commercial removal would improve the economics of the project. Underburning would occur in some of the aspen stands to stimulate suckering. Fencing the aspen stands when needed would protect them from browsing allowing the suckers to develop and the aspen stands to improve in health and vigor. These actions would enable the stands to reproduce and develop in an environment relatively free of competition from other more shade tolerant species. Across the subwatershed, there would be a wider representation of age classes and stand structures over time, moving closer to the HRV.

Insect and Disease

The additional light and warmth in thinned stands is inhospitable for bark beetles, providing an immediate degree of protection to the trees. As the trees respond with increased growth over the next several decades after the thinning, their increased vigor would allow them to withstand attempted beetle attacks by successfully pitching out the invading insects. As fewer attacks are successful, the population outbreaks would decrease to low levels, reducing the amount or size of pockets of mortality.

Group selection in mixed conifer stands would remove all grand fir within areas each no more than 2 acres within the stand. This prescription lowers the risk of spruce budworm more than the prescriptions in Alternative 2 because it removes more of the host species, fir. It is also consistent with the Blue Mountain Entomologist's recommendation to: reduce the proportion of budworm hosts, white fir and Douglas-fir, where they have replaced non-host pine. The Blue Mountain Entomologist said, if accomplished in the next 5-6 years it may reduce the impact of the current budworm outbreak and certainly would reduce that of the next one (Speigel, Schmitt, 2008). The incidence of fir engraver would also be reduced as the proportion of fir is reduced, and the remaining fir trees would be healthier and less susceptible to attacks. Stands not treated would benefit from the reduction of host species in nearby stands, which would lessen the severity and size of outbreaks. Stem and root diseases would be reduced since thinning would

reduce the primary host (late seral species). The removal of late seral species during the thinning operations would reduce the amount of trees susceptible to root diseases.

Cumulative Effects

All activities in Appendix C have been considered for their cumulative effects on vegetation. The area considered for cumulative effects is the Tamarack Creek Subwatershed. The time period considered for cumulative effects begins with the initial operations and continues for 50 years. The following discussion focuses on those past, ongoing, and foreseeable activities that may contribute effects to vegetation.

Past Final Removal, Overstory Removal and clearcut harvests, primarily during the 1980s, removed many of the large ponderosa pine with a number of timber sales including Cottam, Gotcha, Skagway, Leftover, Rim, Cougar, Pit, Panther, and BearMilk on a total of approximately 6,175 acres within the subwatershed. These harvests were accounted for in the Affected Environment and have contributed to the old forest structures departing from HRV. In addition, during the Cottonwood Prescribed Fire Project approximately 300 acres between Alder Creek and Cat Creek burned with moderate to high severity. This effected vegetation by the mortality it caused and the change in the structure of some stands.

Fire suppression, timber harvest, and grazing have contributed to the current conditions of vegetation and the departure from the HRV. These actions have resulted in increases in understory vegetation and surface fuels, changes in species composition and vegetative continuity. Past grazing reduced fine fuels at varying levels depending on the intensity of grazing which reduced potential fire spread contributing to missed fire cycles.

Grazing and hedging of aspen suckers as well as the changes in the natural disturbance regime have contributed to the current condition of aspen.

Road construction enabled fire suppression personnel to more easily access fire starts and contributed to successful fire suppression. Fire suppression would continue as an ongoing activity but would get increasingly more difficult as fuels increase.

The planned actions of both action alternatives, in combination with the past actions, would create a matrix of treated stands over much of the subwatershed. These treatments would serve to reduce the severity and extent of wildfire and also the chance of insects and disease reaching an outbreak situation. Disturbances within treated stands are expected to be reduced in intensity and duration, as a result of better growing conditions and a more resistant species mix. Disturbances in stands not treated would be smaller in geographic scope and more within historic scales as there would be less unbroken blocks of stands in unhealthy condition.

Future grazing would continue to affect fine fuels. This can impact the implementation of prescribed fire and meeting objectives if it removes the fuel (grasses) to carry fire. Future prescribed burning would be necessary to maintain fuels at desirable levels and limit ingrowth.

Irreversible and Irretrievable Commitments

There are no irreversible and irretrievable commitments to vegetation resulting from the proposed action or alternatives.

Consistency with Direction and Regulations

Forest Plan

The Proposed Action Alternative (Alternative 2) and Alternative 3 address Forest wide standards to apply integrated pest management principles to minimize the impacts of the mountain pine beetle, western spruce budworm, tussock moth, and other insect and disease infestations. Avoid the creation of vegetation conditions that could promote insect and disease infestations. The No Action Alternative does not address this.

Both action alternatives meets Forest Plan direction in General Forest and Big Game Winter Range to schedule timber harvest on the portion of the management area classified as suitable for timber management and emphasize even-aged silvicultural systems. Alternative 2 better meets this direction due only to the acres of Group Selection that would create small openings (2 acre maximum) to reduce the proportion of grand fir in these stands.

Regional Forester's Eastside Forest Plan Amendment 2 (Eastside Screens)

Both action alternatives meet the direction to maintain or enhance late and old structure under Scenario A as OFMS is within HRV and treatment would change the structure to OFSS (currently below HRV) or reduce density within OFMS to maintain the stand. No live trees equal to or greater than 21"dbh are to be harvested (except for incidental trees cut for road and landing construction and for safety). There are no treatments within the Amendment 2 connectivity corridors between old forest structure stands under either alternative.

Both action alternatives address the objective to protect existing old forest structure and to shorten the time to grow additional old forest structural stages, since thinning overstocked stands will increase growth rates and resiliency against loss to insects, disease, and fire.

Requirements of 36 CFR 219.28, which are part of the NFMA regulations, will be met. Specifically: 1) Harvest will occur only on suitable timberlands; 2) Following commercial activities under Alternative 2 reforestation activities will not be required as the stands will be fully stocked after commercial thinning and under Alternative 3 the small created openings in group selection stands will regenerate naturally.

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Silviculture Specialist Report located in the project record.

Terrestrial Wildlife

Affected Environment

Introduction

This section lists species and status of wildlife present in the Knox Project Area as well as existing conditions for terrestrial species and their habitat. This section determines direct, indirect and cumulative effects on terrestrial species and their habitat.

Regulatory Framework

The Malheur National Forest Land and Resource Management Plan (LRMP; USDA Forest Service 1990) (hereafter referred to as Forest Plan) contains Standards and Guidelines that must be met for specific Management Areas and wildlife habitats. The Regional Forester's Eastside Forest Plans Amendment 2 (USDA Forest Service 1995) amends some of the standards contained in the Forest Plan and establishes standards for old growth habitat, snag and downed wood densities, Northern goshawks, and habitat connectivity. The standards and guidelines in the Forest Plan, as amended, apply to the proposed activities contained in this analysis.

The Malheur National Forest Plan provides goals and objectives for four categories of wildlife species: threatened and endangered species; sensitive species; management indicator species and featured species.

Regional Forester's Sensitive Species List (Update): On January 31, 2008, Regional Forester Linda Goodman released an updated Sensitive Species List which includes federally listed, federally proposed and sensitive species lists.

In the cover letter for the updated species list (Regional Forester Linda Goodman, January 31, 2008) the Regional Forester states that projects initiated prior to the date of this letter may use the updated sensitive species list or the list that was in effect when the project was initiated. The Responsible Official for the project has authority to decide which list to use. "Initiated" means that a signed and dated document such as a project initiation letter, scoping letter, or Federal Register Notice for the project exists.

The Knox Project meets the criteria for "initiated" because the Project Initiation Letter (PIL) was signed on July 23, 2007. Therefore, this analysis will use the 2004 Regional Forester's Sensitive Species List.

Analysis Method

Information Sources and Methodology

A variety of models and methodologies were utilized to develop data and conclusions within the wildlife report. The following sources of information were used to complete the input provided in this wildlife report:

- Spatial data, data tables, graphics, maps and other information within and/or generated from information stored within the corporate Geographic Information System (GIS) data bases on the Prairie City Ranger District and Malheur National Forest, as well as

information stored in R-6 data bases. These sources are referenced in the analysis package for this project.

- The Habitat Effectiveness Model (HEI), an established and often used (as directed by the LRMP) elk habitat effectiveness model, was utilized for the analysis of alternatives.
- The Decayed Wood Advisor and Management Aid (DecAID, Mellen 2006) was used during this analysis to quantify the effect the proposed activities would have on snags and downed wood habitat.
- Wildobs database, identifying wildlife sightings reports and locations within the project area. This information is stored in the GIS database.
- Numerous publications, reports, scientific papers and personal communications with professional wildlife biologists and managers. Those utilized are documented and cited within the wildlife report and BE, as well as the EA.
- INFORMS is a decision support framework designed specifically for the Forest Service IBM platform. The acronym comes from "INtegrated FOrest Resource Management System." INFORMS was used to extrapolate stand exam data over the entire subwatershed.

Scale of Analysis

Generally, the scale of the analysis will be the Tamarack Creek Subwatershed (excluding privately owned lands). The Tamarack Creek Subwatershed will be referred to as the "analysis area" or the "project area." The analysis of big game cover (HEI), road density and distribution, stand structure, local connectivity, old growth, snag density (DecAID), downed wood, Neotropical Migratory Birds, birds of prey, and Management Indicator Species occurred at this scale. For consistency throughout this section of the document, references to the immediate, short, mid and long term will correspond to 0->=1 years, 1-5 years, 6-15 years, and 15+ years.

Existing Condition

Past Management Actions and the Current Project Area Description

Warm, dry plant association groups dominate the project area. Stands within the project area have Douglas fir, lodgepole pine, western larch, grand fir and ponderosa pine with ponderosa pine being the dominant tree species.

Past activities surrounding and within the project area included fire suppression, road construction, firewood harvest, livestock grazing and timber harvest. Past timber management decisions have resulted in the existing open road densities and vegetative conditions within the project area. These activities will be considered in the discussion of Cumulative Effects. The current state of open roads and the vegetative condition of the stands is relevant to consider in the analysis of the Knox Project in conjunction with other present and reasonably foreseeable future actions discussed later in this document.

Four grazing allotments, Spring Creek (1,040 acres), Ott (18,523 acres), Blue Bucket (176 acres), and Antelope (48 acres) are within the project and analysis area. Grazing of forest and rangeland in the Tamarack Creek area started in the late 1800s and continues, although the level of grazing in the late 1800s and early 1900s was much higher than the present. While livestock numbers have generally decreased in the subwatershed over the past 100 years, big game

numbers, particularly elk, have increased. The elk populations in the area since 1999 have met or exceeded Oregon Department of Fish and Wildlife Management Objectives (MOs) for the Malheur River Big Game Management Unit. Livestock and big game grazing has affected the amount and type of groundcover vegetation and regeneration of shrubs and aspen.

Timber harvest records show that intensive timber management has occurred in the Tamarack Creek Subwatershed since the early 1970s. Over the years, about 8,543 acres of the forested area within the subwatershed has had some kind of timber harvest. Almost no activity has occurred within the last 10 years. About 2,589 acres of the forested area has been treated within the last 20 years. These timber harvest activities removed larger overstory trees and left younger, smaller, more even-aged trees in the stands. Replacement of large, old forests with young dense forests resulting from timber harvest activities has created a higher fire hazard and increased risk of insect infestation. Table WL-1 summarizes past timber harvest activities and the number of acres affected within the Tamarack Creek Subwatershed.

Table WL-1. Previous Harvest within the Tamarack Creek Subwatershed.

Year	Sale Name	Treatment	Acres
1978	YOGURT	HPR	282
1983	COTTAM	HFR	1135
1983	GOTCHA	HCR	80
1983	GOTCHA	HFR	417
1983	OTT	HFR	425
1983	OTT	HTH	151
1983	SKAGWAY	HFR	213
1983	TERMITE	HTH	513
1984	GOTCHA	HCC	19
1984	OTT	HCR	24
1984	OTT	HFR	262
1984	OTT	HTH	94
1984	SKAGWAY	HFR	20
1985	COTTAM	HFR	56
1985	OTT	HCR	51
1986	LEFTOVER	HFR	216
1986	LEFTOVER	HPR	581
1986	RIM	HFR	975
1986	THREE_BEAR	HFR	441
1987	COUGAR	HFR	88
1987	LAZY	HFR	93
1987	LAZY	HPR	41
1987	LEFTOVER	HPR	544
1987	THREE_BEAR	HFR	87
1989	COUGAR	HFR	581
1989	COUGAR	HPR	63
1990	PIT	HOR	346
1991	BEARMILK	HOR	91
1991	PIT	HOR	540
1992	ALDER_ED	HPR	98
1996	PANTHER	HOR	17

Replacement of large, old forests with young dense forests resulting from timber harvest activities has created a higher fire hazard and increased risk of insect infestation. Since 1981 there have been 39 fire starts that were put out in 10 acres or less within the analysis area. Wildfires that have occurred in the analysis area have reduced hiding cover for big game, increased forage for big game, created snag and down wood habitat, and regenerated some aspen habitat.

Fire suppression has changed stand characteristics by increasing the density of small trees and increasing the kinds of tree species toward climax dominant species, such as grand fir. The increasing density of small trees and gradual change of tree species to less fire tolerant types, coupled with drought conditions in recent years, has increased the risk of wildfires and insect infestations. The changes in tree density and tree species have influenced the kinds of wildlife currently utilizing the habitat.

Features of the dry forest type, such as large down woody debris, large snags, and old-forest conditions, have diminished appreciably in ponderosa pine forests in Oregon, the Analysis area and the project area. Any decline in associated species, for which currently, there is no site specific data available, would be associated with a decline in habitat (Altman 2000.) There is insufficient sample size for many birds, specifically pileated, white-headed, and Lewis' Woodpecker and Flammulated Owl, for trend analyses in the Northern Rocky Mountains breeding bird survey physiographic region and the State of Oregon (Altman 2000). Harvesting of large, old overstory trees, salvage harvesting of insect infested trees and wildfire killed stands, fire suppression, and firewood harvesting have contributed to the decline in the availability of snag habitat and down wood. Many species of wildlife, including primary and secondary cavity-dependent species have been affected by the reduction of snag habitat for nesting and large down wood for hiding cover and foraging.

Aspen habitat has been steadily declining in the Knox Project Area. Regeneration of aspen habitat has been thwarted by fire suppression, grazing by livestock and big game, and encroachment of conifers. There may be a decline in aspen-dependent birds such as hermit thrush, flycatchers, sapsuckers or vireos as a result of decreased habitat availability but there is no local information to confirm or deny that.

Proposed, Threatened, and Endangered Wildlife Species

The effects determinations in this section are for all alternatives.

Canada Lynx (Lynx canadensis) – Threatened

Distribution

Oregon: The Canada lynx is considered extirpated from the State of Oregon.

Malheur National Forest: The Canada lynx is not known to currently occur within the Malheur National Forest. Detections, current or historic, have not occurred on the Forest. Historically, areas immediately adjacent to National Forest System lands had recorded sightings. Unconfirmed sightings have occurred on the Forest. In 2006 United States Fish and Wildlife Service (USFWS) determined that the Malheur National Forest is currently unoccupied by lynx.

Analysis Area: No detections or sightings of the Canada lynx have occurred in the analysis area.

Life History and Habitat

The Canada lynx typically inhabits higher elevation subalpine fir-dominated forests. Snow depth works to the advantage of this species, as it is adapted to living in deep, soft snow conditions. Prey is composed primarily of snowshoe hare, though the lynx will also prey upon other species such as the ruffed grouse, red squirrels, other leporidae species (rabbits and hares), and other rodents. Lynx typically spend much of their time associated with the early successional lodgepole pine thickets and hardwood thickets that are heavily used by snowshoe hares. Habitats with high densities of down wood material are used for denning.

Existing Habitat Condition

The project area is not within a Lynx Analysis Unit (LAU); the nearest LAU is approximately 4 miles to the north of the project area. The Knox Project Area could provide some dispersal habitat for lynx in the northern section.

The Lynx Conservation Agreement (CA) between the U.S. Fish and Wildlife Service was revised and amended in 2005 and 2006, and the FWS Recovery Outline was issued in September 2006. The 2006 amendment to the CA identified the Malheur National Forest as not occupied based on the results of surveys conducted there as part of the National Lynx Survey. The revision to the CA concluded that the Lynx Conservation Assessment and Strategy (LCAS) (under which Lynx Analysis Units (LAUs) were delineated) did not apply to habitat that was unoccupied by lynx. However, the CA amendment also states that the LCAS may provide useful information for FS managers to consider when making decisions regarding unoccupied, mapped lynx habitat. The Forest is included in "Peripheral Habitat" in the FWS Recovery Outline (pg 4):

> "In 'peripheral areas' the majority of historical lynx records is sporadic and generally corresponds to period following cyclic lynx population highs in Canada. There is no evidence of long-term presence or reproduction that might indicate colonization or sustained use of these areas by lynx. However, some of these peripheral areas may provide habitat enabling the successful dispersal of lynx between populations or subpopulations…"

Effects and Determination

The proposed action would not have an adverse cumulative effect on Canada Lynx or its habitat when combined with the effects of past, present, and reasonably foreseeable future activities. Because there are no direct or indirect effects to lynx, there are no cumulative effects from this project. While there is potential dispersal habitat within the project area; variable density, spacing, and connectivity corridors proposed in this project will provide for free movement of this species.

In 2006 United States Fish and Wildlife Service (USFWS) determined that the Malheur National Forest is currently unoccupied by lynx, so there will be **No Effect (NE**) to the lynx or its habitat in any of the alternatives for the following reasons:

- The Canada Lynx is not currently known to occur in the affected area or on the District.
- The project area is not within lynx primary or secondary habitat.
- The project is not in a LAU.

Gray Wolf (Canus lupis)

The northern Rocky Mountain gray wolf was listed as endangered on June 4, 1973, and a recovery plan was released in 1987. The United States Fish and Wildlife Service proposed to establish a distinct population segment (DPS) of the gray wolf (Canis lupus) in the Northern Rocky Mountains (NRM) of the United States. The proposed NRM DPS of the gray wolf encompasses the eastern one-third of Washington and Oregon, a small part of north-central Utah, and all of Montana, Idaho and Wyoming. The wolves' minimum recovery goal was to achieve at least 30 breeding pairs and 300 individual wolves for three consecutive years. This goal was achieved in 2002, and the population has continued to grow. Consequently, effective March 28, 2008, the US Fish and Wildlife Service removed the Northern Rocky Mountain population from the federal list of Endangered and Threatened Species under the Endangered Species Act (ESA).

On July 18, 2008, a federal judge granted a preliminary injunction on the de-listing of the Northern Rocky Mountain DPS for the gray wolf (Defenders of Wildlife et. al. vs. Hall et. al. (D. Mt.) (July 18, 2008). Endangered Species Act protections have been reinstated for the northern Rocky Mountain gray wolf pending final resolution of this matter on the merits of the case.

In the Knox Project, the gray wolf is analyzed as an endangered species.

Distribution

Oregon: This species has suspected reproducing wolves in the State of Oregon. Dispersing individuals from Idaho's experimental population have dispersed to Oregon.

Malheur National Forest: Dispersing individuals have been confirmed on the Forest. In 1999, a collared wolf (B-45-F) from the experimental, non-essential Idaho population was confirmed north of the analysis area near the Middle Fork John Day River, but was captured and returned to Idaho. Another wolf was found dead near Baker City in the spring of 2000 and another found shot in October 2000 north of Ukiah. Current flights to locate radio-collared wolves have not confirmed any evidence of wolves in Oregon. Flights occurred over the Malheur National Forest in April 2006. However, in the past 6 years large canid tracks have been seen and scat collected for analysis on the Malheur NF. It is postulated that while no denning habitat or packs of wolves have been located to present, individual wolves may be traveling through the Blue Mountains. This indicates that the three Blue Mountain Forests are probably suitable habitat for wolves. Wolves are not currently known to occur on the Malheur National Forest.

Analysis Area: No observations of the gray wolf have occurred in the analysis area.

Life History and Habitat

Wolves are a habitat generalist, occurring where sufficient prey resources and low levels of human disturbance are present. The availability of prey is the most important habitat indicator for this species. Gray wolves feed extensively upon large ungulates, including moose, Rocky Mountain elk, and mule deer. Seasonally, rodents, such as field mice, are also important prey/forage sources. Gray wolves are a pack animal. This allows the wolf to effectively hunt large ungulates. The location and seasonal movements of the prey often directly influence daily and seasonal movements of gray wolf. The greatest threat to individual gray wolves and packs is the adverse interaction between humans and wolves.

Existing Habitat Condition

The presence of moderate to high populations of big game (primarily elk) within portions of the analysis area indicates the potential for at least seasonal habitation by wolves. The elk populations in the area since 1999 have met or exceeded Oregon Department of Fish and Wildlife Management Objectives (MOs) for the Malheur River unit. Over time, wolves dispersing from the growing experimental, non-essential central Idaho wolf population could return to the Blue Mountains and establish packs. No observations of the gray wolf have occurred in the analysis area

Effects and Determination

The proposed action would not have an adverse cumulative effect on gray wolf or its habitat when combined with the effects of past, present, and reasonably foreseeable future activities. Because there are no direct or indirect effects to gray wolf, there are no cumulative effects from this project.

Wolves are limited by prey availability and are threatened by negative interactions with humans. Generally, land management activities are compatible with wolf protection and recovery, especially actions that maintain ungulate populations. Despite good populations of ungulates on the Malheur National Forest, no wolf populations currently exist and no denning habitat has been located, therefore, there will be **No Effect (NE)** to the gray wolf in any of the alternatives.

There are no other threatened or endangered species or their habitats in the analysis area.

Sensitive Wildlife Species

California Wolverine (Gulo gulo)

Distribution

Oregon: The California wolverine is found in higher elevation areas of Oregon, including the Blue Mountains. It is also suspected to occur in the Cascade Mountains.

Malheur National Forest: The presence of wolverine has been confirmed on the Malheur National Forest. Several reliable sightings, as well as a carcass of a juvenile wolverine found in the Strawberry Mountain Wilderness (north of the analysis area by 10.5 miles), indicate that this species is present on the Malheur National Forest.

Analysis Area: No observations of wolverine have been recorded in the analysis area. There is a potential that dispersing individuals of this species may occur in the Tamarack Creek Subwatershed. They are not suspected to occur in the project area (within treatment units) due to environmental and human-caused factors.

Life History and Habitat

This species is strongly associated with higher elevation alpine and coniferous forest habitats. The presence of avalanche chutes, boulder fields, and/or large piles of down logs are also important habitat features. Wolverine are considered a wide ranging carnivore. This species is known to travel long distances between summering and wintering areas. These movements are based largely on the acquisition of food sources, primarily carrion, though the wolverine will also hunt rodents. Individuals typically have large home ranges, ranging from 30 to over 300

square miles in size, depending upon abundance and distribution of prey sources.

Existing Habitat Condition

Periodically, throughout the 1990s, wolverine surveys were conducted across the district. During these surveys no wolverines or evidence of presence were documented. Potential reproduction habitat for the California wolverine is not present within the analysis area. Suitable habitat is primarily located within the Strawberry Mountain Wilderness Area, to the north-west in Cold Dry and Cool Moist subalpine fir-dominated habitats. At lower elevations outside the wilderness area, habitat suitability declines due to environmental factors (potential vegetation, biophysical environment, etc.) and the effects of human-related disturbance associated with the road and recreational trail system and past harvest. Potential habitat is present south of the wilderness boundary, but is generally restricted to habitat north of the 16 Road.

Effects and Determination

The proposed action would not have an adverse cumulative effect on wolverine or its habitat when combined with the effects of past, present, and reasonably foreseeable future activities. Because there are no direct or indirect effects to wolverine, there are no cumulative effects from this project. While there is potential dispersal habitat within the project area; variable density, spacing, and connectivity corridors proposed in this project will provide for free movement of this species.

At lower elevations outside the wilderness area, habitat suitability declines due to environmental factors (potential vegetation, biophysical environment, etc.) and the effects of human-related disturbance associated with the road and recreational trail system and past harvest. As the analysis area is located south of the 16 Road and potential habitat is not located within the analysis area; there will be **No Impact (NI)** to the wolverine in any of the alternatives.

Pygmy Rabbit (Brachylagus idahoensis)

Distribution

Oregon: The distribution of this species is generally limited to eastern Oregon. This species is associated with sagebrush-steppe habitats.

Malheur National Forest: The pygmy rabbit is suspected to occur on the Malheur National Forest.

Analysis Area: No observations of the pygmy rabbit have occurred in the analysis area. Because potential habitat is present, this species is suspected to occur in the analysis area.

Life History and Habitat

The pygmy rabbit is a sagebrush obligate species that inhabits sagebrush shrubland habitats. It uses stands of mature sagebrush shrubland for cover/security habitat and forage. The species will also consume green forbs and grasses in these habitats.

Existing Habitat Condition

Habitat for the pygmy rabbit is limited within the analysis area. Conifers (lodgepole pine and western juniper) are encroaching into these habitats and have likely contributed to reduced

habitat quality. Reduced canopy closure of shrubs resulting from grazing and other management activities has reduced the quality of sagebrush-steppe habitats in the analysis area.

Effects and Determination

The proposed action would not have an adverse cumulative effect on pygmy rabbit or its habitat when combined with the effects of past, present, and reasonably foreseeable future activities. Because there are no direct or indirect effects to pygmy rabbit, there are no cumulative effects from this project.

None of the proposed treatments occur within potential habitat for this species, so there will be **No Impact (NI**) to the pygmy rabbit.

Western Sage Grouse (Centrocercus urophasianus)

Distribution

Oregon**:** The western sage grouse historically occurred throughout central and eastern Oregon, inhabiting the abundant sagebrush steppe habitats that were present. Agriculture, urban and rural development, and the conversion of sagebrush steppe habitats to unsuitable conditions have restricted their range to the south-central and southeast regions of the state, where sagebrush steppe habitats are still intact.

Malheur National Forest: Sage grouse distribution on the Malheur National Forest is limited to the Prairie City and Burns Ranger Districts, with occasional presence on the Blue Mountain Ranger District. The fringe sagebrush steppe habitat on the southern end of the Malheur National Forest supports seasonal use by this species, mostly associated with the brooding of young.

Analysis Area: The western sage grouse is suspected to occur in the analysis area, associated with the sagebrush shrub habitats; however, there have been no observations of sage grouse within the analysis area. If present, habitat use would occur during late May through October, during which time hen sage grouse are brooding the current year's young.

Life History and Habitat

The western sage grouse is considered sagebrush obligate, due to its reliance upon sagebrush habitat for nearly all of their survival needs. Sagebrush habitat provides nesting cover, security cover from predators, and is an important forage source year round for this species (USDA 2001). The western sage grouse is known to have extensive home ranges, covering thousands to hundreds of thousands of square acres of habitat (USDA 2001 and USDI 2000). Populations that exhibit such large home ranges usually demonstrate seasonality in the use of those habitats, with specific areas that are used as mating/lekking habitat, nesting habitat, brood rearing habitat, and wintering habitat, with many of these habitat "components" separated by distances that may exceed 45 miles (USDI 2000). With these unique habitats, there are specific habitat requirements that are somewhat specific to their use. The presence of sagebrush is a common denominator, however, differences in canopy densities, presence of different forage species, adjacency to water, and other factors that play important roles in how each is used (USDA 2001 and USDI 2000).

Brooding females and offspring feed heavily upon specific forbs (dandelion, legumes, yarrow, wild lettuce, Hawk's beard), as well as insects (specifically beetles and ants) (USDA 2001, USDI

2000, and Fischer et al. 1996). Such habitats are often closely associated with and/or contain riparian and wet meadow habitats that provide a mesic habitat condition later into the warm summer months, providing for herbaceous growth and abundant insects (USDI 2000). In order to provide optimal brooding habitat for the sage grouse, sagebrush shrublands should be managed for conditions that provide an abundance of these forage sources as well as sufficient sagebrush cover to provide cover from predators (USDA 2001, USDI 2000, and Fischer et al. 1996).

Existing Habitat Conditions

Habitat components important to brooding females and offspring are present in the analysis area. Potential habitat is generally restricted to the area south of the 16 Road. Condition of this habitat is generally poor due to intensive livestock grazing that occurred in the past. Proximity to conifer forested lands and encroaching conifers (lodgepole pine, ponderosa pine, and western juniper) limit the quality of these habitats. These habitat areas are connected to a larger expanse of sagebrush steppe habitat within Logan Valley proper. Habitat condition in these areas varies. Historic and current livestock grazing practices, historic restoration work, water manipulation and management, and other factors influence the condition of habitat.

Effects and Determination

The proposed action would not have an adverse cumulative effect on sage grouse or its habitat when combined with the effects of past, present, and reasonably foreseeable future activities. Because there are no direct or indirect effects to sage grouse, there are no cumulative effects from this project.

As this project will not be altering sagebrush habitat there will be **No Impact (NI**) to the western sage grouse.

Gray Flycatcher (Empidonax wrightii)

Distribution

Oregon: The gray flycatcher is distributed throughout eastern Oregon. It is strongly associated with dry shrub steppe and juniper woodland habitats.

Malheur National Forest: The species has not been observed on the Malheur National Forest. Due to the presence of suitable habitat in the analysis area, it can be assumed to be present on the Forest.

Analysis Area: Suitable habitat for the species exists in the analysis area. There have been no observations of this species in the analysis area.

Life History and Habitat

Little is known about the habitat requirements and life history of this species. It is known that this species selects for open, arid shrubland and juniper woodland habitats, as well as transitional ponderosa pine habitats located on the fringes of shrubland and juniper woodland habitat areas. Some level of vegetation structure is required to provide for nesting habitat and perches for hunting. Foraging behavior is assumed to be similar to the other empidonax flycatcher species, pursuing airborne insects on the fly.

Existing Habitat Condition

Sagebrush shrubland and juniper woodland habitat is present within the analysis area Juniper woodland habitat is somewhat limited and restricted to isolated pockets. The limited information available for this species indicates that this habitat is likely suitable for this species.

Effects and Determination

The proposed action would not have an adverse cumulative effect on gray flycatcher or its habitat when combined with the effects of past, present, and reasonably foreseeable future activities. Because there are no direct or indirect effects to gray flycatcher, there are no cumulative effects from this project.

As this species is known to select for open woodland habitats and the proposed treatments avoid this habitat, the proposed treatments within this project will have **No Impact (NI)** to gray flycatcher.

Bobolink (Dolichonyx oryzivoru)

Distribution

Oregon: This species is distributed throughout eastern Oregon. It may occasionally occur west of the Cascade Crest.

Malheur National Forest: Occurrence of the species on the Malheur National Forest has been documented.

Analysis Area: The bobolink is not currently known to occur within the analysis area. Suitable grassland habitats preferred by this species are present within and adjacent to the analysis area.

Life History and Habitat

The bobolink is a Neotropical Migratory bird species. This species breeds in North America and winters in South America. Breeding and nesting activity begins in late May. Fall migration to wintering grounds begins in late September.

The bobolink is strongly associated with grassland habitats located near standing water. High forb densities are also an important feature of suitable habitat. The species is often associated with wet meadows, hayfields, irrigated fields, and meadows. This species feeds mainly on seeds from a variety of plants, but their diet will also include insects and other animal matter, particularly while brooding young.

Existing Habitat Condition

Potential habitat for this species is present in the analysis area. The primary limiting factor within the analysis area would be the lack of standing water and wetland habitat conditions required by this species. Standing water is limited and available only seasonally within the project area. These areas, and surrounding grassland areas, may provide suitable habitat for this species.

Effects and Determination

As a result of the determination, the proposed action would not have an adverse cumulative effect on bobolink or its habitat when combined with the effects of past, present, and reasonably

foreseeable future activities. Because there are no direct or indirect effects to bobolink, there are no cumulative effects from this project.

As there is limited standing water within the project area and none within the proposed treatment units there will be **No Impact (NI**) to the bobolink.

Upland Sandpiper (*Bartramia longicauda*)

Distribution

Oregon: The upland sandpiper occurs in isolated locations east of the Cascade Crest. In the 1980s up to 1991, Oregon contained the largest population of nesting sandpipers west of the Rocky Mountains. The Oregon population is made up of seven locations. Bear Valley and Logan Valley (Malheur National Forest) represent two of these locations. Both Bear Valley and Logan Valley have areas of short grasses mixed with forbs and scattered sagebrush patches.

Malheur National Forest: The Malheur National Forest and surrounding private lands contain isolated populations of upland sandpipers. Currently, Bear Valley (Blue Mountain Ranger District, approximately 23 miles to the west) hosts a small population. Logan Valley (Prairie City Ranger District, approximately 8 miles to the northwest) was also known to support a small isolated population of breeding individuals in the past.

Analysis Area: The upland sandpiper historically occurred within the analysis area, as recently as the early 1990s. Monitoring has not detected this species in the last few years.

Life History and Habitat

Large, open meadows with mixed grasses and forbs provide habitat for the upland sandpiper. They selectively nest where vegetation is between 6 and 13 inches tall and avoid fields containing relatively uniform stands of grass, tall undisturbed stands of grass, or those seeded to smooth brome. Upland sandpipers have strong site fidelity, returning to the same area each year. Other key habitat features near nest sites are loafing and feeding areas that have shorter, sparser vegetation than nesting areas and sites in close proximity to small shrubs or trees. Fence posts are often used as perches, possibly to survey the area for predators. Sandpipers are very secretive and easily disturbed by humans. Early research on upland sandpipers suggests that subtle habitat changes can cause nesting areas to become unacceptable.

Upland sandpipers in the northwestern United States are considered to be a disjoint population from the Midwest population.

Existing Habitat Condition

Suitable habitat for the upland sandpiper exists within the analysis area. However, habitat occurs in small patches, and may not be large enough to support nesting by this species. No observations of this species have occurred within the analysis area. Historically occupied habitat is located north west of the analysis area.

Effects and Determination

The proposed action would not have an adverse cumulative effect on upland sandpiper or its habitat when combined with the effects of past, present, and reasonably foreseeable future activities. Because there are no direct or indirect effects to upland sandpiper, there are no cumulative effects from this project.

The quality of habitat is poor within the analysis area, primarily due to shrub and conifer encroachment that has occurred in grassland habitats. Due to the limited and poor quality of habitat this project will have **No Impact (NI)** on upland sandpiper.

There are no other sensitive species or their habitat within the analysis area.

NON-TES WILDLIFE

The following non-TES wildlife categories were considered in the analysis of the Knox Project based on possible presence/absence and habitat assessment:

Management Indicator Species (MIS)

Old Growth MIS - pileated and northern three-toed woodpeckers, pine marten.

Big Game MIS - Rocky Mountain elk.

Dead Wood MIS - primary cavity excavators (most woodpeckers), pine marten.

Featured Species – blue grouse, western sage grouse, osprey, pronghorn antelope, California bighorn sheep, upland sandpiper, northern goshawk, and other raptors

Landbirds - including neotropical migratory birds (NTMB)

Management Indicator Species

The National Forest Management Act directs National Forests to designate management indicator species. Forest Service Manual Direction 2621.1 defines the criteria for selection of management indicator species.

Management indicator species (MIS) are selected to serve as barometers for species diversity and viability. Management indicator species are monitored over time to assess the effects of management activities on their populations and habitat, and the populations of other species with similar habitat needs.

The Forest Plan identifies a number of primary cavity excavators as MIS for the availability and quality of dead and defective wood habitat these include: black-backed woodpecker, three-toed woodpecker, downy woodpecker, Lewis' woodpecker, white-headed woodpecker, pileated woodpecker, hairy woodpecker, northern flicker, Williamson's sapsucker, red-breasted sapsucker and yellow-bellied sapsucker (USDA Forest Service 1990, IV-32). The red-breasted and yellow-bellied sapsuckers were formerly classified with the red-naped sapsucker. Neither the red-breasted or yellow-bellied sapsuckers are known to occur in eastern Oregon. The red-naped sapsucker will be used as a substitute MIS in this discussion.

Table WL-2 lists the 12 management indicator species currently used as indicators of the Malheur National Forest. The table also includes what their habitat requirements are and whether or not their habitat occurs in the analysis area (Tamarack Creek Subwatershed).

A detailed analysis of the existing condition and the expected effects on MIS can be found in the Old Growth Habitat, Big Game Habitat, and Primary Cavity Excavator sections. Additional analysis on Lewis' woodpecker and red-naped sapsucker can be found in the Landbird/ Neotropical Migrant Species section.

Table WL-2. Management Indicator Species, Habitat Needs, and Presence / Absence.

MIS Species	Representing	Habitat Requirements	Habitat Present in Analysis Area
Elk	Commonly hunted Big-game Species	Forested Mountains and meadows with grasses and forbs	Yes, habitat is present to provide for this species, though there are no identified calving areas within the subwatershed.
Pine Marten	Old Growth	Mature, mesic coniferous forests, with high structural diversity in the under story	Yes, secondary habitat for this species is present. Due to lack of canopy cover; there is no primary habitat within the project area.
Pileated Woodpecker	Old Growth, Primary Cavity Nester, Snags and Down Wood	Extensive areas of dense coniferous forests with tall closed canopy, high basal area and large diameter snags	Yes, there is evidence of use by this species but the canopy cover is less than what this species prefers within the analysis area.
Three-toed Woodpecker	Old Growth, Primary Cavity Nester, Snags and Down Wood	Higher elevation (above 4,500 feet) lodgepole pine forests with 75 contiguous acres	No, there are no contiguous lodgepole pine forests within the project area.
Lewis' Woodpecker	Primary Cavity Nester, Snags and Down Wood	Open forests and nests in large snags in cavities created by other cavity nesters or in very soft snags	Yes, habitat is present for this species though it is not overly abundant
Red-naped Sapsucker	Primary Cavity Nester, Snags and Down Wood	Associated with riparian habitats consisting of a mixture of grasses shrubs and hard woods	Yes, habitat is present though past logging and grazing activities have resulted in a loss of hard wood species.
Williamson's Sapsucker	Primary Cavity Nester, Snags and Down Wood	Mature higher-elevation coniferous forests for nesting and feeding	Yes, the entire subwatershed is above 4,000 ft in elevation.
Downy Woodpecker	Primary Cavity Nester, Snags and Down Wood	Associated with riparian habitats consisting of a mixture of grasses shrubs and hard woods	Yes, habitat is present though past logging and grazing activities have resulted in a loss of hard wood species.
Hairy Woodpecker	Primary Cavity Nester, Snags and Down Wood	Habitat generalists that prefer large trees in open park like stands along ridges	Yes, habitat is present though there is a general lack of large trees and snags.
White-headed Woodpecker	Primary Cavity Nester, Snags and Down Wood	Open ponderosa pine forests with large trees and snags in large patches	Yes, habitat is present though there is a general lack of OFSS stands.
Black-backed Woodpecker	Primary Cavity Nester, Snags and Down Wood	Forests with dead, insect-infested trees associated with large-scale disturbances such as fire or wind throw; with lodgepole pine plant associations.	No, there are no lodgepole pine plant associations within the project area.
Northern Flicker	Primary Cavity Nester, Snags and Down Wood	Habitat generalists that prefer large trees in open park like stands near meadows	Yes, habitat is present though past logging and grazing activities have resulted in a loss of hard wood species.

Old Growth Habitat

Existing Condition

Dedicated Old Growth

The Forest Plan identifies three Management Indicator Species (MIS) for old growth, primarily Old Forest Multiple Strata (OFMS) structured stands: pileated woodpecker, pine marten and three-toed woodpecker. In addition, the white-headed woodpecker is a good indicator of the health of Old Forest Single Stratum (OFSS). By providing old growth habitat for these species, it is assumed that habitat for old-growth obligate species will be provided as well.

The Dedicated and Replacement Old Growth network was analyzed at the project area level (approximately 20,147 acres of National Forest System Land). Existing and historic old growth levels (OFMS and OFSS) are calculated at the project area level. Future old growth was projected 10 years after treatment and 50 years after treatment. Connectivity corridors were only designated for the project area, but connect with old growth located outside the project area.

The following terms for old growth are used interchangeably throughout this section. Nuances in the vocabulary are defined throughout the section.

- Old Growth
- Late and Old structure (LOS)
- Dedicated Old Growth (DOG)
- Replacement Old Growth (ROG)
- Old Forest Multiple Strata (OFMS)
- Old Forest Single Stratum (OFSS)

Dedicated Old Growth (DOG) and Replacement Old Growth (ROG)

Forest Plan, Management Area 13 (MA-13) provides for the management of old growth through a network of DOG/ROG areas. Each DOG/ROG is specifically managed for one of two Management Indicator Species (MIS) for OFMS: pileated woodpecker or pine marten. ROGs are established to counter possible catastrophic damage or deterioration of the DOGs. Replacement areas may not have all the characteristics of old growth at the present time, but are to be managed to achieve those characteristics in the future so that when a DOG area no longer meets the needed habitat requirements, the ROG can take its place.

The Forest Plan directs continued review of DOG/ROG areas, with adjustments to boundaries as appropriate, to ensure suitable levels of old growth habitat are provided for species dependent upon them and to ensure those units meet Forest Plan standards and guidelines. The Forest Plan and its corresponding Final Environmental Impact Statement identifies the process and direction to identify ROG and Pileated Woodpecker Feeding Areas (PWFA) for each DOG area. MA-13 direction permits exchanging the status of DOGs and ROGs.

In addition to the DOG/ROG network, Forest-wide Standard 59 (LRMP, page IV-31) directs Forest managers to delineate areas of old growth lodgepole pine. These old growth areas are specifically managed for three-toed woodpeckers, a MIS for old growth lodgepole pine. These areas are not considered part of the MA-13 network. Since there is no pure old growth lodgepole pine stands in the project area, there will be no old growth effects. Changes in dead wood habitats could affect this species; discussions are in the Primary Cavity Excavator section.

To maintain an even distribution of old growth across the Forest, DOGs and ROGs were designated in all biophysical environments or forest types. Attempts were made to identify some of the best habitat available, while maintaining the old growth grid system. Generally, dry forest types provide lower quality habitat for pileated woodpeckers and pine martens than moist forest types. Historically, dry forest types were maintained under a low intensity, frequent fire regime; historic stand structure was likely Old Forest Single Stratum (OFSS). Due to fire suppression, tree stocking and canopy closure are greater than they were under historic conditions. Although many of the stands in the DOGs/ROGs currently do not meet old growth definitions, some stands do contain habitat components that can support pileated woodpeckers and martens in the short- to mid-term.

Regional Forester's Eastside Forest Plan Amendment 2 (USDA 1995) amended the Forest Plan to manage late and old structure (LOS) stands within the Historic Range of Variability (HRV). Amendment 2 direction applies to LOS stands both inside and outside of the DOG/ROG network. Stands classified as Old Forest Multiple Strata (OFMS) and Old Forest Single Stratum (OFSS) would be considered LOS habitat.

Old Growth within the Analysis Area

The Tamarack Creek Subwatershed contains an incidental amount of Hot Dry Biophysical Environment; effects will be similar to the Warm Dry Biophysical Environment. Discussions will focus on effects to old growth in the Warm Dry Biophysical Environment; old growth treatments are not being proposed in any other biophysical environments. Refer to the Forest Vegetation section of this EA for the HRV Analysis.

In the early- to mid-1990s, old growth surveys were conducted in the DOGs/ROGs. In 2005, taped pileated woodpecker calls were broadcasted. The DOGs/ROGs have periodically been visited to record presence of pileated woodpeckers, pine marten and other wildlife species. Within the analysis area, there are three DOG habitats (870 acres), two ROG habitats (170 acres), and one PWFA habitat (150 acres) identified. Table WL-3 below lists each DOG or ROG, its associated MIS, and total acres. Management requirements are described in the footnote. Refer to the project record for a map of the location of the DOGs within and in close proximity to the project area.

Table WL-3 Dedicated Old Growth (DOG), Replacement Old Growth (ROG), and Pileated Woodpecker Feeding Area (PWFAs).

DOG #	Management Requirement Species	Minimum Forest Plan Acre Requirements[1]	DOG Acres	ROG Acres[2]	Pileated Feeding Acres[2]	Total Acres
DOG 4328 Existing Condition	Pileated Woodpecker	600	401	N/A	300	701
DOG 4329 Existing Condition	Pileated Woodpecker	600	300	N/A	N/A	300
DOG 4355 Existing Condition	Pileated Woodpecker	600	170/404	N/A	N/A	170
ROG 4328 Existing Condition	Pileated Woodpecker	300	N/A	150	N/A	150
ROG 4329 Existing Condition	Pileated Woodpecker	300	N/A	19/178	N/A	19
TOTAL		**2400**	**871**	**169**	**300**	**1340**

[1]Old-growth Management Area (MA-13) Minimum Management Requirements:
Pileated Woodpecker Areas (PWFA) = 300-acre DOG + 300-acre feeding area = 600 acres. ROGs = 150-acres and can overlap with feeding areas. Pine Marten = 160-acre DOG + 80-acre ROG = 240 acres
[2]ROG acres also contribute towards pileated woodpecker feeding acres. "Proposed ROG Acres" and "Additional Pileated Feeding Acres" fields should total at least 300 acres for each DOG.

DOG 4328 – Pileated Woodpecker

DOG 4328 is 401 acres and currently exceeds Forest Plan standard (300 acres). This DOG is located within the Warm Dry Biophysical Environment. Stands are mixed conifer. Species composition consists of varying levels of ponderosa pine, Douglas-fir and encroaching grand fir. Stands do not classify as old growth; rather, they are in a mid-seral condition, primarily Young Forest Multiple Strata (YFMS) and Stem Exclusion (SE). The number of large diameter trees fall short of quantities required for Old Forest Multiple Strata (OFMS) classification. Past and ongoing insect and disease has caused tree mortality. As a result, canopy cover is reduced with about 13% of the DOG meeting canopy cover levels that provide primary or secondary habitat for pileated woodpecker. Primary habitat for these species is stands that are OFMS with canopy closures of 60% or greater; secondary habitat is OFMS with canopy closure of 40 to 59% or YFMS with canopy closure greater than 40%.

DOG 4329 – Pileated Woodpecker

DOG 4329 is 300 acres and currently meets Forest Plan standard (300 acres). This DOG is located within the Hot Dry and Warm Dry Biophysical Environments. Stands are mixed conifer. Species composition consists of varying levels of ponderosa pine, Douglas-fir and encroaching grand fir. Stands do not classify as old growth; rather, they are in a mid-seral condition, primarily Young Forest Multiple Strata (YFMS) and Stem Exclusion (SE). The number of large diameter trees fall short of quantities required for Old Forest Multiple Strata (OFMS) classification. Past and ongoing insect and disease has caused tree mortality. As a result, canopy cover is reduced with about 70% of the DOG meeting canopy cover levels that provide primary or secondary habitat for pileated woodpecker.

DOG 4355 – Pileated Woodpecker

DOG 4355 is 404 acres and currently exceeds Forest Plan standard (300 acres). Only 170 of the acres of this DOG are within the project area. There is no associated ROG for this DOG and does not meet Forest Plan standard (150 acres). This DOG is located within the Warm Dry Biophysical Environment. Stands are mixed conifer. Species composition consists of varying levels of ponderosa pine, Douglas-fir and encroaching grand fir. Stands do not classify as old growth; rather, they are in a mid-seral condition, primarily Young Forest Multiple Strata (YFMS) and Stem Exclusion (SE). The number of large diameter trees fall short of quantities required for Old Forest Multiple Strata (OFMS) classification. Past and ongoing insect and disease has caused tree mortality. As a result, canopy cover is reduced with about 45% of the DOG meeting canopy cover levels that provide primary or secondary habitat for pileated woodpecker.

ROG 4328 – Pileated Woodpecker

ROG 4328 is 424 acres and currently exceeds Forest Plan standard (150 acres). This ROG overlaps with the associated PWFA which is within the Forest Plan Standard (300 acres). This ROG is located within the Warm Dry Biophysical Environment. Stands are mixed conifer. Species composition consists of varying levels of ponderosa pine, Douglas-fir and encroaching

grand fir. The ideal behind ROGs is that if something happens to the DOG (stand replacing fire, etc.) the ROG will still be able to provide habitat for the species. Stands do not classify as old growth; rather, they are in a mid-seral condition, primarily Stem Exclusion (SE).

ROG 4329 – Pileated Woodpecker

ROG 4329 is 178 acres and currently exceeds Forest Plan standard (150 acres). Only 19 acres of this ROG are within the project area. This ROG is located within the Warm Dry Biophysical Environment. Stands are mixed conifer. Species composition consists of varying levels of ponderosa pine, Douglas-fir and encroaching grand fir.

Pileated Woodpeckers and American Pine Marten

Pileated woodpeckers and American pine marten are species dependent upon dense multi-strata habitats. Both pileated woodpecker and pine marten have been documented in the analysis area (subwatershed) but northeast of the treatment units. Both species associate heavily with forested habitat with forested habitats typified by higher canopy closures, multiple canopy levels, and abundance of deadwood in all size classes.

Stands with Old Forest Multiple Strata (OFMS) and Young Forest Multiple Strata (YFMS) stand structures provide potential nesting, roosting, foraging, and denning habitat for pileated woodpeckers and pine marten. Refer to the Forest Vegetation section of the environmental analysis for a detailed description of these habitats. These stand structures are not very common in the project area. Primary and secondary habitats are sparsely distributed throughout the project area, as there is very little habitat south of the 16 Road. Most sites in the Warm Dry and Hot Dry Biophysical Environments will not support the required level of canopy cover for long periods of time. Currently, there are 2,373 acres of OFMS, and 162 acres of YFMS structure habitats within the analysis area. Stands in an OFMS structural condition would be considered late and old structure (LOS) habitat.

Pileated woodpeckers require extensive tracts of mature trees with large-diameter snags and logs. Their home range is between 250 and 2,500 acres. Pileated woodpeckers prefers stands with high canopy closure (>60%) that have an abundance of large living and dead trees with heartwood decay. They are insectivores, eating primarily carpenter ants and wood-boring beetle larvae that they find by excavating deep rectangular holes often at the base of large trees and stumps. Further life history information on pileated woodpeckers can be found in Nature Serve (2004).

Pileated woodpeckers have been confirmed in the Knox Project Area. There is insufficient sample size for pileated woodpeckers for trend analyses in the Northern Rocky Mountains breeding bird survey physiographic region and the State of Oregon (Altman 2000).

Pine marten require habitats in the Warm Dry and Cool Moist Biophysical Environments, with OFMS and YFMS as potential habitat for pine marten. Primary habitat is defined as Cool Moist or Warm Dry Biophysical Environments, OFMS structure, greater than 60% canopy closure; secondary habitats as Cool Moist or Warm Dry Biophysical Environments, OFMS structure, 40-59% canopy closure, or Cool Moist or Warm Dry Biophysical Environment, YFMS structure, greater than 40 % canopy closure. Normally they prefer these types of stands at high elevations (>4000’).

Interior Columbia Basin Ecosystem Management Project (ICBEMP 2000) population trends for pileated woodpecker indicate that source habitat within the basin has declined moderately or strongly in more than 50% of the subwatersheds containing appropriate habitat. Within the Blue Mountains Ecological Reporting Unit (ERU), there has been a balanced mix of increases and decreases. Data indicates that there has been a major decrease in the pileated woodpecker in eastern Oregon, with a 7.8% reduction per year. Habitat trend information derived from Interior Columbia Basin studies (Wisdom et al. 2000) indicated that about 50% of the watersheds in the Blue Mountains showed a decreasing trend in marten habitat and 35% showed an increasing trend. The distribution of marten within the Interior Columbia Basin has been fairly stable, but population changes are not known (Wisdom et al. 2000).

Multi-stratum habitat is generally within the range of historical conditions (HRV) for most forest types within the analysis area. The OFMS and YFMS structural stages are below the HRV in the Cold Dry Plant Association Group (PAG). OFMS is within the HRV in the Hot Dry PAG. OFMS is within and at the high end of the HRV in the Warm Dry PAG which is the predominant type in the analysis area. Habitats in the Warm Dry and Cool Moist PAGs, with OFMS and YFMS structures provide the bulk of the habitat for these species. Table WL-4 identifies the acres of potential habitat for these species that exists in the project area (primary habitat = Cool Moist or Warm Dry PAG, OFMS structure, >60% canopy closure; secondary habitats = Cool Moist or Warm Dry PAG, OFMS structure, 40-59% canopy closure, or Cool Moist or Warm Dry PAG, YFMS structure, >40% canopy closure). Currently, there are 0 acres of primary and 2,110 acres of secondary habitat (OFMS and YFMS acres combined) for the pileated woodpecker and pine marten within the analysis area.

Table WL-4. Primary and Secondary Pileated Woodpecker and Pine Marten Habitat (Existing Condition)

Type of Habitat	Plant Association Group	Stand Structure	Percent Canopy Cover	Subwatershed Acreage
Primary[1]	Cool Moist and Warm Dry	OFMS	>=60	0
Secondary[2]	Cool Moist and Warm Dry	OFMS	>=40 and <60	916
Secondary	Cool Moist and Warm Dry	YFMS	>=40	1,194

1 Primary habitat would be defined as habitat that fully meets the needs of the species per documented science and literature.

2 Secondary habitat mostly meets habitat needs but is deficient in 1 form or another, canopy cover or structure.

White-Headed Woodpeckers

White-headed woodpeckers are generally found in mature to old-growth forests (150+ years or older (USDA Forest Service 1995) of fir and ponderosa pine at altitudes between 4,000 and 9,000 feet. The white-headed woodpecker differs from many of the other primary cavity excavators identified as MIS in the Forest Plan in its near exclusive selection of Old Forest Single Stratum (OFSS), ponderosa pine dominated habitats. Historic accounts show a strong presence of this habitat condition, structure, and tree composition across much of the analysis area. Past harvest in the Tamarack Creek Subwatershed focused on removal of mature ponderosa pine, which reduced the amount and distribution white-headed woodpecker habitat. In the Tamarack Creek Subwatershed, mature ponderosa pine habitat in a single stratum structure condition occurs on <1% of the Warm Dry and Hot Dry Biophysical Environments. Historically, this habitat type occurred on 15-55% and 20-70% of the Warm Dry and Hot Dry Biophysical Environments, respectively. The historic distribution of this mature ponderosa pine type was

much more prevalent, as described in the vegetation sections of this document. Refer to the vegetation section for Historical Range of Variability (HRV) Analysis.

Soft snags and stumps of dead pine are excavated for nesting. Pine seeds make up 50% of their diet. They search for insects, larvae and spiders on the trunks and limbs of living and dead trees. The size of the home range of white-headed woodpeckers depends upon the amount of contiguous habitat and fragmentation, and is approximately 250-1250 acres. White-headed woodpecker populations are imperiled in Oregon (NatureServe 2004). The species is a bird conservation concern and on the Partners in Flight Watch List. Woodpeckers are generally not conducive to detection by the breeding bird survey methodology. The breeding bird survey trend map for the white-headed woodpecker population in the Malheur National Forest area of Oregon from the year 1966 through 2003 indicates greater than +1.5 percent change per year. There is insufficient sample size on white-headed woodpeckers to determine accurate trend analysis in the Northern Rocky Mountains breeding bird survey physiographic region (Altman 2000).

Habitat trend information derived from Interior Columbia Basin studies (Wisdom et al. 2000) indicated that about 70% of the watersheds in the Blue Mountains showed a decreasing trend in white-woodpecker habitat and 30% showed a static or increasing trend. Basin-wide, >50% of watersheds had strong negative declines in the availability of source habitats (old growth ponderosa pine, aspen/cottonwood/willow, large diameter ponderosa pine snags). Breeding Bird Survey (BBS) data indicated a 3.0% annual increase in populations in Oregon and Washington from 1966 through 1994 (Wisdom et al. 2000).

Black-backed and Three-toed Woodpeckers

Three-toed woodpeckers and black-backed woodpeckers are management indicator species that have usable habitat present in the analysis area. Preferred foraging and nesting habitat for these species occurs in areas with late successional, cold and moist forest types (lodgepole/mixed conifer) with high lodgepole snag densities or burned forest. Three-toed woodpeckers prefer higher elevations and the black-backed woodpeckers can also be found in lodgepole or mixed conifer forests containing lodgepole, and in larch stands and spruce. Three-toed woodpeckers are found throughout the analysis area (Prairie City Observation databases). The Forest Plan requires 75 contiguous acres of old growth pure Lodgepole pine for nesting and roosting for the three-toed woodpecker. That habitat is not present in the project area to the extent necessary to provide for the three-toed woodpecker. Since there is no pure old growth lodgepole pine stands within the project area, there will be no effects to three-toed woodpecker and there will be no further discussion of this species in this section.

The black-backed woodpecker forages in a broader range of mixed conifer types compared to the three-toed woodpecker. Both species are associated with mature and over mature stand structures. Home range size for the black-backed is estimated at averaging 430 acres, and for three-toed 130-750 acres. Suitable habitat for both species is tied to existing levels of diseased and decaying trees with heart rot for nesting and roosting, as well as decaying substrate to provide a prey base for wood-boring insects (Goggins et al. 1987).

Black-backed woodpeckers selected nest sites with high densities of small diameter snags in a study by Saab et al. (1999). Black-backed woodpeckers were noted selecting unlogged stands with high snag densities for both nesting and foraging habitat. Species respond positively to large snag pulses caused by fire, insect or disease. Post-fire habitats for these species are rare in the analysis area. The 1998 - 2001 Cottonwood Prescribed Burn Fire burned about 5,500 acres

with approximately 300 acres between Alder Creek and Cat Creek burning at a moderate to high severity; no salvage occurred; many snags are still standing and likely provide habitat. Fire suppression has nearly eliminated the influence of this disturbance factor in the analysis area. In green stands, insect and disease levels are elevated in overstocked stands of trees.

Activities will occur in potential black-backed woodpecker habitat which includes the cool dry and Cold Dry PAG, or within the Eastside Cascade Mixed Conifer ~ Blue Mountain wildlife habitat type that contain lodgepole pine. There are no lodgepole pine plant association groups within the project area and post fire habitats are rare due to fire suppression; therefore there will be no effects to black-backed woodpecker and there will be no further discussion of this species.

Connectivity

The Regional Forester's Eastside Forest Plans Amendment 2 (USDA 1995) gives direction for maintaining connectivity between LOS habitats to allow the free movement of old growth wildlife species. Connectivity is defined as stands in which medium diameter or larger trees are common (≥9 inches DBH), and canopy closures are within the top one-third of site potential. Connectivity corridors should commonly have medium diameter or larger) and canopy closure within the upper third of site potential. Corridors should be at least 400 feet wide. If stands with these conditions are not available, then the next best stands will be selected and should be managed to improve connectivity.

Connectivity corridors between LOS and Dedicated Old Growth were identified which: 1) provide at least two connectivity avenues to/from each LOS within the project area to LOS and dedicated old growth adjacent to the project area, 2) keep the corridors as short and direct as possible, 3) take advantage of natural features such as riparian corridors which would provide stands and sites capable of maintaining higher canopy covers, 4) include goshawk nest stands, that although they are not classified in this analysis as LOS, are close to that classification and would be managed to attain and maintain that classification in the future, 5) provide a minimum of 400 feet width of connectivity corridor, and 6) provide for the development of a maintainable future connectivity corridor network. Average canopy covers found in plant association plots established during the development of the plant association guide: "Plant Associations of the Blue and Ochoco Mountains" by Charles Grier Johnson and Rodrick R. Clausnitzer (1992) were used to determine site potentials.

Dedicated Old Growth habitat and late and old structure (LOS) stands are distributed throughout the analysis area. The current condition shows about 1,652 acres in the project area as connectivity stands, including those that currently meet the canopy cover requirement, and those that do not, but provide the greatest potential for maintainable connectivity (next best stands for connections). Those stands with a high degree of ground level vegetation provide additional screening and security cover for old growth associated species as well as for wide ranging carnivores. Generally, connectivity corridors are maintained or managed at higher tree densities and canopy cover than adjacent areas to provide more security for dispersal or movement.

Corridors generally meet the minimum requirements as described in Amendment 2 of the Forest Plan. In most cases, corridors were designated at the "stand level" with stand width often exceeding the minimum 400-foot width. In some cases, where suitable forest conditions do not exist, stands have been identified as connectivity habitat even though minimum canopy closure or corridor width requirements were not met. One example is where large blocks of non-forest

bracket a narrow riparian area. Refer to the Wildlife Report and the project record for a map of connectivity corridors.

Landscape connectivity is assessed on the scale of the entire subwatershed or multiple subwatersheds. Habitat connectivity for wide ranging terrestrial wildlife would be assessed at this scale. On the larger scale, the project area contains patches of LOS and connectivity that facilitate movement by dispersing old growth associated species and wide ranging carnivores. The Strawberry Mountains provide a natural east/west corridor area leading along the south side of the John Day River Valley, connecting the McClellan and Aldrich Mountains (and the Ochocos further to the west) and the mountains north and east of the Strawberries, including the Baldy Mountain/Glacier Mountain areas, and the Vinegar Hill/Indian Rock/Dixie Mountain areas.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action

Dedicated Old Growth (DOG) & Replacement Old Growth (ROG)

The No Action Alternative has no direct effects on existing old growth. In the short-to mid-term, DOGs/ROGs would remain in their current condition and location. OFMS and OFSS located both inside and outside the DOG/ROG network would remain in their current condition. This alternative does not meet Forest Plan standards for DOG/ROG network and will not provide for a ROG for DOG 4355. Existing stand structures and high stocking levels would persist, thus increasing the risk of stand replacing fire.

In the long-term, stands would move towards old growth conditions. Table WL-5 displays the existing percentages of OFMS and OFSS and the percentages expected in 50 years if no action is taken. Projected old growth levels are also provided for Alternative 2 and Alternative 3 for comparison purposes. Under the No Action Alternative, both OFMS and OFSS would increase overtime. OFSS would develop from stands that have been thinned in the last 20 years.

Table WL-5. Estimated Percentage Changes of OFMS and OFSS for the Warm Dry and Hot Dry Biophysical Environments.

	Warm Dry PAG (14,503 acres)		Hot Dry PAG (1,830 acres)	
	OFMS	**OFSS**	**OFMS**	**OFSS**
Historic Range of Variation	5-15%	15-55%	5-15%	20-70%
Existing Condition – No Action	13%	1%	9%	3%
Alternative 2 Post Treatment	11%	4%	9%	5%
Alterantive 3 Post Treatment	11%	4%	9%	5%
No Action in 50 Years	37%	6%	32%	18%
Alternative 2 in 50 Years	39%	12%	20%	35%
Alternative 3 in 50 Years	39%	12%	30%	22%

Alternative 1, the No Action Alternative, would result in no changes to existing DOG, ROG or PWFA (Pileated Woodpecker Feeding Area) designations that currently exist in the analysis area. In addition, there would be no new designations of ROGs or PWFAs in association with existing DOG habitats where they currently do not exist. Management activities in stands adjacent to DOGs would not occur as a result of this project. Fire hazard would remain high in the project area as discussed in the Fire Hazard/Fuels Specialist Report. Long-term maintenance and/or development of old growth and connectivity habitat could be diminished if stand development is disrupted by epidemic bark-beetle activity (likely) or severe fire effects (possible).

Pileated Woodpeckers and American Pine Marten

Alternative 1 would maintain the existing condition of habitat for multi-stratum dependent species, such as the pileated woodpecker and the pine marten. Existing canopy closure, stand structure, and dead wood habitats would be maintained across the analysis area in the short-term. Multi-strata stands would become denser in the mid to long term due to continued fire exclusion. Standing and downed wood densities would increase in the mid and long term as stand densities increase, and projected insect and disease infestations occur. Populations would not be expected to change in the short- to mid-term. The amount of habitat for pileated woodpecker and pine marten would increase as a result of the no action alternative in the long-term. The most significant increase in habitat would come in the primary habitat, estimated greater than 3 fold increase (from 13% to 37% in Warm Dry and 9% to 32% in Hot Dry), over the next 50 years.

With the No Action Alternative, the current stand structures and high stocking levels mentioned above would persist into the future. Individual tree diameter growth would continue to decline as the result of overstocking. Tree competition and declining tree growth in younger aged stands would increase the time required for stands to grow sufficient large trees to be classified as late and old structure. Due to the high stocking and bark beetle risk, the probability of increasing bark beetle mortality, if not epidemic levels, is high. The bark beetle mortality would have a detrimental effect upon the stands progression to late and old structure due to mortality in the large trees. Stands in the area would continue to have the potential for high intensity wildfires to occur. If a high intensity wildfire were to occur in the area, the effects would probably be severe, and affected stands would be pushed away from a late and old structure and back to stand initiation and would convert primary and secondary pileated woodpecker and pine marten habitat to an unsuitable condition.

White-Headed Woodpeckers

White-headed woodpecker habitat would not change in the short- to mid-term. OFSS would remain below HRV, limiting habitat for white-headed woodpecker and other species associated with OFSS. In the long-term (50 years), OFSS habitat would increase from 1% to 6% in the Warm Dry and from 3% to 18% in the Hot Dry Biophysical Environments. Populations of white-headed woodpeckers would not be expected to increase dramatically, if at all, and OFSS would still remain below HRV, limiting habitat.

Connectivity

Currently, connectivity corridors are expected to support the free movement of old growth associated terrestrial wildlife. With the No Action Alternative, no activities would occur within

existing connectivity corridors; these corridors would continue to provide for the free movement of LOS associated species in the short- to mid-term.

Fire hazard would remain high in the project area as discussed in the Fire Hazard, Fuels, and Air Quality Specialist Report. Long-term maintenance and/or development of old growth and connectivity habitat could be diminished if stand development is disrupted by epidemic bark-beetle activity (likely) or severe fire effects (possible).

Alternative 2

Dedicated Old Growth (DOG) & Replacement Old Growth (ROG)

Alternative 2 has no direct effects on existing old growth. In the short-to mid-term, DOGs/ ROGs would remain in their current condition and location as described in the existing condition section. OFMS and OFSS located both inside and outside the DOG/ROG network would remain in their current condition. This alternative did not propose to create a ROG for DOG 4355 because only a small portion (170 of a 404 acre DOG) of the DOG is within the project area and suitable habitat does exist to designate this ROG in future analysis. Existing stand structures and high stocking levels would persist, thus increasing the risk of stand replacing fire.

In the long-term, stands would move towards old growth conditions. Table WL-5 displays the existing percentages of OFMS and OFSS and the percentages expected in 50 years if no action is taken. Projected old growth levels are also provided for Alternative 3 for comparison purposes. Under the No Action Alternative, both OFMS and OFSS would increase overtime. OFSS would develop from stands that have been thinned in the last 20 years.

Pileated Woodpeckers and American Pine Marten

Habitat for pileated woodpeckers and pine martens would decrease in the short term as stand density and canopy cover decreases. In the short- to mid-term, OFMS habitat would decrease from 13% to 11% in the Warm Dry Biophysical Environments; and decreased slightly in the Hot Dry Biophysical Environment; due to rounding the percentage would remain at 9%. Populations would not be expected to change in the short- to mid-term. Habitat for pileated woodpeckers and pine martens would increase in the long term as stand density and canopy cover increases. In the long-term (50 years), OFMS habitat would increase from 13% to 39% in the Warm Dry Biophysical Environments; and increased from 9% to 20% in the Hot Dry biophysical. OFMS would be within HRV for the Warm Dry and remain below HRV for the Hot Dry Biophysical Environments. Populations of marten and pileated woodpecker would potentially increase.

White-Headed Woodpeckers

White-headed woodpecker habitat would not change in the short- to mid-term. OFSS would remain below HRV, limiting habitat for white-headed woodpecker and other species associated with OFSS. In the long-term (50 years), OFSS habitat would increase from 1% to 12% in the Warm Dry and from 3% to 35% in the Hot Dry Biophysical Environments. Populations of white-headed woodpeckers would not be expected to increase dramatically, if at all, and OFSS would still remain below HRV in the Warm Dry Biophysical Environment, limiting habitat.

Connectivity

Approximately 28% (462 acres) of stands set aside for connectivity corridors (1,652 acres) will have prescribed fire activities take place in them. Prescribed fire has the potential to clear away

some of the hiding cover but has very little effect (mortality less than 5%) on larger trees or overstory. Approximately 5% (89 acres) of stands set aside for connectivity corridors will be commercially thinned from below. In order for any treatment to occur in connectivity stands; the upper one third of site potential, in respect to canopy cover, shall be maintained. As a result of this connectivity will be largely unchanged from the existing condition. Current and long-term connectivity between LOS is maintained by a system of connectivity corridors. These corridors would continue to provide for the free movement of LOS associated species in the short- to mid-term.

Alternative 3

Dedicated Old Growth (DOG) & Replacement Old Growth (ROG)

Alternative 3 has no direct effects on existing old growth. In the short-to mid-term, DOGs/ ROGs would remain in their current condition and location as described in the existing condition section. OFMS and OFSS located both inside and outside the DOG/ROG network would remain in their current condition. This alternative did not propose to create a ROG for DOG 4355 because only a small portion (170 of a 404 acre DOG) of the DOG is within the project area and suitable habitat does exist to designate this ROG in future analysis. Existing stand structures and high stocking levels would persist, thus increasing the risk of stand replacing fire.

In the long-term, stands would move towards old growth conditions. Table WL-5 displays the existing percentages of OFMS and OFSS and the percentages expected in 50 years if no action is taken. Projected old growth levels are also provided for Alternative 3 for comparison purposes. Under the No Action Alternative, both OFMS and OFSS would increase overtime. OFSS would develop from stands that have been thinned in the last 20 years.

Pileated Woodpeckers and American Pine Marten

Habitat for pileated woodpeckers and pine martens would decrease in the short term as stand density and canopy cover decreases. In the short- to mid-term, OFMS habitat would decrease from 13% to 11% in the Warm Dry Biophysical Environments; and decreased slightly in the Hot Dry Biophysical Environment; due to rounding the percentage would remain at 9%. Populations would not be expected to change in the short- to mid-term. Habitat for pileated woodpeckers and pine martens would increase in the long term as stand density and canopy cover increases. In the long-term (50 years), OFMS habitat would increase from 13% to 38% in the Warm Dry Biophysical Environments; and increased from 9% to 30% in the Hot Dry biophysical. OFMS would be within HRV. Populations of marten and pileated woodpecker would potentially increase.

White-Headed Woodpeckers

White-headed woodpecker habitat would not change in the short- to mid-term. OFSS would remain below HRV, limiting habitat for white-headed woodpecker and other species associated with OFSS. In the long-term (50 years), OFSS habitat would increase from 1% to 12% in the Warm Dry and from 3% to 22% in the Hot Dry Biophysical Environments. Populations of white-headed woodpeckers would not be expected to increase dramatically, if at all, and OFSS would still remain below HRV in the Warm Dry Biophysical Environment, limiting habitat.

Connectivity

Approximately 28% (462 acres) of stands set aside for connectivity corridors (1,652 acres) will have prescribed fire activities take place in them. Prescribed fire has the potential to clear away some of the hiding cover but has very little effect (mortality less than 5%) on larger trees or overstory. In order for any treatment to occur in connectivity stands; the upper one third of site potential, in respect to canopy cover, shall be maintained. As a result of this connectivity will be largely unchanged from the existing condition. Current and long-term connectivity between LOS is maintained by a system of connectivity corridors. These corridors would continue to provide for the free movement of LOS associated species in the short- to mid-term.

Cumulative Effects

The area considered for cumulative effects is the Tamarack Creek Subwatershed. All of the activities in Appendix C have been considered for their cumulative effects on old growth species. Past activities such as timber harvest, road construction, fire suppression and wildfire have combined to create the current old growth condition in the analysis area. HRV tables in the Forest Vegetation section reflect the effects of past activities on structural stage. There are no foreseeable future activities that would have an effect on old growth forests.

Shifting stands from OFMS to OFSS would reduce habitat in the short-term for canopy dependent species such as pileated woodpecker and pine marten and improve habitat for species such as white-headed woodpecker and flammulated owl. This shift in old growth type would increase, rather than decrease the wildlife species diversity. In the long term both types of old growth would increase. Cumulatively, restoring natural vegetation conditions and fire regimes would make these habitats far more self-sustaining for associated wildlife species. Overall, proposed timber management and prescribed burning would contribute positively toward the viability of species that use old growth habitats.

The Forest's network of Dedicated Old Growth (DOGs) and Replacement Old Growth (ROGs) is being managed to maintain or develop habitat for pine marten and pileated woodpeckers. Additional OFMS habitat outside the DOG/ROG network is available and currently exceeds HRV, and would also continue to provide habitat for these species.

Snag and down logs habitat are important to old growth MIS. Cumulative effects to snags and down logs are discussed in the Primary Cavity Excavator section. This project includes design features to protect snags and down logs; overall, changes in dead wood habitats would be considered incidental.

Generally, adjacent private lands have been intensively managed. In the past, these timber stands do not appear to have been managed for old growth habitat and no change in this strategy is expected. These areas are not expected to provide OFMS or OFSS habitat in the future.

Past harvest has reduced the quantity and quality of connectivity between old growth stands. Since 1993, the Forest Plan as amended has directed the Malheur National Forest to protect connectivity habitat between LOS stands. Future thinning and burning prescriptions would be designed to maintain connectivity.

Cumulatively, management activities across the Forest are distributed sufficiently to minimize disturbance impacts at the population levels. In the short- to mid-term, the No Action Alternative would not contribute to cumulative losses of old growth or connectivity habitat because stands

would not be treated. In the long-term, the No Action Alternative, by forgoing action, could negatively contribute to the loss of old growth and associated species if a stand-replacing event such as wildfire occurs.

In the short-term, neither alternative would contribute to cumulative losses of mature and old growth habitat. In the long-term, Alternative 2 would contribute positively to cumulative effects by accelerating the development of OFMS (and OFSS though slower than Alternative 3) and maintaining connectivity habitat between LOS. In the long-term, Alternative 3 would contribute positively to cumulative effects by accelerating the development of OFSS (and OFMS although slower than Alternative 2) and maintaining connectivity habitat between LOS. Therefore, proposed activities would contribute positively toward the viability of species that use these habitats.

Based on the past, present and reasonably foreseeable activities (Appendix C) and effects determinations in the old growth section, there are no significant adverse cumulative effects to pileated woodpeckers or pine martens or their habitat from Alternative 2; there are positive effects to white-headed woodpeckers from OFSS development.

Big Game Habitat

Big Game Populations

Major populations of Rocky Mountain elk inhabit the Blue Mountains of Oregon (Oregon Department of Fish and Wildlife 2003). Rocky Mountain elk are distributed widely across the District and within the analysis area. They are found in mountain meadows and stands of coniferous and deciduous forests during the summer. In the winter, elk move to elevations with less snow and are found in the foothills and valleys. Elk are grazers, primarily eating grasses. Lesser amounts of forbs and woody plants are also consumed. Elk are vulnerable to disturbance, displacement, and hunting pressure. High-quality habitat for elk provides effective escape and hiding cover. Further information on elk can be found in Oregon's Elk Management Plan (Oregon Department of Fish and Wildlife 2003).

Big game management on the Malheur National Forest is a cooperative effort between the Forest Service and the Oregon Department of Fish and Wildlife (ODFW) where the Forest Service manages habitat while ODFW manages populations. The agencies cooperate by managing big game according to pre-established Management Objectives (MOs) for each big game management unit. The project area is in the Malheur River Big Game Management Unit. Elk populations in the Malheur River Unit have met or exceeded management objectives since 2003 (ODFW 2006). Table WL-6 displays MOs for elk populations, bull to cow ratios, and calf to cow ratios. Annual estimates by ODFW are displayed since 2003.

Table WL-6. **Management Objectives (MOs) for the Malheur River Big Game Management Unit. (Annual estimates, 2003-2008, are displayed for populations, bull to cow ratios and calf to cow ratios.)**

Year	Population	Bulls per 100 cows	Calves per 100 cows
Management Objectives	**2200**	**15**	**N/A**
2008	2850	17	32
2007	2800	11	43
2006	2800	22	51
2005	2200	10	36
2004	2200	14	30
2003	2300	9	30

Existing Condition

HEI and Cover

The habitat effectiveness index (HEI) models the relative quality and effectiveness of elk habitat within a subwatershed. It takes into account the abundance and distribution of cover and forage habitats and open road density variables. The Forest Plan identifies levels of habitat effectiveness that must be met for elk habitat at the subwatershed scale. Table WL-7 shows the existing HEI figures for summer and winter range habitat in the Tamarack Creek Subwatershed, as well as the identified Forest Plan standards.

Although the existing condition for satisfactory cover is below the Forest Plan, the marginal cover is well above Forest Plan standards bringing the total cover to 26.6%. Winter range total cover is below Forest Plan standards. The ideal cover to forage ratio is 40:60. The existing cover to forage ratio in the analysis area is 26:74. Forage habitats include open meadows and previously harvested areas within the subwatershed.

The Tamarack Creek Subwatershed does not currently meet Forest Plan standards for HEI or quantity of road densities. In Winter Range total cover, HEI, and HER are below Forest Plan standards. In summer range HER is below Forest Plan standard. The subwatershed currently has 126.33 miles of open road. For big game summer range the Forest Plan Standard is 3.2 miles per square mile, the current road density is 3.94 miles per square mile. For big game winter range the Forest Plan Standard is 2.2 miles per square mile, the current road density is 4.13 miles per square mile. Table WL-7 shows Forest Plan standards and existing condition for elk cover and habitat effectiveness for the Tamarack Creek Subwatershed.

Table WL-7: Existing HEI Values, Cover Percentages and Open Road Densities by Subwatershed and Summer/Winter Range Classification.

Subwatershed	HEc	HEs	HEf	HEr	HEcsfr (HEI)	%S	%M	Total Cover %	Open Road Density (miles per square mile)
Summer Range									
Forest Plan Standard	**.30**	**.30**	**N/A**	**.40**	**.40**	**5**	**5**	**20**	**3.20**
Tamarack Creek	.59	.58	N/A	.30	.48	5	21.6	26.6	3.94
Winter Range									
Forest Plan Standard	**.40**	**.30**	**.40**	**.50**	**.50**	**5**	**10**	**20**	**2.20**
Tamarack Creek	.53	.59	.50	.28	.46	1.2	20.0	21.2	4.13

HEI = Habitat Effectiveness Index. HEc = habitat effectiveness derived from the quality of cover
HEs = habitat effectiveness derived from the size and spacing of cover
HEf = habitat effectiveness derived from the quantity and quality of forage; HEf is not used in summer range.
HEr = habitat effectiveness derived from the density or roads open to vehicular traffic
%S = Satisfactory Cover, %M = Marginal Cover, % Total Cover = %S + %M. N/A – Not Applicable.

The subwatershed exceeds minimal standards for the Habitat Effectiveness Index (HEI) for summer range. The subwatershed is below minimal standard for HEI for winter range. The Forest Plan also identifies target objectives for summer range and winter range at 0.5 and 0.6 respectively. The Forest Plan directs moving stands towards these objectives where site-specific vegetation characteristics and health provide that opportunity (LRMP Record of Decision, LRMP, Management Area-4a). The subwatershed is below the desired objective.

The desired objectives for HEI are probably not sustainable; the minimum standards for HEI are more appropriate. In dry biophysical environments, cover requirements (HEc, satisfactory and marginal cover percentages) may not be compatible with Historical Range of Variability (HRV). Historical conditions and fire return intervals favored large blocks of OFSS with canopy closure too low to support large blocks of satisfactory or marginal cover. Under historical conditions, cover percentages would be inherently low, probably below Forest Plan standards and guidelines. Much of the Tamarack Creek Subwatershed typifies this condition; the majority of the analysis area is in the Hot Dry and Warm Dry Biophysical Environments. Refer to the Forest Vegetation section for the HRV analysis.

Past timber harvest, fragmentation, fire suppression and natural openings have resulted in a cover/forage ratio of about 26% cover and 74% forage. Individual habitat components, i.e., satisfactory cover and open road densities do not always meet standards, but appear to be at levels that support desired populations.

Forage

Approximately 74% of the analysis area currently classifies as forage. For the purpose of this analysis, forage areas include areas ranging from grasslands to forested stands with less than 40% canopy cover. Forage conditions are primarily the result of timber and grazing management, fire suppression and site productivity. Overstocked forested stands tend to reduce forage; many shrub, grass and forb species are inhibited by reduced sunlight reaching the forest floor. Livestock grazing can be beneficial or detrimental to big game. Range standards are set to meet the forage needs for both livestock and big game.

Cover

Satisfactory and marginal cover is sometimes referred to as thermal cover. Deer and elk use thermal cover to moderate harsh weather conditions, i.e., to keep cooler on hot days and to keep warmer on cold days. Under thermal cover, animals need to expend less energy for thermal regulation. The Forest Plan defines satisfactory cover for elk as a stand of coniferous trees 40 or more feet tall with an average canopy closure equal to or exceeding 50% for ponderosa pine and 60% for mixed conifer. Marginal cover is defined as a stand of coniferous trees greater than 10 feet tall with an average canopy cover meeting or exceeding 40%. Satisfactory and marginal cover comprises 3.7% and 22.2% of the analysis area, respectively. Total cover is provided on approximately 26% of the analysis area.

The Forest Plan recommends conducting cover calculations at the subwatershed level to better describe cover distribution. Total cover and marginal cover meet or exceed Forest Plan standards for both winter range and summer range for the subwatershed (see Table WL-7). Satisfactory cover falls below standards in winter range for the subwatershed. The low satisfactory cover levels may not be unreasonable. As discussed previously, historical conditions and fire return intervals in the Tamarack Creek Subwatershed favored large blocks of OFSS with canopy closure too low to support large blocks of satisfactory or marginal cover. Under historical conditions, cover percentages would be inherently low, probably below Forest Plan standards and guidelines.

Hiding cover, also referred to as security cover, is also important to big game animals. Hiding cover provides a visual barrier between big game animals and disturbance sources. This is especially important during hunting season when big game animals alter their travel patterns to

avoid humans. Hiding cover is difficult to quantify. Many stands classified as satisfactory or marginal cover also provide hiding cover. Even in non-thermal cover stands, small thickets of saplings 1 to 2 acres in size can offer security. Generally, hiding cover is more prevalent in the moist forest environments at higher elevations and less prevalent in the dry forest environments at lower elevations. Topography can also reduce sight distance. Where topography is steep and dissected by multiple ridge lines and valley bottoms, greater security is provided

Table WL-7 displays levels of satisfactory and marginal cover; these cover percentages provide some indication of the availability of hiding cover in the analysis area. Satisfactory cover is typically multi-storied and often provides the best elk hiding cover. Marginal cover also provides hiding cover, but cover can be much more variable or patchy.

Historically, the project area may not have had a substantial amount of hiding cover. The majority of the area is in the Warm Dry Biophysical Environments. These environments typically do not support high densities of conifer stems for more than 40 years. In recent years, commercial and precommercial thinning in the Dry Biophysical Environments have started shifting stands back towards more historic conditions, reducing hiding cover in size and quality. Nevertheless, hiding cover is currently believed to be at levels that exceed HRV.

During project planning, connectivity corridors were designated between late and old (LOS) structured stands to allow movement of old growth species (see Old Growth Existing Condition, Connectivity Section). The goal is to manage stands in the corridors at higher canopy densities than more intensively managed stands located outside the corridors. Corridors established for old growth species typically serve big game as well.

Open Road Densities

Over the entire Tamarack Creek Subwatershed, open road densities are 4.01 miles per square mile with 126.33 miles of open road. Both summer and winter range open road densities exceed Forest Plan standards (USDA Forest Service 1990, IV-6). For big game summer range the Forest Plan Standard is 3.2 miles per square mile (currently road density is 3.94 miles per square mile). For big game winter range the Forest Plan Standard is 2.2 miles per square mile (currently road density is 4.13 miles per square mile). Table WL-7 shows the road densities within the subwatershed and project area.

Perhaps more important than the impacts of road densities is the spatial relationships of those roads upon elk habitat use and selection. Recent studies at the Starkey Experimental Station found a strong correlation between road activity and habitat selection (USDA 2005). Elk response was affected by traffic rates, amount of forest cover near roads, and the type of road (which related to traffic rates). Female elk consistently selected areas away from open roads in both spring and summer. Once the elk were farther away from roads, they were more influenced by other factors such as conditions affecting forage. When elk were unable to avoid roads and trails, subsequent studies showed that animals increased their movement rates, which can increase energy expenditures. Higher movement rates could thus reduce the animals' fat reserves and undermine general animal condition and winter survival. The highest potential for road related impacts on big game is during the hunting seasons, when road use is highest. Research from the Starkey Experimental Forest demonstrates strong correlations between the presence of open roads and elk habitat selection (Wisdom et al., 1998). Wisdom et al. and others have found elk habitat selection was adversely impacted by the presence of open roads, with the impact to habitat selection extending out beyond 1000 meters from open roads (1998). Elk were

increasingly found in areas further away from open roads, while those areas with many roads and limited distances between roads received limited use.

The Starkey Research suggests the special arrangement of roads has a greater influence on elk and deer than the Forest Plan road density model suggests. The research has shown that distance bands are more accurate for estimating disturbance to elk than road density alone. This effect would gradually decrease as distance from open roads increases. All (100%) of the analysis area is within 1000 meters of an open road under the existing condition. This provides no areas of security where deer and elk can select habitats free from road influences. About 88% of the area is within 500 meters of an open road; i.e., 20% of the area is further than 500 meters. The presence of open roads likely reduces the habitat effectiveness of the area.

Environmental Consequences

Direct and Indirect Effects

Alternative 1- No Action

HEI and Cover

The existing condition would be maintained in the subwatershed, resulting in no change in the Habitat Effectiveness Index (HEI) for elk. HEI would remain .48 in summer range and .46 in winter range in the short- term under this alternative.

Future development of multi-strata stands (with continued fire suppression) would create additional satisfactory and marginal cover stands in the mid to long term, increasing hiding and security cover for elk. These stands would become denser, and downed wood is expected to increase due to insect and disease infestations in these stands. Increasing stand density and downed wood would improve cover habitat by increasing understory screening structure. These long-term changes could improve HEI in this time frame. These habitat changes would also increase the chance of a high severity wildfire in the analysis area. A fire of this magnitude and severity would convert multi-strata cover habitat to stand initiation forage habitat in the long term, increasing vulnerability of big game to hunting in the roaded portion of the analysis area.

Road Densities

This alternative has the potential to affect wildlife habitat through the indirect effects of doing nothing. Open road systems potentially affect big game animal's security, density, distribution, and habitat selection, especially during hunting seasons when road use is highest. This alternative would result in the existing condition remaining the same.

Relationships between the spatial distribution and disturbance associated with open roads and hiding cover habitat would also not change, as existing road densities and levels of use are expected to remain the same in the short term. Implementation of this alternative would create no new roads, but at the same time, it would do nothing to modify existing open road densities or road management.

Alternative 2

The proposed action in Alternative 2 reduces cover with negative effects to habitat effectiveness for elk, but overall HEI values would improve, mainly due to road closures. Table WL-8 displays post-treatment HEI, cover, and open road densities. FVS was used to predict post-

treatment canopy cover. See Table WL-7 for existing condition comparison. The HEI model runs are available in the project record.

Table WL-8. Alternative 2 HEI Values, Cover Percentages and Open Road Densities by Subwatershed and Winter/Summer Range Classification.

Subwatershed	HEc	HEs	HEf	HEr	HEcsfr (HEI)	%S	%M	Total Cover %	Open Road Density (miles per square mile)
Summer Range									
Forest Plan Standard	**.30**	**.30**	**N/A**	**.40**	**.40**	**5**	**5**	**20**	**3.20**
Tamarack Creek	.61	.55	N/A	.39	.51	5	17.4	22.4	2.96
Winter Range									
Forest Plan Standard	**.40**	**.30**	**.40**	**.50**	**.50**	**5**	**10**	**20**	**2.20**
Tamarack Creek	.53	.57	.50	.44	.51	1.2	18.4	19.6	2.51

HEI = Habitat Effectiveness Index, HEc = habitat effectiveness derived from the quality of cover
HEs = habitat effectiveness derived from the size and spacing of cover
HEf = habitat effectiveness derived from the quantity and quality of forage; HEf is not used in summer range.
HEr = habitat effectiveness derived from the density or roads open to vehicular traffic
%S = Satisfactory Cover, %M = Marginal Cover, % Total Cover = %S + %M, N/A – Not Applicable.

The most direct effect from the proposed action is the reduction in marginal cover and the change in cover/forage distribution. Cover would be converted to lower quality cover habitat or forage depending on the treatment. In understory removal, and commercial thin units, canopy cover would drop below 40% and be classified as forage. In precommercial thinning units, only smaller trees would be removed; post-treatment classification varies by unit. Some units drop from marginal cover while other stands would remain of a lower quality cover. Following treatment, satisfactory and marginal cover would comprise 3.1% and 17.4% of the analysis area, respectively. Total cover is provided on approximately 20.5% of the analysis area. While cover is reduced, HEI values increase due to mitigation measures, road density reduction, increase in forage, and better distribution of cover and forage.

Deer and elk are believed to use thermal cover, i.e., satisfactory and marginal cover, to reduce the effects of weather and temperature extremes and to hide from predators. It is important to note that recent research at the Starkey Experimental Station in La Grande, Oregon (Cook 1998) has raised the concern that resource managers may be overstating the importance of thermal cover on elk condition. Studies suggest that the energetic benefits of cover may be inconsequential to elk performance, and that it is forage or nutritional effects that may have the greater impact on individual animal performance. However, these studies do not dispute elk's preference for dense forest stands or the numerous studies that show elk using dense stands disproportionately to their availability. Dense conifer cover contributes to better distribution of elk across available habitat, and may be more of a disturbance/hiding cover issue than a thermal regulation issue.

The proposed action would cause the loss of hiding/security cover during and immediately after thinning and burning operations. The potential negative effects of removing understory trees would be reduced by the design requirement to retain unthinned patches of dense trees throughout the project area. Unthinned patches would comprise 5% to 15% of the treated area and range from 3 to 5 acres in size depending on the density of understory trees. In units where treatment is limited to prescribed burning, losses in hiding cover would be reduced. Design

measures provide limits on tree mortality (see Chapter 2). Burning occurs in a mosaic of burned and unburned patches.

Connectivity corridors established for LOS and big game would support deer and elk movement across the landscape (see maps in the project record). Prescribed underburning and thinning would reduce understory stocking; however, design requirements would retain non-thinned patches to facilitate animal movement.

Recent results from long-term big game studies at the Starkey Project indicates that elk avoided the short-term disturbance of logging activity itself, but elk did not avoid the harvests units or the log-hauling roads during and after timber harvest. In general, the elk populations become more dispersed during and after timber harvest which suggests that elk were moving farther over larger areas to meet their needs. Elk productivity was not negatively affected by timber harvest; however, the vulnerability of elk to hunting did increase. Open landscapes and relatively flat topography make elk more visible to hunters. This would increase hunter success, but would have little effect on elk performance (weight gain, general body condition) (USDA 2006).

Thinning and burning would improve forage conditions by opening canopies and allowing more light to the forest floor. Most native grasses and forbs and many shrubs respond positively to increased light and fire. Plants tend to sprout vigorously from their roots if the above ground portions are killed by fire, although it might take 2 to 3 years for grass and forb species and 10 to 15 years for shrubs to return to their pre-fire abundance and volume. Fire can also increase nutrient content and palatability of forage, although the increased quantity of forage after a fire may be more significant than the increased quality of that forage (USDA 2000). Species that respond favorably to fire include pinegrass, elk sedge, wild rose, snowberry, ceanothus, serviceberry, chokecherry and currant.

Mountain mahogany and bitterbrush appear to be somewhat dependent on fire for long-term viability, although short-term effects can be detrimental to these plants. Fire may kill existing plants, but will prepare the necessary seedbed for regeneration. Sagebrush is also killed by fire, but seed germination can be fostered by improved seedbeds as well. The project is not intending to burn through large, expansive shrublands. Mortality/damage of smaller shrub stands and scattered individual plants would be expected. Mosaic burning would retain shrubs throughout the project area. Over browsing has been detrimental to existing shrubs and fire might increase abundance and vigor of many species, thus reducing the level of browsing on any individual species or plant. Ideally, landscapes would be underburned every 10 to 15 years to enhance forage quality and quantity.

Precommercial thinning and pile burning would not be conducted in riparian areas; prescribed burning would be conducted in riparian acres. Treatments would potentially affect calving and fawning habitat. Design features would retain untreated patches to maintain hiding/security cover. Precommercial thinning would have a greater impact than burning, but the number of acres being treated is considered incidental. In known calving/fawning area, precommercial thinning and underburning would be prohibited from May 1st to June 30th to minimize effects. In areas not specifically identified for calving and fawning, burning crews would watch for lone deer or elk. If crews see lone animals, they would search the immediate area for calves and fawns and avoid igniting fire where young animals are discovered.

There would be a short-term increase in big game disturbance during operations. Seasonal restrictions in winter range would minimize effects during the most sensitive season. Activities

would likely change big game distribution, but not affect populations. Open road densities would be reduced, helping mitigate the effects of cover loss.

In summary, reductions in thermal and hiding cover would likely affect big game distribution, but would not be expected to affect population numbers. Retention of unthinned patches in units would help mitigate losses in cover. Open road densities would be below Forest Plan standards in all areas except winter range, reducing the potential for disturbance. Seasonal restrictions on activities would minimize disturbance in winter range. The project was designed to maintain connectivity corridors for deer and elk. Implementation of the proposed action would not be expected to reduce populations.

Alternative 3

The proposed action in Alternative 2 reduces cover with negative effects to habitat effectiveness for elk, but overall HEI values would improve, mainly due to road closures. Table WL-9 displays post-treatment HEI, cover, and open road densities. FVS was used to predict post-treatment canopy cover. See Table WL-7 for existing condition comparison.

Table WL-9: Alternative 3 HEI Values, Cover Percentages and Open Road Densities by Subwatershed and Winter/Summer Range Classification.

Subwatershed	HEc	HEs	HEf	HEr	HEcsfr (HEI)	%S	%M	Total Cover %	Open Road Density (miles per square mile)
Summer Range									
Forest Plan Standard	**.30**	**.30**	**N/A**	**.40**	**.40**	**5**	**5**	**20**	**3.20**
Tamarack Creek	.61	.52	N/A	.39	.50	5	17.2	22.2	2.96
Winter Range									
Forest Plan Standard	**.40**	**.30**	**.40**	**.50**	**.50**	**5**	**10**	**20**	**2.20**
Tamarack Creek	.53	.58	.50	.44	.51	1.2	19.2	20.4	2.51

HEI = Habitat Effectiveness Index
HEc = habitat effectiveness derived from the quality of cover
HEs = habitat effectiveness derived from the size and spacing of cover
HEf = habitat effectiveness derived from the quantity and quality of forage; HEf is not used in summer range.
HEr = habitat effectiveness derived from the density or roads open to vehicular traffic
%S = Satisfactory Cover, %M = Marginal Cover, % Total Cover = %S + %M. N/A – Not Applicable.

The most direct effect from the actions in Alternative 3 is the reduction in marginal cover and the change in cover/forage distribution. Cover would be converted to lower quality cover habitat or forage depending on the treatment. In understory removal, and commercial thin units, canopy cover would drop below 40% and be classified as forage. In precommercial thinning units, only smaller trees would be removed; post-treatment classification varies by unit. Some units drop from satisfactory to marginal cover while other stands would fall out of cover. Following treatment, satisfactory and marginal cover would comprise 3.3% and 20% of the analysis area, respectively. Total cover is provided on approximately 23.3% of the analysis area. While cover is reduced, HEI values increase due to mitigation measures, road density reduction, increase in forage, and better distribution of cover and forage. Everything else would be as stated in the Alternative 2 effects.

Satisfactory cover in winter range, already below Forest Plan standards, would remain the same. Total cover in winter range would be at standard at 20%.

Cumulative Effects

The area considered for cumulative effects is the Tamarack Creek Subwatershed. The following discussion focuses on those past, ongoing and foreseeable future activities that may contribute positive or negative effects (refer to Appendix C).

Past timber harvest, road construction, and fire suppression in the analysis area has affected the quantity, quality, and distribution of cover habitat. Road construction has increased road-related disturbance on big game animals and their habitats. Historic livestock grazing may have affected forage, but today's livestock grazing is considered compatible with big game use. Past activities are reflected in the HEI, cover and road density values described at the beginning of this section.

There are no foreseeable future vegetative management activities (silvicultural or prescribed burns) in this area. Other ongoing and foreseeable actions, i.e., summer and winter recreation, hunting, and firewood cutting would continue to occur in the area but are not expected to affect big game on the large scale. These actions may temporarily and in the short-term affect individuals but are not expected to affect populations.

Disturbance of elk by hunting along open roads and off-road vehicle use would have more impact on big game populations than big game cover conditions created by the proposed action.

Elk population census data for the Malheur River Big Game Management Unit indicates a stable, level, population trend (Table WL-6). It appears that past forest management has not been detrimental to elk populations in this management unit. It is not anticipated that planned activities in this alternative would cause a decline in elk populations either. However, it will likely cause a redistribution of animals across the landscape.

Cumulatively, management activities across the Forest are distributed sufficiently to minimize disturbance impacts at the population levels. Seasonal restrictions are applied on a project by project basis as needed. Generally, adjacent private lands have been intensively managed. In the past, these timber stands do not appear to have been managed for cover and no change in this strategy is expected. These areas are not expected to provide cover habitat in the future. Private lands generally provide good forage and are expected to continue to be managed in such a way that this continues in the future.

The combined effects of the Knox Project with the effects of past, present, and reasonably foreseeable future activities would not be expected to adversely affect populations or viability of big game species within the analysis area.

Primary Cavity Excavators

Existing Condition

Primary Cavity Excavators (PCEs) depend on standing and downed wood for foraging, nesting, and roosting. These species create cavities in dead and live trees. Secondary cavity users (flying squirrels, etc.) can use cavities excavated by these species. Primary cavity nester habitat can occur in a variety of vegetative communities with various structural conditions (Thomas 1979).

The Forest Plan identifies 11 Primary Cavity Excavators (PCE) as MIS for the availability and quality of dead and defective wood habitat: black-backed woodpecker, three-toed woodpecker, Lewis' woodpecker, white-headed woodpecker, pileated woodpecker, downy woodpecker, hairy woodpecker, northern flicker, Williamson's sapsucker, red-breasted sapsucker and yellow-bellied

sapsucker. Because sapsucker species have been re-classified in recent years, the red-naped sapsucker will be used as a surrogate for the red-breasted and yellow-bellied sapsuckers.

Snags and down log densities were estimated using data obtained through stand exams, Most Similar Neighbor analysis, and field reconnaissance. On average, current snag densities in the analysis area do not meet Forest Plan standards for 100% potential population levels, i.e., 2.39 snags per acre equal to or greater than 21" dbh. Existing snags average 6.8 snags per acre 10-20" dbh and .97 snags per acre 20" dbh and greater. Total snags may exceed the Forest Plan standard, but the large diameter snags 20" dbh and greater are deficient. Existing snags levels are primarily a result of past harvest which removed a large portion of the existing snags and large, mature trees (snag replacement trees). Snags were estimated for the analysis area focusing on the Dry Biophysical Environments. Future snags were projected 10 years after treatment and 50 years after treatment.

Refer to the Wildlife Report and the project record for snag distributions for the project area; existing distributions were compared to inventory distribution data in DecAID (Decayed Wood Advisor 2.0 (Mellen 2006). DecAID is an internet-based computer program developed as an advisory tool to help federal land managers evaluate effects of management activities on wildlife species that use dead wood habitats. The tool synthesizes published literature, research data, wildlife databases, and expert judgment and experience. Inventory data in DecAID suggests that small snags and larger snags are variable with some density classes below HRV and some classes above HRV.

Existing snag data was also compared to wildlife data in DecAID 2.0 (Mellen 2006). In DecAID, wildlife tolerance levels (30%, 50%, 80%) are used to describe the % of a population that utilizes a particular habitat characteristic (e.g., snag density). Essentially, the lower the tolerance level, the fewer individuals will likely use the area. For example, at the 30% tolerance level for any given species, it would be expected that 30% of a population would find suitable or usable habitat at the specified snag density. Consequently, 70% of a population would not find suitable habitat conditions at that snag density. It should not be assumed that the highest tolerance level (80% +) is always the goal for management. In many instances, historic conditions, particularly in the dry forest types did not support the density of snags at the 80% level. In the analysis area, existing snag levels correlate to the lower tolerances levels for various PCE species, primarily at the 30%-50% tolerance levels or lower.

While DecAID provides data on wildlife use of snags and down wood, it does not measure the biological potential of wildlife populations. There is no direct relationship between wildlife tolerances, snag density and size used in DecAID and snag density and size that measure potential population levels (Mellen et al. 2006). DecAID is not a viability model, and thus tolerance levels should not be interpreted as population viability "thresholds." Rather, DecAID tolerance levels may be interpreted as three levels of "assurance": low (30% tolerance level), moderate (50% tolerance level), and high (80% tolerance level), Mellen et al. 2006. The higher the tolerance level, the higher the "assurance" that snag habitat is being provided. Therefore, DecAID wildlife tolerance levels are only one component used to evaluate the effects of this project on dead wood habitats and associated species. This analysis also used species' ecology, project design features, Forest Plan standards, local historic snag data and projected snag levels to analyze effects.

Regional Forester's Eastside Forest Plan Amendment 2 prescribes standards for down logs. In the ponderosa pine types, Amendment 2 prescribes retention of 3-6 logs per acre, total lineal length of 20-40 feet, 12 inches in diameter at the small end and each log at least 6 feet in length. In the mixed conifer types, Amendment 2 prescribes 15-20 logs per acre, total lineal length of 100-140 feet.

Visual estimates of down logs were made for each of the stand exams taken. In addition, volumetric estimates of down logs were made for the examined stands. Both visual estimates and volumetric calculations of down wood indicate that most forested stands in the project area meet Forest Plan standards. Results were also compared against down log inventory data in DecAID (Mellen 2006). Exam plots generally indicated that the stands in the project area have more down wood than would be expected under a historic or reference condition. Past management activities, fire suppression, disease and insects could all be cause for the build up of down wood.

Environmental Consequences

Direct and Indirect Effects

Alternative 1- No Action

Selection of the No Action Alternative would maintain existing levels of snags and downed wood in the analysis area. No activities would be implemented, so there would be no creation or loss of existing snags or downed wood. Snags would continue to be recruited and fall at existing rates. In the short- and mid-term, the number of large diameter snags would continue to be below Forest Plan standards. In the long term, continued fire suppression and multi-strata development would increase the chance of insect infestations and disease. These occurrences would potentially increase snag densities. Downed wood densities, on average, would continue to meet Forest Plan standards now and into the future. Logs would be expected to increase as existing or created snags fall.

Table WL-10 displays the average number of existing snags for the Warm Dry and Hot Dry Bio-physical Environments in the analysis area. FVS was used to project snag levels to year 50 if no action is taken. Projected snag levels are also provided for Alternatives 2 and 3 for comparison purposes.

Table WL-10. Snag Densities

	Snags 10-20" dbh per acre	Snags >20" dbh per acre	Total snags per acre
Forest Plan Standard	**NA**	**2.39**	**2.39**
Existing Condition – No Action	3.2	.97	4.17
Alternative 2 in 10 Years	4.8	1.1	5.9
Alternative 3 in 10 Years	4.8	1.1	5.9
No Action in 50 Years	4.9	1.2	6.1
Alternative 2 in 50 Years	7.7	1.9	9.6
Alternative 3 in 50 Years	7.8	1.9	9.7

*Snag estimates for Alternative 2 and 3 do not reflect the effects of retaining untreated patches in harvest units; retention of these patches of trees would continue to provide avenues for snag creation. Values would likely be higher.

In the short- to mid-term, the No Action Alternative would have minimal effects on the MIS species for dead wood habitats including 10 PCE species and the pine marten. Habitat would

remain unchanged in the short- and mid-term. Snag and downed wood used by these species would have the same availability, distribution, and density described in the existing condition section. Dead wood habitat would remain stable for species such as the pileated woodpecker, downy, and hairy woodpeckers, and other species identified at the beginning of the section. These habitats would continue to provide snags for foraging and nesting, as well as higher canopy closures and near ground level canopy development that provides protection from predators. Populations would remain the same.

In the long-term, disease and insects would increase foraging and nesting habitat for these species. Table WL-10 indicates that by year 50, snag levels would be expected to move towards Forest Plan standards. Populations would likely respond positively to these increases. Although snag habitat would be expected to increase, DecAID tolerance levels would be expected to remain around the 30-50% or lower, as described in the existing condition section. Increases in canopy could have additional benefits to pileated woodpecker and pine marten and adverse effects to white-headed woodpeckers; canopy cover effects are discussed in detail in the Old Growth Habitat section.

The growth of understory hardwood shrubs required by some PCE species would be inhibited by reduced sunlight reaching the forest floor. The red-naped sapsucker, Williamson's sapsucker, and downy woodpecker could show a slight negative effect to habitat due to continued decline in aspen habitats. Deciduous habitats only comprise a small portion of the analysis area, so no changes to existing populations would be expected.

Higher fuel loads would increase the chance of a high severity wildfire within the analysis area. A fire of this magnitude and severity would more dramatically affect snag and downed wood densities; snags would be much higher than those displayed in Table WL-10. Stand replacement wildfire would benefit some species (Lewis', black-backed, northern three-toed, and hairy woodpecker, and the northern flicker) while reducing habitat for other species (pileated, white-headed, and downy woodpecker, and the red-naped and Williamson's sapsucker) less associated with fire.

Alternative 2 and 3

The two action alternatives were combined into one effects analysis because for the purposes of snags and down wood the two alternatives would have the same effects. The differences between the action alternatives are in the prescriptions used to accomplish the treatment. Today, many green timber sales are conducted differently than they were in the past. In the Knox Project, snags would not be targeted for removal, although incidental snags may be lost during logging to meet operational/safety needs during logging. Project design criteria, such as retaining clumps of live trees around snags and locating landings and temporary roads where there are few or no snags, would help minimize losses. Retention of untreated patches of trees would continue to provide avenues for snag creation.

Prescribed burning would be expected to have the most effects on snags. Snags can be both lost and recruited during burning. Design features would be incorporated into burn prescriptions to minimize the effects to existing snags. This "snag exchange" may increase local woodpecker viability if fire created snag recruitment exceeds loss. Because most of the mortality would be in trees smaller than 10" dbh, most of the benefits would be to foraging habitat rather than nesting habitat.

At the analysis area scale, the loss of large snags from harvest would be expected to be minor due to the number of acres being treated and the fact that snags would not be targeted for removal. Snags felled for safety during logging operations would impact 2-10% of the existing snags in the treatment units, and less than 1% at the landscape level. Table WL-10 predicts snag densities 10 years following treatment. As suspected, the number of 10-20" dbh snags would increase (3.2 snags per acre to 4.8). The number of large snags would increase slightly (.97 snags per acre to 1.1). Snag levels are somewhat underestimated because snag estimates do not reflect the effects of retaining untreated patches in harvest units; retention of these patches of trees would continue to provide avenues for snag creation. Snag levels would likely be higher. Although the analysis area remains below Forest Plan standards, additional level of impact would not be expected to adversely affect PCE populations in the analysis area.

Table WL-10 indicates that in the long-term (50 years), snag levels would increase, although at slightly lower levels than predicted for the No Action Alternative. This would be expected given proposed thinning treatments would be designed to help reduce the levels of insect and disease operating in the project area. By year 50, total snag levels would be expected to exceed Forest Plan standards; large diameter snags could be deficient (1.9 snags per acre rather than 2.39); although it is believed that these values are somewhat underestimated as discussed in the previous paragraph. Snags levels would better reflect levels in DecAID. Because of proposed treatments, large diameter trees would be plentiful and a portion could be converted to snags to supplement naturally-occurring levels and address any shortfall.

Forest Plan standards for green tree replacements would be met following treatments. Sufficient snag replacement trees would be available to meet future snag needs in all treatment units. Although snag habitat would be expected to increase, DecAID tolerance levels would be expected to remain around the 30%-50% or lower, as described in the existing condition section.

Burning activities would be conducted to ensure little or no net loss of down logs. Logs may be charred, but effects would meet Forest Plan standards that require that no more than 3 inches of the log diameter, 1.5 inches on either side of a log, be consumed. Logs would be expected to increase as existing or created snags fall.

In the short- to mid-term, the proposed actions would have positive effects on most PCE species because of the increase in snag habitat from prescribed burning. Because most of the trees killed would be small trees, benefits would be primarily to foraging habitat. Species that would benefit include black-backed woodpecker, three-toed woodpecker, Lewis' woodpecker, white-headed woodpecker, downy woodpecker, hairy woodpecker, northern flicker, Williamson's sapsucker, and red-naped sapsucker. Black-backed and three-toed woodpeckers tend to use smaller snags for nesting, so benefits may be slightly higher for these species. Although snag habitat would be expected to increase, DecAID tolerance levels would be expected to remain around the 30%-50% or lower, as described in the existing condition section. Habitat increases would not be expected to change populations.

The proposed actions would have a slightly negative impact to pileated woodpecker and pine marten habitat. Snag habitat for these species would increase, but treatment would also degrade (char) down log habitat and reduce cover. Effects to cover are discussed in the Old Growth section. Combined changes in cover and dead wood habitat would not be expected to affect population viability.

In the long-term, disease and insects, although reduced compared to the No Action Alternative, would continue to increase foraging, nesting and denning habitat for dead wood associated species. Populations would likely respond positively to these increases.

During project operations (logging, noncommercial thinning, machine work, burning, and changes in snow mobile routes) degrees of disturbance and displacement of dead wood associated species would be likely. Overall, disturbance from activities would be limited in time and place, and therefore, would not be expected to change populations of species at the landscape level.

Cumulative Effects

The area considered for cumulative effects is the Tamarack Creek Subwatershed. Past timber harvest, fire suppression, road construction, wildfire, and firewood cutting have impacted the quantity, quality, and distribution of dead wood habitats and PCE populations dependent on these habitat features across the analysis area (refer to Appendix C). These activities have created the existing condition of dead wood habitats described in the existing condition section. Large snags are currently below Forest Plan standards. Down logs, on average, exceed Forest Plan standards.

Past timber harvest projects were generally very intensive; focusing upon the removal of the larger, more valuable ponderosa pine, Douglas-fir, and western larch trees (green tree replacements). Likewise, merchantable snags and downed wood were also removed, burned, or otherwise disposed of. The extensive road network in the analysis area (largely a result of past harvest) has impacted snag densities by increasing accessibility of the area to firewood cutting. Firewood cutting has impacted snag habitat in close proximity to open roads. Fire suppression has resulted in dense, multi-strata stands; snag and down log densities are generally higher in these stands than less dense ponderosa pine stands.

Current trends indicate that snags and down log numbers are increasing due to reduced harvest over the past decade and increased retention levels required by Regional Forester's Eastside Forest Plan Amendment 2. In addition, the closing of roads has reduced the amount of snags cut for firewood. Any future thinning or prescribed underburning would be designed to retain a suitable snag and down wood component. Such management strategies are expected to improve habitat for cavity dependent species.

There are no foreseeable future vegetative management activities (silvicultural or prescribed burns) in this area. Other ongoing and foreseeable actions, i.e., summer and winter recreation, hunting, and firewood cutting would continue to occur in the area but are not expected to affect primary cavity excavators on the large scale. These actions may temporarily and in the short-term affect individuals but are not expected to affect populations. Design features would be included to minimize consumption of existing habitat. Overall, snags and down logs would be expected to stay about the same or increase.

Private lands typically do not provide large diameter snags. In the past, adjacent landowners have generally salvaged damaged or dying trees to capture their economic value before they decay to a level where they no longer have a market value. Timber management has favored harvest of large diameter trees because of their higher economic value; removal of overstory trees releases smaller trees that are then managed over the next harvest cycle. Public firewood cutting is expected to continue along open roads.

Cumulatively, management activities across the Forest are distributed sufficiently to minimize disturbance impacts at the population levels. Due to the low level of effect that is expected under the No Action and Proposed Action Alternatives, it is not expected that adverse cumulative effects on snag and downed wood habitat and the species that depend on these habitats would result when combined with the residual and anticipated effects of past, present, and reasonably foreseeable future activities. Future snags projections indicate a gradual increase in snags over time. Populations of species associated with dead wood habitats would be maintained.

Featured Species

Existing Condition

Featured species are those identified in the Malheur Forest Plan as species that require special protections. The Forest Plan (IV-30 and IV-31) provides direction (standards 50-55) for the protection of habitat for these species. There is no potential effect on pronghorn antelope, bighorn sheep, osprey or their habitats from the proposed action. These species will not be discussed further.

Table WL-11 lists the seven featured species currently on the Malheur National Forest. The table also includes what their habitat requirements are and whether or not their habitat occurs in the analysis area (Tamarack Creek Subwatershed).

Table WL-11. Featured Species List, Habitat Needs, and Presence / Absence.

Featured Species	Habitat Requirements	Habitat Present In Analysis Area
Northern Goshawk	Mature, multi-storied ponderosa pine stands, or mixed conifer stands that are dominated by ponderosa pine	Yes, habitat is present. There are six historical nests. Was surveyed in 2006 with no active nests found.
Blue Grouse	Clumps of mistletoe infected Douglas fir on tops or upper slopes of ridges	There is the potential that some Douglas fir may have mistletoe infection.
Western Sage Grouse	Open sagebrush plains from 4000-9000 ft in elevation. Covered in TES section	Potential is there (see TES section) but habitat is low quality, fringe type.
Osprey	Large dead trees suitable for nesting (30”dbh >60’ in height) adjacent to or near large rivers or lakes	No, due to the lack of large dead trees near a large river or lake
Pronghorn Antelope	Open grasslands, with low sagebrush being an important component	Yes, habitat present. Species not present.
California Bighorn Sheep	Alpine-desert grasslands associated with mountains, cliffs, foot-hills, and river canyons	No, the project area does not fall with suitable habitat for Bighorn sheep
Upland Sandpiper	Covered in the TES section	No, habitat occurs in small patches and may not be large enough to support nesting by this species. The quality of habitat is poor within the analysis area, primarily due to shrub and conifer encroachment that has occurred in grassland habitats

Northern Goshawk

Existing Condition

Goshawk is a species specifically identified in the Regional Forester's Eastside Forest Plans Amendment 2. They utilize a wide range of mature and immature forest habitat types. In general, goshawks, nest in mature and old forest stands of relatively large trees with closed canopies (>50%) and an open understory. On the Malheur National Forest, a 30-acre nest area and a 400-acre post-fledging area (PFA) are established for each territory.

Six known historical goshawk nests exist in the project area, five on National Forest Land and one on the private inholding. There are approximately 1216 acres of Post Fledging Area (PFA) in the project area. In 2007 and 2008, taped goshawk calls were broadcasted in the known historic nest stands and potential habitat throughout the of the project area to determine if additional habitat was being used; calls elicited no response. In the spring of 2009, taped goshawk calls will be broadcast in the project area again; any new nest sites that are located will be designated.

Environmental Consequences

Direct and Indirect Effects

Effects to habitat were analyzed for the project area. Future old growth was projected 10 years after treatment and 50 years after treatment. See Old Growth Section

Alternative 1 – No Action

Under the No Action Alternative, habitat for northern goshawk would increase as stand density and canopy cover increases. Populations would not be expected to change in the short- to mid-term, and could potentially increase in the long-term. See the Old Growth Section of this Chapter for additional effects on goshawks and their preferred nesting habitat.

Fire hazard would remain high in the project area as discussed in the Fuels section of this EA. Long-term development of old growth could be diminished if stand development is disrupted by epidemic bark-beetle activity (likely) or severe fire effects (possible).

Alternative 2 and 3– Action Alternatives
Under the action alternatives, there would be a reduction in nesting habitat for the northern goshawk. Thinning and prescribed underburning is intended to reduce understory cover and open up stands, shifting stands towards historic conditions. Primary and secondary habitat would remain plentiful; stand growth projections indicate habitat would increase in the long-term.

Known goshawk territories would be monitored annually for goshawk activity for the life of the project. If active nests are identified within or immediately adjacent to the project area, management activities would be prohibited within ½ mile of the nest sites from April 1 to September 30 to avoid disturbing goshawks during the breeding season.

More open stand conditions would create foraging habitat that would permit this raptor to detect and acquire prey species more efficiently. Because goshawks will prey on primary cavity excavators, retention of dead wood habits will help improve goshawk foraging habitat.

Goshawks prey on a variety of small mammal species as well. Adult goshawks foraging in the area would not likely be disturbed by project activities.

Research (Reynolds et al. 1992 and Marshal 1992) varies on conclusions as to the effects of harvest in and adjacent to nest stands and whether or not goshawks will use these stands following harvest. Several studies (Marshal 1992) have suggested that selection harvest of trees can reduce nesting; however, goshawk management recommendations by Reynolds et al. (1992) do not exclude timber harvest. Local monitoring of goshawk territories is inconclusive on this subject; some territories have remained active from year to year despite adjacent treatments. Treatment within the PFA would follow Reynolds's recommendations, maximizing stand diversity to increase prey species diversity. Approximately 39 acres of the PFA will have commercial treatments, 22 acres will have precommercial thin treatments, and 434 acres will have prescribed fire occur. Annual goshawk monitoring would be conducted to validate effects to nesting goshawks.

Prescribed burning could also reduce cover, but generally burning kills smaller trees and would have minimal effect on canopy cover. As with timber harvest, effects are reduced because seasonal restriction would be applied to burning activities if nesting goshawks are identified.

Proposed treatments would reduce the hazards associated with insect epidemics and stand-replacement fire. Old growth would more likely persist into the future than under the No Action Alternative. Restoring natural vegetation conditions and fire regimes would make these habitats far more self-sustaining for associated wildlife species. Known goshawks territories would be maintained (no treatments are proposed in the nest stands); seasonal restrictions would be applied as needed to minimize disturbance during the reproduction season. Primary and secondary habitat would remain plentiful; stand growth projections indicate nesting habitat would increase in the long-term. Overall, proposed timber management and prescribed burning would contribute positively toward the viability of this species.

Cumulative Effects

The area considered for cumulative effects to nesting habitat is the Tamarack Creek Subwatershed. The following discussion focuses on those past, ongoing and reasonable foreseeable future activities that may contribute adverse effects to the species or its habitat (refer to Appendix C).

On the Malheur National Forest, nesting habitat is typically the limiting factor for goshawks. Past timber harvest reduced mature and old growth habitat preferred for nesting and fledging. Since 1993, the Forest Plan as amended has directed the Malheur National Forest to conduct timber sales in a manner that moves stands towards OFMS and OFSS structural stages, and timber sales planned since that time should not have contributed to loss of mature and old growth forest.

Adjacent private lands have been logged. In the past these timber stands have generally not provided nesting habitat for goshawks. There is one historic nest site on the private inholding in the project area; the status of this stand is unknown. It is known that stands on private land are not being managed for old growth conditions, and therefore are not expected to provide nesting habitat in the future.

Forage is not considered a factor limiting goshawk population viability in the area, and consequently cumulative changes to foraging habitat, whether positive or negative, would not contribute to a measurable change in goshawk populations.

Goshawks are highly sensitive to disturbance during the breeding season. When seasonal restrictions on management activities were disregarded in the past, breeding success may have been reduced. Since 1990, seasonal restrictions on activities within ½ mile have been regularly used in the vicinity of occupied nests. Known goshawk territories are to be monitored annually; if monitoring identifies occupied nesting habitat, seasonal restrictions would be applied to all management activities.

In the short- to mid-term, the No Action Alternative would not contribute to cumulative losses of old growth because stands would not be treated. In the long-term, the No Action Alternative, by forgoing action, could negatively contribute to the loss of old growth and associated species if a stand-replacing event such as wildfire occurs.

In the short- to mid-term, the proposed actions would contribute to a potential reduction in nesting habitat. In the long-term, proposed treatments would reduce the hazards associated with insect epidemics and stand-replacement fire. Old growth would more likely persist into the future than under the No Action Alternative. Restoring natural vegetation conditions and fire regimes would make these habitats far more self-sustaining for associated wildlife species. Known goshawks territories would be maintained; seasonal restrictions would be applied as needed to minimize disturbance during the reproduction season. Primary and secondary habitat would remain plentiful; stand growth projections indicate nesting habitat would increase in the long-term. Cumulatively, management actions would not be expected to reduce population viability.

Blue Grouse

Blue grouse prefer coniferous forests (especially fir) with a mixture of deciduous trees and shrubs near edges, openings. Young blue grouse eat insects, while adults depend on herbaceous material, particularly needles and buds of Douglas-fir and ponderosa pine during the winter. Dense coniferous thickets of small trees, stumps, and down logs are used by blue grouse for resting and escape cover. Large conifers with dense foliage are used for roosting. Blue grouse home range size is between 1.25 and 5 acres. The blue grouse occurs in coniferous forests dominated by Douglas-fir, grand fir, and subalpine fir. These habitats occur at mid-elevations and in subalpine areas, usually associated with openings and rocky areas. Blue grouse winter in open coniferous habitats at higher elevations than those that they inhabit in the summer. The species roosts in large conifers with dense foliage, including mistletoe Douglas-fir. The Forest Plan standard for the protection of grouse habitat (IV-30, Standard #50) states that projects should "Maintain grouse winter roost habitat. The preferred habitat is clumps of mistletoe-infected Douglas fir on tops or upper slopes of ridges." Due to the topography and stand structure and composition of habitat south of FR 16, it is unlikely that these areas would provide winter roost habitat for this species. The effect of the proposed activities on grouse winter roost habitat is described in the effects section.

Direct and Indirect Effects

Alternative 1- No Action

No activities are proposed under this alternative, so there would be no direct or indirect effects on winter roost habitat for this species. Habitat conditions would remain unchanged in the short and mid term, as described in the Existing Conditions section. Over the long term, increased stand densities and related stress will result in a greater incidence of insects and disease in the analysis area. Dwarf mistletoe, one of the diseases that increases incidence with increasing stand densities, would increase throughout the analysis area. Winter roost habitat would also increase given an increase in infected Douglas-fir; gnarled limbs and dense foliage ("witches brooms") created by this disease agent would create ideal roosting habitat for this species.

Alternative 2 and 3

The two action alternatives were combined into one effects analysis because for the purposes of blue grouse the two alternatives would have the same effects. The differences between the proposed actions are in the prescriptions used to accomplish the treatment. Under the action alternatives, harvest of trees potentially providing winter roost habitat would occur. As directed by the Forest Plan, design features would be incorporated into harvest prescriptions to maintain winter roost habitat. Populations of blue grouse would be maintained. During project operations (logging, noncommercial thinning, machine work, road work and use, burning, use of alternative snow mobile routes) degrees of disturbance and displacement of wildlife are likely. Seasonal restrictions in winter range for deer and elk would also reduce effects to blue grouse. Overall, disturbance from activities would be limited in time and place, and therefore, would not be expected to change populations of blue grouse at the landscape level.

Cumulative Effects

Past activities, actions, and events (refer to Appendix C) in the analysis area have contributed to create the existing condition of grouse winter roost habitat in the analysis area. Past harvest and thinning, fire suppression, wild fire, and personal use woodcutting have affected the quality and quantity of winter roost habitat in the analysis area. Past harvest and thinning reduced stand densities and in some cases selectively removed infected trees that would have otherwise provided potential winter roosting habitat. These activities reduced potential winter roost habitat in the analysis area.

Past fire suppression in the analysis area has allowed the encroachment of shade tolerant tree species to invade fire-prone habitat types, increasing stand densities. Increased stand densities throughout the analysis area have increased stress, allowing for an increased incidence of insects and disease, including dwarf mistletoe. Mistletoe is elevated over historic levels. Personal use woodcutting reduces the number of snags (dead standing trees) adjacent to open forest roads. This activity does not affect live trees with a potential to be used by grouse; however, recently dead mistletoe-infected trees may be removed. Woodcutting generally occurs where topography is gentle and access easy; the majority of areas with roosting habitat are not accessible to woodcutters. Generally, adjacent private lands have been intensively managed for Mistletoe eradication. In the past, these timber stands do not appear to have been managed for roosting habitat and no change in this strategy is expected. These areas are not expected to provide roosting habitat in the future.

Ongoing projects that are affecting winter roost habitat include personal use woodcutting. The effects of this activity are the same as those described in the past activities section above. Because design features will be incorporated in the project activities to maintain winter roost habitat there would be no direct or indirect impacts on winter roost habitat for grouse, there would be no cumulative effects on this species or winter roost habitat. There are no foreseeable future silvicultural treatments or prescribed burns in this area.

Landbird/Neotropical Migratory Bird Species (NTMB)

Existing Condition

Neotropical migratory birds are those that breed in the United States and winter south of the border in Central and South America. Continental and local declines in population trends for migratory and resident landbirds have developed into an international concern. Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds,* directs that environmental analyses evaluate the effects of proposed actions on migratory birds.

The Partners in Flight (PIF) Bird Conservation Plan is used to address the requirements contained in Executive Order 13186. Conservation planning allows the analysis of proposed projects on neotropical migratory birds through the use of guidelines for priority habitats and bird species of concern for each planning unit. The Malheur National Forest occurs in the Northern Rocky Mountain Landbird Conservation Planning Region. The conservation planning for the Blue Mountains, Ochoco Mountains and Wallowa Mountains sub-provinces is addressed in the *Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington* (Altman 2000), referred to in this section as the Conservation Strategy. The Conservation Strategy identifies priority habitats and focal species for each planning unit in the United States.

Habitat types described in the Conservation Strategy that occur in the Knox Project Area include Dry Forest, Montane Meadow, Aspen, Riparian Woodland, and Riparian Shrub habitats. Dry Forest habitats are composed of ponderosa pine or a combination of ponderosa pine, western larch, and Douglas-fir. These habitats are mostly found on xeric, upland sites with shallow, stony soils. These habitats are present at the lower and middle elevations within the affected area. Mesic Mixed Conifer habitats are located at higher elevations, wetter sites, northerly aspects, and in draws where soils are well developed and mesic. Dominant tree species include Douglas-fir, grand fir, western larch, hemlock, and lodgepole pine. This habitat does not include areas that were historically ponderosa pine but have now become mixed conifer due to fire suppression and fir encroachment. Riparian Woodland habitats are associated with large snags near streams with a complex canopy and understory foliage component. Riparian Shrub habitats are closely associated with streams, as well as wet meadows and wetlands. These habitats consist of a mix of riparian shrub species, including alder, aspen, red-osier dogwood, willow, and other shrubs. Riparian Shrub habitats in the affected area do not meet the parameters described in the Conservation Strategy; however, because riparian habitats within the affected area provide similar habitat (similar composition in smaller, narrower blocks), these areas will be considered Riparian Shrub habitats. There are several unique habitats, such as Montane Meadows, Aspen, and Shrub Steppe. Focal species and priority habitat features for these habitat types are listed in Table WL-12.

Table WL-12. Priority Habitat Features and Associated Focal Landbird Species in the Northern Rocky Mountain Landbird Conservation Region of Oregon and Washington (Altman 2000).

Habitat Type	Habitat Feature/Conservation Focus	Focal Species
Dry Forest Old Growth	Large patches of old forest with large trees and snags	White-headed woodpecker
	Old forest with interspersion of grassy openings and dense thickets	Flammulated Owl
	Open understory with regenerating pines	Chipping sparrow
	Patches of burned old forest	Lewis' woodpecker
Shrub Steppe	Steppe Shrublands - patches	Vesper Sparrow, Upland Sandpiper
Montane Meadow	Wet or dry open tracts of short grasslands	Upland sandpiper
Riparian Shrub	Willow/alder shrub patches	Willow flycatcher
Riparian Woodland	Large snags	Lewis' woodpecker
	Canopy foliage and structure	Red-eyed vireo
	Understory foliage and structure	Veery
Aspen		Red-naped sapsucker

Dry Forest Old Growth Habitat and Dependent Species

The dry forest habitat types refer to the dryer ponderosa pine dominated habitats of the Interior Columbia Basin. A variety of habitat conditions exist in these dry forest types of the project area, most of them the result of some level of management, including livestock grazing, fire suppression, and timber harvest. As a result of past management, very few acres in the dry forest habitats exist in a condition similar to the pre-European settlement of the region in the early to middle 1800s.

Four habitat attributes are identified within the dry forest types that provide important habitat components for different species of landbirds. They are old forest-large patches, grassy openings-dense thickets, open understory-regeneration, and burned old forest. Four species are also identified as focal species for these habitat attributes. The focal species for the previously mentioned habitat features are the white-headed woodpecker, flammulated owl (also a bird of prey), chipping sparrow, and Lewis's woodpecker, respectively. Without the important habitat characteristics identified, it is unlikely that the habitat would be occupied by the associated focal species, or the guild of species they represent.

Each of the four habitat components of the dry forest types identified is relatively uncommon in the analysis area, particularly when compared to pre-settlement habitat conditions. The old forest-large patches component is particularly lacking in the analysis area. These habitats are characterized as having low levels of canopy closure, mature ponderosa pine in a single canopy layer, and an understory dominated by herbaceous ground cover, shrubs, and scattered patches of pine regeneration. The dense thicket and regeneration patches identified as important habitat components do exist in the analysis area. Typically, they are composed of mixed conifer species, with few patches of pure ponderosa pine regeneration. Altman's Strategy (2000) identifies the dry forest habitat type as having suffered the highest level of change and impact since settlement of the area. Those suite of species associated with this habitat condition have declined in population, distribution, and species diversity as a result of these changes.

Shrub-Steppe Habitats

Shrub-steppe habitats are comprised primarily of dry woodlands, shrublands and grasslands. Dry shrublands/grasslands comprise approximately 764 acres (4%) of the analysis area. These shrub-steppe habitats are relatively small with the average size less than 15 acres and do not meet the habitat needs of upland sandpipers, the focal species for this habitat type. Livestock grazing, fire and road construction have impacted habitat quality. Conifer encroachment along the edge of openings may have reduced the extent of these habitats.

Small openings are also scattered throughout the forested areas, and can include both grasslands and shrublands. Shrub species include sagebrush as well as mountain mahogany and bitterbrush; these areas provide additional habitat for landbird species that use dry shrub-steppe habitats.

Species that use these habitats include vesper sparrow, Brewer's sparrow, lark sparrow, and long-billed curlew.

Riparian Woodland and Shrublands

Riparian woodlands and shrub habitats are typified by the presence of hardwood tree and shrub species, along with associated wetland herbaceous species. Water is obviously an important component of these habitats, including standing wetlands, spring and seeps, or flowing water (rivers and streams). These habitats compose a small portion of the Knox Project Area and analysis area, but potentially provide a high level of avian diversity and density.

The Conservation Strategy (Altman 2000) identifies three habitat components within the riparian woodlands and one within the riparian shrub habitats that are important to many landbirds. They include large snags, canopy foliage cover, understory shrub cover, and dense shrub patches (see Table WL-12). In addition, the Conservation Strategy identifies aspen as unique habitats important to landbirds. Many aspen habitats are associated with riparian areas or ephemeral draws. Within the Knox Project Area many aspen stands are scattered throughout upland areas. See aspen section below.

Within the project area, riparian woodlands and shrublands are generally associated with springs and seasonally flowing streams. Priority hardwood habitats include aspen, willow, dogwood and alder. All four of these habitat components are generally deficient in the project area and analysis area due to past management activities, including timber harvest, livestock grazing, wild ungulate grazing, and fire suppression.

Past grazing management practices likely impacted riparian woodland habitats. Historically hardwood canopies dominated riparian shrublands. Today, shrubs remain in a degraded condition. Improved grazing practices on National Forest lands have resulted in improvement of riparian areas.

Aspen

Presently, there are 65 aspen sites (245 acres) are identified within the proposed project area. Many of these sites are less than one acre in size and in some instances consist of only a few remaining aspen stems. These aspen stands are old and decadent, exhibit poor vigor, and lack regeneration. Due to fire suppression, conifers are encroaching on this stand and compete for water and light. Heavy grazing by domestic livestock and browsing by deer and elk often inhibit hardwood regeneration. Habitats are declining for such species as red-naped sapsucker.

Direct and Indirect Effects

Alternative 1- No Action

Dry Forest Old Growth Habitat and Dependent Species

With the implementation of Alternative 1, there would be no direct effects to the various neotropical migratory/landbird species inhabiting the project area. Habitat modifications would not occur, nor would individuals be directly affected, as no activities are proposed under this alternative. Habitat conditions would remain limited in the short- and mid-term as described in the existing condition section. Species distributions, densities, and overall population levels would remain relatively unchanged in the short- and mid- term.

Indirectly, the implementation of the No Action Alternative would affect some neotropical migratory bird species in the long-term. By selecting this alternative, opportunities to create and enhance OFSS habitats for adapted species would be foregone. In 50 years, the No Action Alternative would still not meet HRV for OFSS in either Warm Dry or Hot Dry Biophysical Environments.

As described in the existing condition section, habitat for the white-headed woodpecker, flammulated owl, chipping sparrow, white-breasted nuthatch, pygmy nuthatch, Williamson's sapsucker, and Lewis' woodpecker is lacking throughout the analysis area. Habitat would increase, but would still not meet HRV in 50 years.

Shrub-Steppe Habitats

With the implementation of Alternative 1, there would be no direct effects to shrub-steppe habitats or to the landbird species that use them. Habitat conditions would be as described in the existing condition section. Species such as vesper sparrow, Brewer's sparrow, lark sparrow and long-billed curlew would be expected to continue to use the area.

Riparian Woodland and Shrublands

With the implementation of the No Action Alternative, there would be no direct effects to the various neotropical migratory/landbird species that utilize riparian areas. Riparian conditions would be as described in the existing condition section. Snags would likely remain limited. Riparian cover would likely remain static or improve. Mature aspen trees would continue to decline and regeneration would be low or nonexistent. By forgoing prescribed burning, riparian areas would remain at high risk to stand replacing fire that could eliminate habitat.

Riparian conditions would continue to affect use by riparian landbird species such as Lewis' woodpecker, red-naped sapsucker, downy woodpecker, red-eyed vireo, willow flycatcher, veery, willow flycatcher, ash-throated flycatcher, tree swallow, house wren, Swainson's thrush, calliope hummingbird, song sparrow, spotted towhee, western wood pewee, warbling vireo, American redstart, orange-crowned warbler, and mountain chickadee.

Aspen

With the implementation of Alternative 1, there would be no direct effects to the various neotropical migratory/landbird species inhabiting the project area. Habitat modifications would not occur, nor would individuals be directly affected, as no activities are proposed under this alternative. Habitat conditions would remain limited in the short- and mid-term as described in

the existing condition section. In the long term, these stands will likely continue to deteriorate and if left unchecked will likely be completely replaced by conifers.

Alternatives 2 and 3

The two action alternatives were combined into one effects analysis because for the purposes landbirds/neotropical migratory birds the two alternatives would have the same effects. The differences between the proposed actions are in the prescriptions used to accomplish the treatment.

During project operations (logging, noncommercial thinning, machine work, road work and use, burning, use of alternative snow mobile routes) degrees of disturbance and displacement of wildlife are likely. Disturbance and displacement of wildlife away from forestry operations depends upon the season of the year and the tolerance of the species and individual. Overall, disturbance from activities would be limited in time and place, and therefore, would not be expected to change populations of species at the landscape level.

Dry Forest Old Growth Habitat and Dependent Species

Under the action alternatives, treatments in Warm Dry and Hot Dry Biophysical Environments would shift stands towards OFSS. For a more detailed discussion see old growth section and silviculture specialist report. Following treatment, many stands or forest patches would closely resemble desired conditions: a large-tree, single-layered canopy with an open, park-like under-story dominated by herbaceous cover with scattered shrub cover and pine regeneration. In the short-term, stands would still not have the requisite number of large diameter trees to classify as old growth, but desired species such as the white-headed woodpecker would still be expected to respond favorably. Design requirements would retain non-thinned patches for species such as the flammulated owl and chipping sparrow. Any conversion multi-storied dense canopy stands is likely to degrade nesting habitat for pileated woodpeckers, northern, although foraging habitat would still be available for use. See the Old Growth section for a more in-depth explanation.

Burning and thinning treatments conducted in the spring can affect landbirds during the breeding season. The effects to avian populations would be minimal due to avian ecology, the number of acres treated in any one year, the mosaic nature of burning, and the recovery rates of ground vegetation. Restoring natural vegetation conditions and fire regimes would make dry forest habitats far more self-sustaining for priority landbird species. MIS or priority landbirds that would directly benefit from treatment include the white-headed woodpecker, flammulated owl, chipping sparrow and Lewis' woodpecker.

Shrub-Steppe Habitats

Prescribed fire is not proposed in any larger expanses of open shrublands or grasslands, although a small amount of light burning may occur along the fringes of these habitats and in small inclusions scattered throughout the forested areas. In fringe areas, any shrubland areas burned would do so in a mosaic of burned and unburned patches. Unburned islands of sagebrush can retain habitat features vital to associated species, such as vesper sparrow. In studies in Idaho, (Smith 2000), prescribed burns killed about 50% of the shrubs; total bird abundance declined significantly in the first year after fire, and then rebounded in years two and three to levels similar to those in unburned areas. Scattered loss of shrubs is not expected to have significant impacts on shrub-steppe habitats or the landbird species that use them. Species such as vesper

sparrow, Brewer's sparrow, lark sparrow and long-billed curlew would be expected to continue to use the area.

Riparian Woodland and Shrublands

Prescribed fire will not be ignited in the riparian areas, but will be allowed to slowly creep or back into these areas. Riparian conditions would be as described in the existing condition section. Snags would likely remain limited. Riparian cover would likely remain static or improve. By forgoing prescribed burning in a truly effective sense, riparian areas would remain at high risk to stand replacing fire that could eliminate habitat. The small remnant aspen stand will be fenced and have conifers removed. See silvicultural report for treatment prescriptions.

Riparian conditions would continue to affect use by riparian landbird species such as Lewis' woodpecker, red-naped sapsucker, downy woodpecker, red-eyed vireo, willow flycatcher, veery, willow flycatcher, ash-throated flycatcher, tree swallow, house wren, Swainson's thrush, calliope hummingbird, song sparrow, spotted towhee, western wood pewee, warbling vireo, American redstart, orange-crowned warbler, and mountain chickadee.

Aspen

Of the 65 aspen sites (245 acres) 28 sites (150 acres) are proposed for treatment. These aspen stands will be either commercially harvested or have the encroaching conifers fell and left in place. This treatment will open up the aspen stands to light and result in regeneration of aspen. A few stands (3 acres) will also be caged with exclosures to prevent browsing use.

Cumulative Effects

The following discussion focuses on past, ongoing, and reasonable foreseeable future activities (refer to Appendix C) that may contribute adverse effects to landbirds and their habitats. Every action (including no action) within the scope of control of the Forest Service has tradeoffs. Past actions, including timber harvest, livestock grazing, recreation development, road construction, and fire suppression, among others, have all impacted landbird species and habitats individually and cumulatively. Past timber harvest has caused a loss of mature, open stands of Ponderosa pine throughout much of the analysis area. The quality and quantity of habitat for species dependent on these habitats has decreased. Large tracts of open pine forest have been fragmented. Road building associated with timber harvest has reduced the quantity of habitat available to some species and led to the fragmentation of habitat. Fire suppression over the last century has resulted in the encroachment of fire intolerant species (Douglas fir, grand fir, and lodgepole pine) into biophysical environments where these species were historically uncommon. Fire suppression has impacted residual pine stands by allowing fire-intolerant tree species to compete with Ponderosa pine, and caused understories to become dense. Past harvest has reduced large snag habitats in mesic mixed conifer forests. Past grazing and fire suppression has reduced riparian shrub and aspen habitats.

Some species have benefited from past actions. Multi-layered habitats have increase due to fire suppression. Past-fires and regeneration harvesting has created patches of burned old forest, and edge and opening habitat features. In dry forest habitats, past harvesting has created some open conditions that now have regenerating pines.

Livestock grazing in the uplands and along streams has also affected, and may still affect Neotropical migratory bird habitat. Livestock grazing generally occurs after the majority of

songbird breeding has occurred, but may impact late breeding individuals or species, or individuals that are re-nesting after loosing their initial brood. Cattle may have caused shifts in species composition and abundance through selection of more palatable forage species. Cattle reduce ground cover through trampling or consuming vegetation, decreasing cover habitat for some ground nesting birds. Past grazing along and in stream corridors has also reduced riparian shrub habitat. The conditions of some riparian areas and aspen habitats has been improved by new management practices and restoration activities in more recent years, but some areas are still not fully restored to conditions that are most suitable for associated landbird species. In the last 10 years, stream restoration work including fencing of riparian areas in the analysis area has helped improve riparian and aspen stand conditions. There are no foreseeable future silvicultural treatments or prescribed burns in this area.

Irreversible and Irretrievable Commitments

The project alternatives as described would not result in any irreversible or irretrievable effects to the wildlife resource. The project moves habitat conditions towards HRV.

Consistency with Direction And Regulations

This project is consistent with the 1990 Malheur National Forest Plan, Management Area 13, Dedicated Old Growth Areas (DOGs) or Replacement Old Growth Areas (ROGs), or any stands that classify as Old Forest are lost by the proposed activities. Some Old Forest Multi Stratum (OFMS) may be converted to Old Forest Single Stratum (OFSS). There will be no net loss of Late and Old Structure (LOS) as a result of the proposed activities. This project will not propose a ROG for DOG 4355; suitable habitat does exist to designate this ROG in the future.

This project is consistent with the Wildlife Standards in the Regional Forester's Eastside Forest Plan Amendment 2 as the proposed activities will not result in net loss of Late and Old Structure (LOS) habitat, no remnant late and old live trees greater than 21" diameter at breast height (dbh) will be cut or harvested, all existing large down logs greater than 12" dbh will be retained for primary cavity excavators. This project established connectivity corridors (of at least 400 feet in width) between LOS stands, no activities, other than prescribed fire are proposed in any of the connectivity corridors. Prescribed burn activities will leave the stands in the upper one third of site potential. This project is consistent with the Regional Forester's Eastside Forest Amendment 2 in concern of northern goshawks.

Snags density does not meet Forest Plan standards as a result of past management. Down logs, on average, also do meet standards. In the action alternatives, design features have been incorporated to protect existing snags and large down logs that contribute to the Forest Plan standards. Snags would not be targeted for removal, although incidental snags may be lost during harvest operations to meet operational/safety needs during logging. Project design elements, such as retaining clumps of live trees around snags and locating landings and temporary roads where there are few or no snags, would help minimize losses. Retention of untreated patches of trees would continue to provide avenues for snag creation. Prescribed fire would likely increase the number of snags, although most would be smaller in diameter. Only incidental losses of additional dead wood habitats would be expected.

Big game habitat would be modified. Satisfactory cover, already below Forest Plan standards, would not be further reduced. Both the summer range and winter range portions of the project

area would maintain satisfactory cover at or above standards. Road densities in summer range would be below Forest Plan standards; road densities in winter range would still remain too high to meet standards.

This project is consistent with the 1918 Migratory Bird Treaty Act (MBTA) and the Migratory Bird Executive Order 13186. Vegetation management cannot completely avoid unintentional take of birds, no matter what mitigations are imposed on the activities. Mitigation, such as avoidance of riparian areas proposed in this project will minimize take of migratory birds.

Regional Forester's Sensitive Species List (Update): On January 31, 2008, Regional Forester Linda Goodman released an updated Sensitive Species List which includes federally listed, federally proposed and sensitive species lists. In the cover letter for the updated species list (Regional Forester Linda Goodman, January 31, 2008) the Regional Forester states that projects initiated prior to the date of this letter may use the updated sensitive species list or the list that was in effect when the project was initiated. The Responsible Official for the project has authority to decide which list to use. "Initiated" means that a signed and dated document such as a project initiation letter, scoping letter, or Federal Register Notice for the project exists. The Knox Project meets the criteria for "initiated" because the Project Initiation Letter (PIL) was signed on February 14, 2007. This analysis uses the 2004 Regional Forester's Sensitive Species list.

This project is consistent with the Endangered Species Act; it is expected to have **No Effect (NE)** on threatened and endangered species. This project is expected to have an **May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species (MIIH)** on Columbia Spotted Frog. This project is expected to have **No Impact (NI)** on all other sensitive species. Based on these effects calls, consultation with the US Fish and Wildlife Service was not considered necessary.

More Detailed Information or Analysis

Additional details about the affected environment, species ecology, and the effects of the alternatives can be found in the Terrestrial Wildlife Biological Evaluation and Specialist Report located in the project record.

Soils Resources

Affected Environment

Introduction

This section describes the regulatory framework for soils resources, analysis methods, existing condition, and the environmental consequences of the alternatives on percent of the activity area expected to be in detrimental conditions after activities.

Regulatory Framework

The Malheur National Forest Plan meets all legal and regulatory requirements for soil conservation. Forest Service Manual R6 Supplement No. 2500.98-1, section 2520.2 says objectives of soil management are "To meet direction in the National Forest Management Act of 1976 and other legal mandates. To manage National Forest System lands ... without permanent impairment of land productivity and to maintain ... soil ... quality. .... Soil quality is maintained when soil compaction, displacement puddling, burning, erosion, loss of organic matter and altered soil moisture regimes are maintained within defined standards and guidelines." So if an action maintains detrimental impacts within the standards and guidelines of the Forest Plan, legal requirements for soil conservation would be met.

LRMP Forest-Wide Standards 101 and 125-129 relate to soils.

Analysis Method

The project soils specialist trained technicians to collect data on the existing condition of soils on units having the greatest risk of exceeding standards. The technicians collected data on transects. These assessments reveal all impacts from past and ongoing activities, including logging, roads, livestock grazing, firewood gathering, fuel treatments, and off road vehicles (ORVs). In addition, they reveal if any special design measures are needed during logging. All harvest units were sampled, except for aspen units

The project soils specialist has formed professional judgments on probable effects. Professional judgments are based on monitoring, personal observation (including observation in similar areas, and in this area), scientific literature, the Malheur Land and Resource Management Plan (Forest Plan) Environmental Impact Statement, and professional contacts. These professional judgments are summarized in the "Quantitative logging effects on detrimental soil conditions" part of soils report in the project record. However, the quantitative effects cannot be precisely predicted. Soil science is not advanced enough to make precise predictions. In addition, effects of management depend on unknowns, such as weather, details of implementation, and whether a wildfire will occur.

The aspen units were assessed and analyzed differently, because the Forest Plan standards were not written for tiny units like most of the aspen stands. All the upland aspen stands with commercial harvest were considered to be a single "activity area" (Standard 126). In addition, the tiny size of aspen units means a disproportionate part of some of them are impacted by roads, so instead of using the actual proportion in roads, they were analyzed for the average amount of road (3%). Stands 106, 140, 152, and 155, which are some of the larger stands with commercial

harvest, were visually assessed for existing impacts. This is believed to be a representative sample of the acreage of the aspen stands.

Existing Condition

Soil Types

The best available soil description and map is the Soil Resources Inventory (SRI) (Carlson 1974). Information in the SRI is the basis for the following discussion. However, this map was made for large-area planning, and mapped at the scale of one inch per mile. Generally, field observations and aerial photos indicate the SRI map is correct, but not in all cases. Because of the exceptions, the Soils Map (refer to the project record) is modified from the SRI map, through use of a map of slope steepness and of a digital aerial photo. Table S-1 shows soil properties. More details on soil types are found in the "Soil Hazard Ratings" and "Concise Soil Descriptions" of the Soils Specialist Report in the project record.

Most soils developed over basaltic andesite bedrock. Topography tends to be gently rolling to hilly, except along part of Cottonwood Creek which is in a small canyon. Elevations range from about 4800 to 6500 feet, though most elevations are between 5200 and 6000 feet. Precipitation ranges from about 20 to 30” per year, depending on elevation.

Sensitive soil types in the planning area are the unforested, shallow, rocky soils supporting low amounts of ground cover – “scab soils” (soil types 44, 46, and 47). Scab soils mostly support juniper woodlands or non-forest vegetation. They are gravelly, cobbly, and very gravelly loams. They cannot absorb much water, and so produce overland flow. They have low amounts of ground cover, and so are erodible. These soils tend to occur in a mosaic along the northeastern part of the planning area. These soils generally would not be included in timber harvest units.

Table S-1. Soil Characteristics.

Soil Type	Soil Depth (inches)	Volcanic Ash Thickness (inches)	Slope (%)	Typical Vegetation
3	> 36	variable	0-15	meadow
5	> 15	15-24	0-15	lodgepole
44	8-15	0	30-70	juniper
46	8-15	0	0-30	juniper & ponderosa
47	4-12	0	0-30	sagebrush
141	12-30	0	0-30	ponderosa
142	12-36	6-12	0-30	ponderosa & mixed conifer
143	12-30	0	30-70	ponderosa
148	12-48	6-12	30-70	ponderosa & mixed conifer

Two main types of forested soils exist in the planning area: ash and non-ash. Forested soils have abundant ground cover, so the potential for erosion exists only where ground cover has been removed. The relatively gentle slopes that characterize the Knox Project Area further reduce erosion hazard. Non-ash soils (soil types 141 and 143) typically support ponderosa pine. They have loam and gravelly loam surface soils. Volcanic ash soils (soil types 5, 142, and 148) tend to occur on north facing slopes throughout the area. They have silt loam surface soils. Ash soils are more productive than non-ash because of they supply more water to plants. In addition, ash soil has a high porosity and little clay, so it has a high infiltration rate. Ash soils typically

support mixed conifers, though in dry areas it supports ponderosa pine. Ash is more easily displaced than non-ash soil

Effects of Past and Ongoing Actions

Detrimental impacts exist on tractor units, resulting from timber sales and fuel treatments (Table S-2, Alt. 1 column). Existing detrimental impacts range from 1 to 17%, and average 7%, this corresponds to 155 acres of detrimental impacts. All units are below the Forest Plan standard of 20%. Most of the detrimental impacts are from compaction and associated puddling although some displacement also exists. Erosion and detrimentally burned soil are negligible in forested areas.

The assessments reveal all impacts on proposed units from past and ongoing activities, including logging, roads, livestock grazing, firewood gathering, fuel treatments, and Off Road Vehicles (ORVs). Appendix C lists most of the activities that produced these effects. Almost all the harvest was ground based. Effects from most other activities, including livestock grazing (in forests), power line construction and maintenance (except existing roads), and fires, are negligible.

In the aspen stands, existing impacts are about 2%, not counting roads. Combined with 3% in roads, total detrimental impacts are about 5%.

Organic Matter & Nutrients

Decades of fire suppression have resulted in heavier forest floors on most soils than would occur under the natural frequent fire regime. Soil nutrients have become more concentrated in litter and duff. If moderate or high severity fires do occur, there is a potential for more loss of nutrients than under a frequent, low severity fire regime. Nitrogen has accumulated since fire suppression became effective, so that nitrogen levels are higher than in the 1800s. Fire usually decreases the amount of nitrogen on the land (though easily available nitrogen often increases for one to a few years). Significant fires have not burned in the area for many decades, so the loss of nitrogen during fires has not occurred. Nitrogen has accumulated as nitrogen from the atmosphere is stored in the organic matter of biomass, forest floor, and soil, especially due to the fixation of nitrogen by Ceanothus.

Environmental Consequences

Table S-2. Percent of the Activity Area Expected to be in Detrimental Conditions after Activities.

Unit	Existing % (except roads)	Roads %	Alt. 1 %	Alt. 2 %	Alt. 3 %	Subsoiling
1+2	2	5	7	16	16	
3	4	1	5	11	11	
7	5	1	6	16	12	
8	2	3	5	11	11	
10	1	1	2	12	12	
13+14	0	6	6	12	12	
16	4	2	6	15	15	
17	3	0	3	15	15	
18	6	1	7	12	7	

Unit	Existing % (except roads)	Roads %	Alt. 1 %	Alt. 2 %	Alt. 3 %	Subsoiling
21	3	1	4	14	14	
22	6	2	8	14	14	
23	3	1	4	12	6	
24	9	2	11	18	18	
25	2	3	5	11	5	
26	3	4	7	16	16	
28	2	3	5	11	5	
29	6	1	8	18	18	
32	7	2	9	15	9	
33	2	2	4	15	15	
37	6	3	9	18	17	
38	6	0	6	12	12	
39	5	4	9	14	14	
40	1	0	1	10	10	
41	3	4	7	14	7	
42	6	0	6	11	11	
44	13	2	15	18	18	Y
46 + 47	4	3	7	13	7	
48 + 49	1	1	2	12	12	
50	13	3	16	19	19	Y
51+ 52	4	1	6	13	13	
54	4	3	7	13	7	
55	3	2	5	11	11	
56	3	2	5	10	10	
57	13	4	17	20	17	Y
58	2	2	5	16	16	
59	4	4	8	15	15	
60	3	3	7	12	7	
65+66	8	2	10	19	19	
67	6	2	8	8	14	
4	3	3	6	11	11	
15	1	0	1	7	7	
27	1	4	5	10	10	
31, 36, 64	2	3	6	11	11	
34	10	5	14	19	19	
35	7	2	10	15	15	
53	4	8	12	17	17	
61+ 62	6	4	11	17	17	
69	4	1	5	11	11	

Direct and Indirect Effects

Alternative 1 – No Action

Under this alternative, no additional soil will be compacted, puddled, or displaced. No additional soil will be eroded by ground disturbing activities. No organic matter or nutrients would be removed.

Alternatives 2 and 3

Tractor Logging

Skidding on steep slopes or unsuitable land often causes displacement. Water bar construction also often causes displacement. Skidding also bares soil, decreases infiltration, and channels overland flow, and thus can accelerate erosion. This acceleration occurs especially on steep slopes. Sites that have steeper slopes are expected to be more impacted than sites with flatter slopes. Uphill skidding is expected to have more impacts than downhill, due to the additional power and slipping of wheels with uphill skidding. The experience of the project soil specialist indicates damage on widely spaced skid trails on slopes less than 45% is acceptable because only moderate amounts of displacement occur, and because of the small size of the area affected.

Displacement and erosion from steep slope skidding would be limited, because slopes steeper than 35% occupy a relatively small proportion of most tractor units and because the extensive ground cover in forests absorbs sediment. Design measures, such as directional felling and winching, would also help to limit displacement and erosion. Usually erosion of skid trails decreases through 1 - 3 years, until it stops. Decreased productivity due to severe displacement and erosion can last hundreds of years. Design elements would keep displacement and erosion to a minimum, within acceptable levels. Design elements that effectively control displacement and erosion include a prohibition on skidding on steep slopes (>45% downhill, >25% uphill on ash soil, >35% uphill on non-ash), limitations on skidding in draws, and water bar requirements.

Skidding would cause negligible sediment export from the units, despite sediment movement within units as described in the preceding paragraphs. Sediment normally is deposited less than 15 feet down slope from skid trails as the water is slowed by ground cover and percolates into the soil. This is true even on slopes up to 45%. The ground cover is provided by litter, duff, and herbaceous plants.

Much of the skidtrail area would be compacted, and some of the soil tracked only once or twice would be compacted. Compaction usually lasts more than 20 years; some compaction lasts more than 50 years. Table S-2 presents expected detrimental impacts on the tractor units. If the unit happens to be harvested over deep snow or on deeply frozen soil, increase in compaction would be about one half of the predicted amount. Design measures that are effective at limiting compaction include designating skidtrail locations, requiring skidtrails to be widely spaced, reusing existing skidtrails where appropriate, prohibiting skidding under wet conditions, allowing only low ground pressure machinery off of skidtrails. It is unnecessary to require low ground pressure yarding machinery. The design measures would keep compaction to a practical minimum and indicate the Forest Plan standards likely would be met in all units.

Landings are severely impacted. Design elements that encourage re-use of appropriately located landings, and subsoiling of landings, would keep these impacts to a minimum.

Biomass Utilization

Biomass can be removed by two methods. One is like current logging methods, with skidders. The other is with low ground pressure forwarders and other equipment on relatively closely spaced forwarder trails. These methods could be applied in several combinations:

- For units where there is no large tree harvest but there is biomass harvest by feller-buncher and skidder, effects perhaps would be similar to a light harvest (1.5 mbf/ac) of larger trees. This assumption was used in calculating effects for Table S-1. Detrimental impacts would increase by 5% to 7%.
- In units where there is no large tree harvest, the biomass could be harvested by low ground pressure machinery. Detrimental impacts would increase by about 5%, similar to forwarder operations on the Umatilla and Wallowa-Whitman National Forests.
- For units where there is large tree harvest, the biomass could be harvested at the same time with the same machinery as the larger trees. In this case, the biomass utilization would probably have no significant impact above the larger tree harvest. A sale administrator has observed that neither feller-bunchers nor skidders impacted more area than if only commercial material was harvested.
- The biomass could be harvested later with skidders and feller-bunchers. In this case, the biomass harvest would increase impacts above larger tree harvest by about 2%, because the feller-bunchers would impact additional area, although the skidders would re-use the same skidtrails.
- The biomass could be harvested later with low ground pressure machinery. In this case, the biomass harvest would increase impacts above larger tree harvest by about 4%. This increase is lower than without large tree harvest because in some cases the machinery would reuse existing skidtrails.

Subsoiling or Winter Logging

Landings would be subsoiled where suitable. Subsoiling landings would decrease their detrimental impacts from about 3% before subsoiling to about 1% of the unit after subsoiling.

In addition, subsoiling of skidtrails (or winter logging) will be used on several stands as a project design element if necessary (see Table S-2 and Chapter 2 for specific requirements). Subsoiling would decrease detrimental impacts by about 50%, for the skidtrails subsoiled.

Subsoiling bares soil, forms channels, makes soil particles more easily detachable, and disrupts roots, thus raising the risk of erosion for a few years. However, subsoiling also increases infiltration which decreases the risk of erosion. This increased infiltration, and the subsoiling design elements means that sediment production from subsoiling would be negligible.

Winter logging would limit the increases in detrimental impacts to 50% of the increase expected under early summer conditions.

Grapple Piling and Pile Burning

A design element in Chapter 2 requires grapple piling machinery to have a low ground pressure, to operate on dry soil, and to operate on skid trails where possible. Low ground pressure is required for grapple piling machinery but not skidding machinery because grapple machinery are not restricted to skidtrails. With this design element, the project soils specialist expects grapple piling would compact about 1% of each unit where it is used. Feller-bunchers of similar ground

pressure operating off skidtrails compacted about 1.5% of a unit (McNeil 1996). This would be in addition to impacts caused by harvest.

Soil beneath grapple piles would be detrimentally burned ("sterilized"), taking many years to recover. However, the project soil specialist has rarely, if ever, observed detrimentally burned soil that occupied more than 1% of a unit and similar results are expected for this project. A design element limits detrimentally burned soil to a maximum of 3% of the acreage.

Temporary Road Construction

Temporary road construction will cause small, localized, temporary increases in erosion hazard, as existing ground cover is disturbed, as soil is compacted, and as ruts form. This erosion would disappear within two years of rehabilitation of the roads.

On temporary roads, much of the productivity lost to compaction would be restored during rehabilitation. Perhaps ½ of the area of the roads would be in detrimental condition immediately after rehabilitation. Productivity lost to remaining displacement and compaction would recover over the course of several decades.

Summary of Detrimental Impacts

As shown by the difference between Alternative 1 and Alternatives 2 in Table S-2, for Alternative 2 increases in detrimental impacts would range from 3 to 12%, and average 7%. For Alternative 3 increases in detrimental impacts would range from 0 to 12%, and average 6%.

Prescribed Burning

Soil effects from prescribed burning would be minor. Ground cover would decrease, especially during fall burns. However, burning would be controlled so as to avoid decreasing ground cover below LRMP standards (Forest-Wide Standard 127); erosion would not be significant. The ground cover loss would recover through the course of between 1 and 5 years.

Soil effects from fireline construction would be minor. No dozer lines would be constructed. Erosion would be further controlled by a design element in Chapter 2 that requires waterbars on slopes steeper than 25%, and bans fire lines that go down draw bottoms. Fire lines impact a negligible area of soil.

Organic Matter and Nutrients

Logging would remove nutrients and organic matter in logs, and fuel reduction treatments would remove nutrients and organic matter during burning and biomass utilization. The removal, especially removal of nitrogen, may decrease site productivity a few percent on some sites. However, on many or most sites, productivity likely is not limited by nutrients or organic matter. Also, removal of nutrients would be limited because nutrients would remain in the soil and the remaining forest floor, and because many trees would be left. Removing organic matter and nutrients by logging and fuel control would move many sites back toward their fertility status before Euro-Americans arrived, because nutrient and organic matter loss in fires was common then. Little dead wood existed before fire suppression became effective, because low severity fires burned it up. These high fire frequency ecosystems persisted for thousands of years with low levels of forest floor and dead wood, so these ecosystems are adapted to low levels of organic matter, so removal of the unnatural organic matter would have only a small adverse effect.

Road Closure and Decommissioning

Road closure would have no effect on soil. Road decommissioning would partially restore the productivity of a tiny amount of land.

Cumulative Effects

Cumulative Effects under All Alternatives

Existing impacts include the impacts from all past and ongoing actions (refer to Appendix C). Existing impacts are shown under Alternative 1 in Table S-2. Past actions include logging, roads, fuel treatments, fire suppression, grazing, firewood cutting, and Off Road Vehicles. Also, no mining occurred in proposed units.

Root action, animals that burrow in the soil, and freezing water will gradually loosen compacted soil over the course of decades.

Ongoing actions, such as grazing, firewood cutting, and ORV use, would continue to compact a negligible amount of soil, at about the same rate as in the past. This compaction would be counter-balanced by recovery from similar impacts in the past, so the level of detrimental impacts from these ongoing and foreseeable actions would remain at about current levels. Appendix C lists no foreseeable future actions, except continuation of ongoing actions.

If a wildfire occurs, the hazard of erosion would greatly increase on severely burned areas due to inadequate ground cover and possibly hydrophobic soil. In addition nutrients and organic matter would be lost.

Alternative 1

As shown in Table S-2, existing detrimental impacts range from 1 to 17%, and average 7%, which corresponds to 155 acres of detrimental impacts. Natural recovery would slowly decrease impacts over decades.

The expected fuel loadings are higher under Alternative 1 than under Alternative 2 or 3, as shown in the Fuels section of this EA. As described in the Fuels section, reduction in surface fuel loads decreases fire behavior and increases fireline control possibilities. Reduction in surface fuels probably also leads to less complete burning of forest floor, which would lead to less severe effects on ground cover and hydrophobicity. Therefore the hazard of severe wildfire and subsequent erosion is higher under Alternative 1.

Alternatives 2 and 3

Detrimental impacts from the proposed operations (harvest, subsoiling, and fuels control) add to past and ongoing actions. Tables S-2 show what the expected site-specific condition would be. For Alternative 2, detrimental impacts would range from 7 to 20%, and average 14%, which corresponds to 313 acres. For Alternative 3, detrimental impacts would range from 5 to 19%, and average 13% which corresponds to 281 acres of detrimental impacts. Thus the Forest Plan standard of 20% (Forest-Wide Standard 126) would be met in all units.

In aspen stands outside RHCAs, increases in detrimental impacts would be about the same as in conifer stands (7%) or perhaps less, because of the low volume to be removed and logging would be limited to dry or frozen soil. Thus logging would result in a cumulative total detrimental impact of 12% under both action alternatives. In aspen stands in RHCAs, there would be no

ground impacting activities even under Alternative 3, so detrimental impacts would remain at 5% under both action alternatives.

If a wildfire occurs, hazard of erosion would greatly increase on severely burned areas due to low ground cover and possibly hydrophobic soil. The expected fuel loadings are higher under Alternative 1 than under Alternatives 2 and 3, as shown in the Fuels section of this EA. As described in the Fuels section, reduction in surface fuel loads decreases fire behavior and increases fireline control possibilities. Reduction in surface fuels probably also leads to less complete burning of forest floor, which would lead to less severe effects on ground cover and hydrophobicity. In addition, less complete burning of the forest floor would result in lower temperatures in the soil, which would result in less damage to the seed bank, plants, soil animals (like arthropods and worms), and soil micro-organisms, all of which probably would speed recovery of soil. Therefore the hazard of severe wildfire and subsequent erosion is lower under Alternatives 2 and 3 than under Alternative 1.

Irreversible and Irretrievable Commitments

No irreversible or irretrievable commitments of the soils resources are expected from the proposed action or alternatives.

Consistency with Direction and Regulations

All alternatives would be consistent with Forest Plan soil protection standards, because all Forest-wide Standards mentioned above in the "Regulatory Framework" section would be met, as explained in all the preceding sections.

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Soils Resources Specialist Report located in the project record.

Hydrology

Affected Environment

Introduction

The purpose of this section is to display the effects of proposed fuel reduction activities on water quality and large wood retention, recruitment, and creation within the riparian areas in the Knox Project Area. Water quality and large wood are two aquatic elements that contribute to the health and resilience of streams in forested ecosystems.

Regulatory Framework

The main objective of the Federal Water Pollution Control Act of 1972 (Public Law 92-500 also known as the Clean Water Act) is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (CWA Section 101 (a)). The Forest Service is directed to "Comply with State requirements in accordance with the Clean Water Act for protection of waters in the State of Oregon (Oregon Administrative Rules, Chapter 34041) through planning application and monitoring of Best Management Practices (BMPs) in conformance with Clean Water Act, regulations, and federal guidance issued thereto." (Land and Resource Management Plan, Malheur National Forest (Forest Plan), Standard 117, Chapter IV, page 39)

The Forest Plan provides direction to protect and manage water resources through compliance with State requirements (described in a May 2002 Memorandum of Understanding (MOU)) that are in accordance of the Clean Water Act and the selective use and enforcement of Best Management Practices (Forest Plan, Standards 117-120, Chapter IV, page 39). The MOU requires that Forest Service, through management activities, cannot further degrade water quality impared streams. The MOU recognizes that BMPs are the primary means to control non-point source pollution on National Forest lands. Adherence to BMPs will provide adequate protection and avoid significant effects to listed impaired streams within the project area or its influence.

The Forest Plan also provides direction to protect or enhance riparian-dependent resources in watersheds supporting non-anadromous fish, and to protect habitat and populations of non-anadromous fish (MA 3A, Chapter IV, pages 55-61; Amendment 29; The Inland Native Fish Strategy for watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (INFISH)). INFISH identifies Riparian Habitat Conservation Areas (RHCAs), Riparian Management Objectives, and standards and guidelines for activities in RHCAs. Standards contained in Malheur Forest Plan Amendment 29 considered to be more protective than those in INFISH, supercede comparable ones in INFISH.

Analysis Method

Streams and ephemeral draws in the project area were mapped using a combination of USGS topographic maps, information in the Malheur National Forest GIS, and recent reconnaissance of streams and draws.

Effects of fuel reduction on water quality and large wood were concluded from a review of literature, and experience of the project hydrologist.

Cumulative effects on water quality were assessed by considering the proportion of the area treated, the proposed treatment, and past events.

Existing Condition

The Knox Project is located within the 24,485 acre Tamarack Creek Subwatershed (170501160601). Approximately 80% of the subwatershed, or 20,147 acres, is National Forest System lands. There are no known domestic/municipal sources in the project area. There are 789 total acres of Riparian Habitat Conservation Areas (MA-3A/RHCAs) in the subwatershed with 320 acres in non-anadromous riparian areas and 469 acres in upland aspen areas.

In general, vegetation along streams in the Knox Project Area is patchy with sparse canopy cover for stream shading. There are areas of overstocking along portions of Cottonwood Creek, though. Beaver appear to have played an important role in the past building dams to provide pools and the mechanism to connect streams to their flood plains, provide the disturbance to rejuvinate hardwood stands,and to provide small downed wood for channel roughness.

Disturbance from low severity high frequency fire is also missing from these stream systems. These fires would have helped maintain the hardwoods by reducing young conifer survival and encouraging sprouting (Brown, 2000). Olson (Olson, 2000) found that keeping fire out of the riparian ecosystem will continue to alter structure and vegetation composition.

Streams in the project area are:

Alder Creek is a fish bearing stream with a 300 foot wide RHCA on each side of the stream. It is a water quality limited stream (303(d)) and is listed in the 2004-2006 Oregon DEQ database for sediment and summer temperature (anadromous fish passage, salmonid rearing). The orientation of the lower reaches of the stream is generally north-south and vegetation, unless overhanging the stream, provides less shade during the critical mid-day hours. The upper reaches flow in a more northeasterly direction and vegetation on the south side of the stream plays a slightly greater role in providing shade. There are numerous aspen stands along this stream that are in decline mostly due to conifer encroachment. Portion of this stream may not meet standards for large wood.

Cat Creek is a fish bearing stream with a 300 foot wide RHCA on each side of the stream. It is not a water quality limited stream (303(d)) and is not listed in the 2004-2006 Oregon DEQ database. Several log weirs were constructed in this stream, most likely in an attempt to re-connect the stream to its flood plain, possibly restoring subsurface cool water storage in the floodplain. Although they are not functioning for that purpose, they appear to provide cover for the resident fish and do not block migration. As with Alder Creek, the orientation of the stream is such that trees play less of a role in providing shade. Aspen stands are scattered along the creek and are generally in a state of decline.

Cougar Creek is a fish bearing stream with a 300 foot wide RHCA on each side of the stream. It is not a water quality limited stream (303(d)) and is not listed in the 2004-2006 Oregon DEQ database. Two large aspen stands in the Knox Meadow area ajacent to the main stem of Cougar and a tributary. Conifer encroachment is contributing to the decline of these stands. More than 75% of these stands are far enough away from the stream to have any effect on shade.

Cottonwood Creek is a fish bearing stream with a 300 foot wide RHCA on each side of the stream. It is a water quality limited stream (303(d)) and is listed in the 2004-2006 Oregon DEQ

database for sedimentation and summer temperature. No known source search has been conducted, but the number of roads within the subwatershed likely contribute to the sediment problem. A recent Proper Functioning Condition survey (summer 2007) rated this stream in a downward condition. There are numerous non-functioning check dams along this stream, another apparent atttemp to re-connect the stream to its flood plain, possibly restoring subsurface cool water storage in the floodplain. Many of the riparian stands are over-stocked increasing the risk of stand mortality from insect or fire disturbance.

Tamarack Creek – At the southern-most end of the project area are two short reaches of tributaries to Tamarack Creek which is not a water quality limited stream (303(d)) and is not listed in the 2004-2006 Oregon DEQ database.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Aspen stands will continue to degrade. Beaver will likely not return to these systems due to declining hardwoods. Large wood input to the riparian areas from conifers will continue over time. Water temperature could remain elevated due to lack of cool water storage and shade.

Alternative 2 – Proposed Action

Aspen release and prescribed fire are the treatments proposed in the riparian areas and upland aspen. Commercial removal will occur in about 55 acres of upland aspen, which is less than 12% of the upland aspen in the subwatershed. In riparian areas, 95 acres or 20% of RHCAs in the subwatershed will be treated. Only conifers less than 21" will be felled and left, no commercial removal will occur. Fire will be re-introduced in these areas.

There may be an increase of downed wood in the riparian areas contributing to stream function as conifers are cut and left. Stream shading should not be affected; the aspen overstory will remain intact and the numbers of conifer to be felled that contribute to stream shading are minimal. The re-introduction of fire should also increase aspen sprouting and will accelerate habitat for beaver.

Alternative 3

Aspen release and prescribed fire are the treatments proposed in the riparian areas and upland aspen. Fifty-five acres of upland aspen and 95 acres of RHCAs will be treated. There will be commercial conifer removal in 55 acres of upland aspen (19% of upland aspen in the subwatershed) and 35 acres (4% of RHCAs in the subwatershed). Felled trees adjacent to or contributing to stream function will not be removed.

Trees that are removed will be surplus to the needs and function of the riparian area. There may be an increase of downed wood in the riparian areas contributing to stream function as conifers are cut and left. Stream shading should not be affected; the aspen overstory will remain intact and the numbers of conifer to be felled that contribute to stream shading are minimal. The re-introduction of fire should also increase aspen sprouting and will accelerate habitat for beaver.

Cumulative Effects

Road building, grazing, and lack of disturbance from beaver and low intensity, high frequency fires have all had negative effects on the stream and riparian systems in the Tamarack Creek Subwatershed (refer to Appendix C). They have led to streams that are disconnected from their floodplains and a reduction of subsurface cool water storage.

This project will not result in any increases in stream temperature, and there will be no removal of trees that contributed to the function and health of the streams. This project attempts to begin restoration of stream function by releasing aspen and re-introducing fire to the ecosystem. There are no adverse cumulative effects from implementation of this project.

Irreversible and Irretrievable Commitments

There are no irreversible and irretrievable commitments to water quality resulting from the proposed action or alternatives.

Consistency with Direction and Regulations

This project is consistent with Forest Plan direction and with service-wide regulation for water resource protection.

Alder Creek and Cottonwood Creek are on the Oregon 303(d) list for water quality-limited water bodies for sediment and summer temperatures. All Alternatives comply with the Clean Water Act, since none raise stream temperatures, and since all follow Best Management Practices as specified in "Forest Service R6 General Water Quality Best Management Practices" (1988). The site specific BMPs are listed in Chapter 2 (in the description of the alternatives and in the Integrated Design Elements, Table 8), in INFISH Standards and Guidelines (as described in Chapter 3, Fisheries Resources section).

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Hydrology Specialist Report located in the project record.

Fisheries Resources

Affected Environment

Introduction

This section lists species and status of fish present in the Knox Project Area as well as existing conditions for aquatic species and their habitat. This section builds on conclusions from soils and watershed sections and determines direct, indirect and cumulative effects on aquatic species and their habitat.

Regulatory Framework

This section describes relevant laws, management objectives, guidelines, direction, and recommendations to guide Forest Service management activities in the Knox Project Area. This information comes from a variety of sources.

The Executive Order 12962 of 1995 (aquatic systems and recreational fisheries) requires federal agencies to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. The Order requires federal agencies to evaluate the effects of federally funded actions on aquatic systems and document those effects relative to the purpose of this order.

The two principle laws relevant to fisheries management are the National Forest Management Act of 1976 (NFMA) and the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). Direction relative to fisheries is as follows:

- NFMA requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native wildlife species and conserve all listed threatened or endangered species populations (36CFR219.19).
- ESA requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) if a proposed activity may affect the population or habitat of a listed species.

The Malheur National Forest Land and Resource Management Plan (Forest Plan) as amended (USDA 1990), provides direction to protect and manage resources. Only direction pertaining to fish and fish habitat that has project relevance is included here.

The Forest Plan Goals for Fisheries Resources Include:

- Assist in the identification, protection and recovery of threatened, endangered and sensitive species (Goal 15, p. IV-2).
- Provide for improved fish habitat conditions to support increased populations of anadromous and resident fish (Goal 18, p. IV-2).
- Provide a diversity of habitat sufficient to maintain viable populations of all species (Goal 19, p. IV-2).

Forest Plan Objectives for Fisheries Resources

- The Forest Plan objectives state how resources will be managed under the Forest Plan:
- Plan and design all management activities to avoid actions which may cause a species to become threatened and endangered. Critical habitat and other habitat necessary for the conservation of these species will not be destroyed or suffer adverse modification. All actions will be coordinated with other agencies as appropriate (p. IV-17).
- Manage habitat of candidate species for listing as threatened or endangered in cooperation with the U.S. Fish and Wildlife Service (USFWS). Monitor known populations and survey for additional populations with the cooperation of the Nature Conservancy and the Oregon Natural Heritage Data Base (p. IV-17).
- Cooperate with other resources such as timber, range, recreation, minerals, etc., to identify means of facilitating the achievement of fish and wildlife management objectives. Cooperate with other agencies and groups to promote mutual objectives including funding through the Challenge Cost-share Program and program accomplishment through use of volunteer efforts (p. IV-17).
- Manage fish habitat and riparian areas to achieve increases in fish habitat capability. This habitat improvement will be accomplished by a combination of the following:
  (a) Implementation of livestock management strategies to achieve better distribution of livestock, and better control of forage utilization in riparian areas. This will help achieve a more diverse and abundant riparian vegetation condition and geomorphic recovery of the stream channel.
  (b) Implementation of the riparian timber management prescriptions, which will provide for improved stream shading and a better supply of large woody material to the stream channel.
  (c) Implementation of watershed and fish habitat improvement structures, to improve habitat conditions and accelerate geomorphic recovery of the stream channel (p. IV-17).
- Similar management activities will be applied to resident and anadromous streams and riparian areas, but emphasis for appropriated funds will go to anadromous streams until major structural improvements are completed in most of these streams (p. IV-18).

Forest-Wide Standards Provide Further Guidance:

- Provide habitat requirements for the following selected Management Indicator Species (MIS):
  (a) Redband trout
- Meet all legal and biological requirements for the conservation of threatened and endangered plants and animals. Assess all proposed projects that involve habitat changes or disturbance and have the potential to alter the habitat of threatened, endangered or sensitive plant and animal species.
- When threatened or endangered species or habitats are present, follow the required biological assessment process, according to the requirements of the ESA (Public Law 93-205). Meet all consultation requirements with the USFWS and state agencies (p. IV-33).
- Specify all protection or mitigation requirements (36 CFR 219.27(a) (8)) before project implementation begins. Manage all habitats for existing federally classified threatened and endangered species to help achieve recovery objectives (p. IV-33).

- Perform a biological (field) evaluation for use in planning of proposed projects when sensitive species are present or suspected. Conduct surveys in cooperation with other agencies and groups to document the locations of sensitive species populations and to provide more specific information on habitat requirements and relative management guidelines (p. IV-33).

Amendments to the Forest Plan

Amendment 29 (1994)

Amendment 29 amended the Forest Plan in 1994 to incorporate recommendations for managing and restoring aquatic habitat from the Columbia River Basin Anadromous Fish Habitat Management Policy and Implementation Guide (January 25, 1991). Amendment 29 of the Forest Plan established numeric desired future conditions (DFCs) for aquatic habitat by modifying Forest Plan Standard 5 for MA-3A, non-anadromous riparian areas. Modification included incorporation of numeric DFCs for the following aquatic habitat elements: sediment/substrate, water quality, channel morphology and riparian vegetation. Numeric DFCs were designed to manage designated habitat elements within their natural ranges of variability on the Forest.

INFISH (1995)

The Forest Plan was amended in 1995 by direction of the Regional Forester with the Interim Strategy for Managing Non-Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (INFISH). Activities in the Knox Project Area fall under direction of INFISH since the project area is located outside the range of anadromous fish.

INFISH Riparian Goals

The INFISH riparian goals establish an expectation of the characteristics of healthy, functioning watersheds, riparian areas, and associated fish habitats. The goals are to maintain or restore:

1. water quality to a degree that provides for stable and productive riparian and aquatic ecosystems;
2. stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed;
3. instream flows to support healthy riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood events;
4. natural timing and variability of the water table elevation in meadows and wetlands;
5. diversity and productivity of native and desired non-native plant communities in riparian zones;
6. riparian vegetation to:
   a) provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;
   b) provide adequate summer and winter thermal regulation within the riparian and aquatic zones;
   c) help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.

7. riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region; and
8. habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate population that contribute to the viability of riparian-dependent communities

INFISH Riparian Habitat Conservation Areas

INFISH amended the Forest Plan by establishing riparian habitat conservation areas (RHCAs), establishing numeric riparian management objectives (RMOs), and establishing standards and guidelines for managing activities in RHCAs. INFISH replaced existing direction contained in the Forest Plan except where the plan provided more protection for anadromous fish habitat. Riparian-dependent resources receive primary emphasis in RHCAs, and management activities are subject to specific standards and guidelines.

RHCAs are differentiated by the following four categories (Table F-1). INFISH establishes default buffers for RHCAs on the Forest (USDA and USDI 1995).

Table F-1. INFISH RHCA Buffer Widths.

RHCA Category	Description	*RHCA Width (Feet)
1	Fish bearing streams that are either perennial or intermittent	300
2	Non-fish bearing streams that are perennial	150
3	Ponds, lakes, reservoirs, and wetlands > 1 acre	150
4	Non-fish bearing streams that are intermittent, ponds, lakes, or wetlands < 1 acre	**50

*Interim RHCA widths apply where watershed analysis has not been completed. Site-specific widths may be increased where necessary to achieve riparian management goals and objectives, or decreased where interim widths are not needed to attain RMOs or avoid adverse effects.

**For Priority Watersheds, the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greater. For watersheds, not identified as Priority Watersheds, the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one-half site potential tree, or 50 feet slope distance, whichever is greatest (see Watershed Section for additional discussion).

Buffer widths for INFISH RHCAs are based on slope distances. When the Malheur National Forest created the Forest GIS cover for RHCAs, RHCAs were delineated using an average slope of 35% which resulted in a buffer width of 283 ft for Category 1 RHCAs, 142 ft for Category 2 RHCA, and 93 ft for Category 4 RHCAs. These widths are used for planning purposes only. During layout of unit boundaries, RHCA buffer widths are based on actual slope distances. Where slopes are greater than 35% actual RHCA buffer widths will be narrower than displayed by the Forest's RHCA GIS cover and where slopes are less than 35% actual RHCA buffer widths will be greater than the Forest's RHCA GIS cover. Therefore, there will likely be slight differences in acreages between planning documents and actual implementation of projects for RHCAs and units adjacent to RHCAs.

Cottonwood Creek, Cougar Creek, Cat Creek and Alder Creek, all fish-bearing streams, are protected by 600-foot wide (total width) RHCAs. *RHCA widths along other streams in the project area vary depending on whether stream flow is perennial or intermittent (see above).

INFISH Standards and Guidelines

- Prohibit timber harvest, including fuelwood cutting, in RHCAs except where:
  - Catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, allow salvage and fuelwood cutting in RHCAs only where present and future woody debris needs are met, where cutting would not retard or prevent attainment of other RMOs, where adverse effects to inland native fish can be avoided. For priority watersheds, complete Watershed Analysis prior to cutting in RHCAs (INFISH Standard TM-1a).
  - Apply silvicultural practices for RHCAs 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 Standard TM-1b).
- For each existing or planned road, meet RMOs and avoid adverse effects on listed anadromous fish by minimizing road and landing locations in RHCAs (INFISH Standard RF-2b).
- For each existing or planned road, meet RMOs and avoid adverse effects on listed anadromous fish by avoiding sidecasting of soils or snow. Sidecasting of road material is prohibited on road segments within or abutting RHCAs in watersheds containing designated critical habitat for inland native fish (INFISH Standard RF-2f).
- Determine the influence of each road on RMOs. Meet RMOs and avoid adverse effects on inland native fish by:
  - Reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards, or that have been shown to be less effective than designed for controlling sediment delivery, or retard attainment of RMOs, or do not protect designated critical habitat for inland native fish from increased sedimentation (INFISH Standard RF-3a).
  - Prioritizing reconstruction based on the current and potential damage to inland native fish and their designated critical habitat, the ecological value of the riparian resources affected, and the feasibility of options such as helicopter logging and road relocation out of RHCAs (INFISH Standard RF-3b).
  - Closing and stabilizing or obliterating, and stabilizing roads not needed for future management activities. Prioritize these actions based on the current and potential damage to inland native fish in priority watersheds, and the ecological value of the riparian resources affected (INFISH Standard RF-3c).
- Trees may be felled in RHCAs when they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives (INFISH Standard RA-2).
- Prohibit storage of fuels and other toxicants within RHCAs. Prohibit refueling within RHCAs unless there are no other alternatives. Refueling sites within a RHCA must be approved by the Forest Service and have an approved spill containment plan (INFISH Standard RA-4).
- Locate water drafting sites to avoid adverse effects to inland native fish and instream flows, and in a manner that does not retard or prevent attainment of RMOs (INFISH Standard RA-5).

- Design fuel treatment and fire suppression strategies, practices, and actions 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 Standard FM-1).
- Design prescribed burn projects and prescriptions to contribute to the attainment of RMOs (INFISH Standard FM-4).

INFISH Priority Watersheds

The intent of designating priority watersheds is to provide a pattern of protection across the landscape where habitat for inland native fish would receive special attention and treatment. Areas in good condition would serve as anchors for the potential recovery of depressed stocks, and also would provide colonists for adjacent areas where habitat had been degraded by land management or natural events:

1. Watersheds with excellent habitat or strong assemblages of inland native fish, with a priority on bull trout populations; or
2. Watersheds that provide for meta-population objectives; or.
3. Degraded watersheds with a high restoration potential.

Neither the Otis Creek Watershed nor the Tamarack Creek Subwatershed in which the Knox Project Area falls, meet the three criteria for INFISH Priority Watersheds.

Analysis Method

The analysis area encompasses all fish habitats that have the potential for effects from the Knox Project. Based on topography, drainage patterns and the effects analysis, the project analysis area includes the following streams: Cottonwood Creek from Cottonwood Spring downstream to approximately the Grant/Harney County line, and fish bearing portions of Cougar Creek, Cat Creek and Alder Creek to their confluences with Cottonwood Creek. The project area lies entirely within the Tamarack Creek Subwatershed within the Otis Creek Watershed of the Upper Malheur River Subbasin. Information was compiled from stream surveys based on Region 6 Level II Stream Survey protocol (1989, 1997), Oregon State Game Commission Physical and Biological stream survey (OSGC 1966), Malheur National Forest (MNF) Geographic Information System, visual observations made on November 6, 2006 and from the Malheur River Subbasin Assessment and Management Plan (Management Plan) (2004). The Existing Condition was evaluated qualitatively, based on the principles of applied fisheries and watershed science, professional judgment and knowledge of the area. Where data gaps existed (e.g., Data available from some earlier stream surveys was not available to adequately type streams based on Rosgen stream classification or to quantitatively determine the percent of particles less than 2mm), the Baseline Condition was evaluated qualitatively, based on the principles of applied fisheries and watershed science, professional judgment and knowledge of the area. Field surveys were conducted during the 2006 field season and GIS was updated in 2007 to incorporate data gathering during field surveys.

Existing Condition

Aquatic Species

The Cottonwood Creek drainage is currently home to populations of indigenous Columbia River redband trout (*Oncorhynchus mykiss gairdneri*) and introduced hatchery rainbow trout (*O. mykiss).* Indigenous, non-game species that may be present within the project analysis area include long-nosed dace *(Rhinichthys cataractae),* speckled dace *(R. osculus),* redside shiner *(Richardsonius balteatus balteatus),* shorthead sculpin *(Cottus confuses),* mottled sculpin *(C. bairdi)* and bridgelip sucker (*Catostomus columbianus*). Dams constructed in the early 1900s blocked migration into headwater streams within the Malheur River Basin that were historically used by anadromous fish, and in 1958, construction of the Brownlee Dam on the Snake River effectively blocked access to all anadromous species including Pacific lamprey (*Lampetra tridentata*), Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), and steelhead (*O. mykiss gairderi*) (WPN 2004b). Anadromous fish probably did not use Cottonwood Creek drainage (Perkins pers. com. 2007). Bull trout (*Salvelinus confluentus*) are present within the headwaters of the North Fork Malheur and upper Malheur River streams; however neither bull trout nor their historic habitats are found within the Cottonwood Creek drainage (Buchanan et al. 1997). Westslope cutthroat trout (*O. clarki lewisi*) have never been found within the Malheur River Basin and Malheur Mottled Sculpin *(C. bairdi ssp.)* are not found within this Basin. Malheur Mottled Sculpin are thought to be just mottled sculpin reacting to high temperatures (Perkins pers. com. 2007). Brook trout (*S. fontinalis*), an introduced species, exist within the Subbasin in the headwater streams in the Logan Valley area but, have not been documented in the Cottonwood Creek drainage. Columbia spotted frog may be found along the grassy margins of low gradient streams, lakes, ponds, springs, and marshes within the project area.

Management Indicator Species, Threatened, Endangered and Sensitive Species

Management Indicator Species (MIS) are species of vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities. Through the MIS concept, the total number of species found within a project area is reduced to a subset of species that collectively represent habitats, species, and associated management concerns. The MIS are used to assess the maintenance of populations (the ability of a population to sustain itself naturally) and biological diversity (which includes genetic diversity, species diversity, and habitat diversity), and to assess effects on species in public demand. Forest Plan Standard 61 (p. IV-32) lists species and gives direction to provide for habitat requirements of MIS species. Aquatic MIS in the project area for the Knox Project include rainbow/redband trout.

Threatened and endangered species are listed under the ESA; whereas, sensitive species are identified by the Forest Service Regional Forester. An endangered species is an animal or plant species that is in danger of extinction throughout all or a significant portion of its range. A threatened species is an animal or plant species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. A sensitive species is an animal or plant species for which species viability is a concern either a) because of current or predicted downward trend in population numbers or density, or b) because of current or predicted downward trends in habitat capability that would reduce a species' existing distribution. Forest Plan Standard 62 (p. IV-32) gives direction to meet all legal and biological requirements for the conservation of threatened and endangered plants and animals. Standard 62 states, "Assess all

proposed projects that involve habitat changes or disturbance and have the potential to alter the habitat of threatened, endangered or sensitive plant and animal species." When threatened or endangered species or habitats are present, follow the required biological assessment process, according to the requirements of the ESA (Public Law 93-205). Forest Plan Standard 64 further states, "Meet all consultation requirements with the US Fish and Wildlife Service and state agencies." Effects to aquatic threatened, endangered, and sensitive species are analyzed in the Knox Project Aquatic Biological Evaluation found in Appendix D.

Rainbow/Redband Trout

Redband trout are considered the native, resident form of rainbow trout and they are a Sensitive species on the Region 6 Sensitive Animal List and Oregon's ESA. Redband trout was considered a candidate species for listing under the federal ESA until March 20, 2000 when the decision was made not to list redband trout. In the Cottonwood Creek drainage, the redband species is considered to be Columbia River redband trout. Redband trout within upper Cottonwood Creek may be considered a distinct breeding population due to habitat isolation caused by dam construction (WPN 2004a).

See the Management Plan for a complete discussion of redband trout life history and habitat requirements within the Malheur River Basin. General limiting factors throughout the Malheur River Basin are best described in Hanson et al. (1990) and include nonpoint source pollution, riparian zone conditions, altered streamflow patterns, and unscreened diversions (WPN 2004a). A brief life history is presented here. Most redband trout reach spawning age at three or four years of age, but have been noted to sexually mature as early as age two and as late as age six. Riffle and pool tailouts with well aerated gravels relatively free of sediment are ideal spawning habitats. Redband trout require varying types of habitat throughout the year. Redband trout tend to seek out deep pools during summer months where temperatures may be somewhat cooler. During fall and winter months, redband trout require deep pools with extensive amounts of cover to overwinter (WPN 2004a). Redband trout feed on a variety of types of food items including plankton and aquatic invertebrates, often depending on what's available in their surrounding habitat (WPN 2004a).

Portions of Cottonwood Creek within the analysis area were chemically treated with rotenone on August 27, 1966 (OSGC 1966). According to the Oregon Department of Fish and Wildlife (ODFW), the treatment project on Cottonwood Creek in the mid-1960s centered on Cottonwood Creek Reservoir. The reservoir and a section of the creek upstream from the reservoir were treated with rotenone, in an attempt to eradicate all non-game fish including bridgelip suckers (Perkins pers. com. 2007). Hatchery rainbow trout were restocked into the reservoir and may have moved upstream into Cottonwood Creek during high flow years. Observations over the last 17 years by ODFW staff indicate that the reservoir has been dry more years than not (Perkins pers. com. 2007).

Distribution

Information on species occurrence (i.e., presence/absence) was obtained from the MNF GIS, a field visit by the project fisheries biologist on November 6, 2006, first hand information from the ODFW and the Management Plan.

Cottonwood Creek

Redband trout inhabit Cottonwood Creek from below the Forest Service boundary upstream to approximately the mouth of Cougar Creek (approximately 16.5 miles upstream from Cottonwood Creek Reservoir (OSGC 1966). Much of Cottonwood Creek goes subsurface during summer months and redband trout may take refuge in deeper pools or up tributaries where cool water refugia exist. Redband trout and minnows were observed in scour pools below culverts on Cottonwood Creek (near the mouth of Cougar Creek) and other isolated pools during a field visit in November 2006. They apparently are able to survive in these isolated pools throughout the dry season. Cottonwood Creek was chemically treated on August 27, 1966 to eliminate bridgelip suckers above Cottonwood Creek Dam. This treatment started approximately 16.0 miles upstream from the Cottonwood Creek Reservoir Dam.

Cougar Creek

In November 2006, redband trout were observed in Cougar Creek upstream of the culvert crossing on Forest Service road (FSR) 1420. This culvert is passable to adult and juvenile redband trout. A survey completed in 1966 (OSGC) indicates that redband trout were observed in Cougar Creek upstream approximately 3.5 miles from the mouth.

Cat Creek

During a November 2006 survey, redband trout were observed in Cat Creek both upstream and downstream of FSR 489 culvert. A series of dysfunctional log weirs on mainstem Cat Creek upstream from FSR 489 culvert are currently providing hiding cover for adult redband trout. These log weirs do not appear to be barriers to adult migration. During a 1966 survey, redband trout were found in mainstem Cat Creek approximately 1 mile upstream from the confluence with Cottonwood Creek (OSGC). The eastern tributary to Cat Creek does not contain fish, however caddis fly larvae were observed in perennial portions of this tributary by stream survey crews in 1997. Approximately 1/3 mile upstream from FSR 489 crossing on the eastern tributary is a heavily utilized spring with severe head cuts in several places.

Alder Creek

Just upstream from where FSR 496 crosses Alder Creek, fine gravels have settled out, indicating this culvert is probably undersized. Woody debris has also piled up at the culvert entrance. Redband trout were observed throughout perennial sections of Alder Creek all the way up to just below Billy Pond. A November 2006 field trip found that just upstream from FSR 495 crossing (just below Alder Spring) water trickles from the base of a 13 foot high dam and a spillway exists to accommodate higher flows. A 1966 survey found redband trout up to approximately 1.25 miles from the mouth of Alder Creek (OSGC).

Columbia Spotted Frog

Spotted frogs are highly aquatic and are rarely found far from permanent water. They are usually found along the grassy margins of low gradient streams, lakes, ponds, springs, and marshes.

During winter, spotted frogs burrow into banks adjacent to streams, ponds, and springs. Breeding occurs in the spring varying with elevation. In the Columbia Basin of Washington, breeding occurs from March to April in lower elevations, and from May to June in the higher elevations. Breeding habitat is usually found in shallow water in ponds or other quiet waters

along streams. Breeding may also occur in flooded areas adjacent to streams and ponds. Adults may disperse overland in the spring and summer after breeding.

Condition and Trend of Population

This species occurs in extreme southeastern Alaska, southwestern Yukon, northern British Columbia, and western Alberta south through Washington east of the Cascades, eastern Oregon, Idaho, and western Montana to Nevada (disjunct, Mary's, Reese, and Owyhee River systems), southwestern Idaho (disjunct), Utah (disjunct, Wasatch Mountains and west desert), and western and north-central (disjunct) Wyoming. Disjunct populations occur on isolated mountains and in arid-land springs. In Oregon, Columbia spotted frogs are widely distributed east of the Cascade Mountains.

USFWS lists livestock grazing and introduction of nonnative fish (salmonids and bass) as threats to the Great Basin population of Columbia spotted frogs (66 FR 1295).

The Columbia spotted frog (*Rana luteiventris*) is on the Regional Forester's Sensitive Species List and is a candidate for Federal listing under the ESA. The spotted frog is considered present in all subbasins on the Malheur National Forest. It is assumed this species is widely distributed in the Upper Malheur Subbasin. Limited habitat surveys have been conducted specifically for spotted frogs; however, habitat probably exists along low gradient perennial streams. Fish surveys record incidental sightings of frogs but most do not differentiate species.

Aquatic Habitat

Legacy Conditions and Upland Influence

For over 100 years the Tamarack Creek Subwatershed has been subjected to a variety of land-use practices. Practices have included past silviculture treatments, fire suppression, road construction, and livestock grazing on public and private land. These activities have reduced aquatic TES species habitat quality and complexity of streams within the analysis area.

Historically, wildfires within the subwatershed would have had a higher frequency of occurrence, but fires would generally have been of lower intensity than under a fire-suppression strategy. Sediment inputs would probably have been more frequent due to this fire pattern but would have been short-lived as vegetation returned quickly to the burned areas. Wildfire suppression over the past 75 to 100 years has altered natural disturbance regimes that contribute to watershed structure and function. Fire exclusion has caused the build-up of fuels, overstocking of trees, and has created a situation where the possibility exists for an uncharacteristic wildfire. With a probable historic fire-return interval of 12 years, as many as seven fire events in the may have been eliminated from this ecosystem in the past century.

Data on earlier harvests is incomplete; however nearly all stands within the planning area have received some form of active management in the past 50 years. Past logging within RHCAs reduced canopy cover in some areas, resulting in less shade over streams. These harvest activities likely reduced the amount of LWD in perennial streams within the Analysis Area. The amount of LWD and coarse wood available for delivery from intermittent drainages during storm events was also likely reduced.

Evidence suggests that fires and disturbance in general can pose greater threats to fishes when their habitats become fragmented and otherwise altered by human activities (Dunham et al. 2003). Other human influences can interact with fire and when taken cumulatively can

negatively affect aquatic TES species (e.g. habitat loss, degradation, fragmentation, nonnative species invasions) (Dunham et al. 2003).

Roads can account for most of the sediment problems in a watershed because they are a link between sediment source areas (cut slopes, etc.) and stream channels. They can directly affect the channel morphology of streams by accelerating erosion and sediment delivery and by increasing the magnitude of peak flow (Furniss et al. 1991). Wemple (1994) focused on the interaction of forested roads with stream networks in western Oregon and found that nearly 60% of the road network drained into streams and gullies, and are therefore, hydrologically integrated with the stream network. However, the Knox Project Area has less steep slopes and less precipitation than the western Cascades, and so much less than 60% of the roads drain into streams and gullies. From a qualitative standpoint, the following assumptions can be used as general indicators of sediment delivery risk associated with roads: 1) the higher the road density the higher the potential for sediment yield increases due to the larger acreage of exposed surfaces, 2) the more drainage ways that are crossed the higher probability that direct sediment introduction would occur, and 3) the greater the distance, or higher on the slope, that the road is from the drainage network, the less probability for delivered sediment to occur (erosion may occur but is less likely to be routed to the stream). Road drainage structure, function, and spacing are keys to minimizing the amount of surface flow, which directly affects surface erosion. The spacing of drain or ditch relief structures depends on the road gradient, road surface and ditch soil types, runoff characteristics, and the effects of concentrated runoff on slopes below the road. Forest Service Handbook and other manuals provide guidelines for drainage structure spacing. Drainage structures should be close together on silt-sand soils with little to no binder on steep slopes and farther apart on gravel road surfaces with moderate binder and little to no fines on flat or minimum grades.

Surface erosion is highly dependant on soils, road surfacing and condition, road grade, traffic volumes, and the effectiveness and spacing of drainage structures. The greatest surface erosion problems occur in highly erodible terrain, particularly landscapes underlain by granitic soils, soils of the Clarno formation, and certain highly fractured or weathered rock types. Granitic soils, soils of the Clarno formation, and highly fractured or weathered rock types do not occur in the Knox Project Area. Studies have found that sediment delivery to stream systems is highest in the initial years after road construction, although raw ditch-lines and road surfaces with little binder can remain chronic sources of sediment. Native surface roads (mostly Maintenance Level 1 and 2 roads) are generally greater chronic sediment sources than surfaced, higher standard roads. Approximately 95% of on-Forest RHCA roads in the Tamarack Creek Subwatershed and approximately 94% of on-Forest RHCA roads in the Knox Project Area are native surface roads. Native surface roads are more likely to contribute fine sediment to streams that can adversely affect aquatic habitat compared to roads with other surface types. Most native surface roads, if used other than during dry or frozen conditions cannot tolerate much traffic without rutting causing other resource problems. Adverse affects to aquatic TES species are more likely to occur where native surface roads are located adjacent to Category 1 streams (Table F-2).

In the interior Northwest, stronghold populations of salmonids are associated with higher-elevation forested lands and the proportion declines with increasing road densities (Quigley et al. 1996). The higher the road density, the lower the proportion of subwatersheds that support strong populations of key salmonids. Specifically, Quigley et al. (1996) shows a strong correlation with road densities of 2 miles/mile^2 or higher and reduction of strong populations of

salmonids. Further reductions of strong salmonid populations were identified at densities of 3 miles/mile^2 and 4 miles/mile^2 or greater. Roads in the project area that occur within 100 feet of streams or cross streams commonly impact fish and fish habitat more than roads located in uplands (Table F-2).

Table F-2. Road/Stream Interaction Information.

	Knox Project Area (Public & Private)[1]					
	Total Road Miles	**Road Miles w/i 100 ft. of Cat. 1-4 Channels**	**Stream Crossings on Roads (Cat. 1 or 2)**	**Stream Crossings on Roads (Cat. 4)**	**Stream Cros-sings on Roads (Unknown stream category)**	**Total Road Density - Open & Closed (Mi/ Mi^2)**
Knox Project Area	141.7	10.9	11	29	3.70	3.70

1 Note: Rounding road miles during calculations may result in minor (0.1) mile discrepancies. This information was derived from the Malheur National Forest GIS.

Total road densities would remain above 3.4 miles/mile^2 in the Tamarack Creek Subwatershed and miles within 100 feet of Category 1- 4 channels would remain high (Table F-2). There are slightly over 10.9 miles of roads that likely impact streams due to proximity (100 feet or less). These conditions continue to reduce availability of subsurface cool water storage and have led to streams that are disconnected from their floodplains.

Beaver

Historic beaver sign has been found along portions of the Alder Creek the project area and it is possible that beaver utilize the lower portions of other streams within the analysis area where conditions are suitable. Beaver play a crucial role in the maintenance of stream channels and associated RHCAs. Beaver dams trap sediment, reduce water velocity, and can redistribute water as hypothetic flow. The net effect of beaver dams may be to lower water temperatures by increasing bank storage, which leads to increased base flow levels.

The quality of fish habitat is affected by conditions within the stream channel and riparian areas along the channel. This section presents information on instream conditions. Stream surveys have been completed on four streams within the analysis area; however, recent surveys exist only on Cottonwood, Cat and Alder Creeks (Table F-3).

Table F-3. Stream Habitat Surveys Conducted in the Knox Project Area.

Stream	Survey Year	*Agency	RHCA Category	Reach No.'s In the Analysis Area	Surveyed Length (mi.)
Cottonwood Creek	1966	OSGC	1	-	~6.0
Cougar Creek	1966	OSGC	1	-	~3.5
Cat Creek	1966	OSGC	1	-	~1.0
Alder Creek	1966	OSGC	1	-	~3.0
Cottonwood Creek	1989/1997	USFS	1	7	~5.0
Cougar Creek	1989	USFS	1	1	~0.4
Cat Creek	1989/1997	USFS	1	1	~1.0
Alder Creek	1989/1997	USFS	1	2	~1.8

*OSGC=Oregon State Game Commission prior to becoming Oregon Department of Fish and Wildlife

Cottonwood Creek

Many small logjams were noted in Cottonwood Creek during the 1996 survey. It was noted they do not provide obstacles to fish movement (OSGC). At the MNF boundary the valley floor

averages approximately 15 yards wide bordered by steep 30 to 45 degree slopes. Mature forest provides dense shade. The stream channel is 10 to 25 feet wide with a moderate gradient. Notes describe the relatively poor quality of pool habitat. Pools are described as averaging 3 to 6 feet wide with a maximum depth never exceeding 1.4 feet. Photos from the 1997 stream survey show numerous large wood pieces providing fish cover and acting to create scour pools. Notes also mention large boulders creating fish habitat.

Cougar Creek

The 1966 survey described Cougar Creek as lacking quality pool habitat and as being an important spawning and rearing stream for small rainbow (OSGC). Speckled dace were collected in the first ¾ of a mile of stream.

Cat Creek

Valley floor is described as 80 yards wide at mouth, narrowing to 20 to 50 feet. Mature forest shades the valley, grass is common and cattle use described as heavy in the 1966 survey (OSGC). Numerous beaver ponds were described in the 1966 survey as averaging 20' by 10' by 3' with very low flows. Aspen were described as common. The 1989 stream survey describes remnant beaver dams and four exclosures.

Alder Creek

The valley floor is 100 yards wide at the mouth and narrows to approximately 30 yards. Canyon walls are moderately steep and covered with mature ponderosa, lodgepole and fir forest. Cattle use was described as moderate to heavy and the stream channel averages three feet wide. Throughout portions Alder Creek water is intermittent with never a stretch longer than 500 yards. A field visit in November 2006 found the middle portion of Alder Creek to contain decadent aspen stands and remnant beaver dams. Towards the upper portion of the survey gradient increases slightly, the valley floor narrows and downed logs become common in and around the stream bed.

INFISH RMOs and Forest Plan Amendment 29 DFCs

Important aquatic habitat elements as defined by INFISH and/or Forest Plan Amendment 29 include: 1) pool frequency, 2) water temperature/stream shading, 3) large woody debris, 4) bank stability, 5) width to depth ratio, and 6) embeddedness. These habitat elements are important in maintaining aquatic habitat function and health. Stream survey information was analyzed to compare existing habitat conditions to Forest Plan RMOs/DFCs for aquatic habitat (Table F-4).

Pool Frequency

Pool frequency is a gage of aquatic habitat diversity, and is an indicator of the degree to which streams are capable of supporting a varied and complex community of fish species. Pools are important for providing rearing habitat for juvenile fish and cool-water refuge areas for adult fish during periods of low flow and elevated temperatures. Pool spacing varies by channel morphology (Rosgen 1996). Deep pools also provide important habitat for adult Chinook salmon and steelhead trout.

Pool habitat can be reduced where management activities result in reductions of pool forming elements (e.g. LWD), changes in bedload (e.g. large increases in fine sediment), or changes in channel morphology (e.g. widening or straightening).

Stream surveys indicate that the INFISH RMO for pool frequency is not being met in Cottonwood Creek or Alder Creek; however Forest Plan DFC is being met in Alder Creek. Accurate data is not available for Cougar or Cat Creeks (Table F-4).

Table F-4. Fish Habitat Summary Data for Category 1 Streams in the Knox Project Area.

Stream Name	Pools/ Mile	Pieces LWD/Mile[4]
Cottonwood Creek[5]	7[2]	37
Cougar Creek[5]	*	17
Cat Creek[6]	*	*
Alder Creek[6]	75[1]	5
INFISH RMO	96[1] 56[2]	20
Amend 29 DFC	75-132[1] 38-66[2]	80-120[3]

Notes: 1) channels of <10 feet in width, 2) channels of >10 to 20 feet in width, 3) mixed conifer ecosystem, 4) Stream survey protocol in 1989 included not only large woody material within the bankfull channel, but also leaning live trees that have the potential to fall into the stream; in 1997 protocol stated not to count leaning logs or trees and also that the tree bole or root swell of live or dead trees must interact with the streamflow at bankfull conditions, 5) 1989, 6) 1997, *Inadequate sample size data suspect.

Water Temperature/Stream Shading

Water temperature influences the metabolism, behavior, and health of fish and other aquatic organisms. Fish can survive at temperatures near extremes of suitable temperature ranges. However, growth is reduced at low temperatures because all metabolic processes are slowed. At the opposite extreme, growth is reduced at high temperatures because most or all energy from food must be used for maintenance needs. Fish are also more susceptible to diseases near the extremes of suitable temperature ranges.

The Forest Plan water temperature standard is for no measurable increase in maximum water temperature, and maximum water temperatures below 64°F within migration and rearing habitat and below 60°F within spawning habitats (INFISH RMO). In general, juvenile and Chinook salmon, redband trout, and juvenile steelhead will occupy water that is from 55 to 64°F. Upper lethal temperatures for redband trout range from about 80 to 85°F depending on acclimation temperature.

Large Woody Debris

LWD plays an important role in forested stream reaches. LWD aids in dissipating stream energy, trapping sediment and the formation of pools and associated aquatic habitat.

Quantity of LWD in streams can be altered by removal of streamside trees for timber production or salvage of instream pieces. Timber has been harvested from areas adjacent to streams in the Analysis Area. In extreme cases, large increases in peak flows and/or large increases in channel width can result in destabilization of instream pieces and subsequent transport downstream thus resulting in a decrease in LWD.

Riparian forests, especially individual trees that are within ½ to ¾ tree length of the stream channel, produce LWD that is recruited into a stream where it creates critical habitat features for aquatic species. The Malheur National Forest recognizes the role of LWD. Forest Plan Amendment 29 specifies a range in the number of pieces of LWD to be maintained for each mile of stream in certain ecotypes. In this analysis, the current condition of the riparian zones was rated with respect to near-term (10 to 20 years) LWD recruitment potential.

Stream surveys indicate that the INFISH RMO for large woody debris is being met in Cottonwood Creek; however Forest Plan DFC for large woody debris is not being met. Stream surveys indicate that neither INFISH RMO nor Forest Plan DFC standards for large woody debris in Cougar Creek and Alder Creek are being met. Accurate data is not available for Cat Creek (Table F-4).

Embeddedness/Fine Sediment

Composition of the stream substrate is an important feature of aquatic habitat. Cobble and gravel substrates provide habitat for a diverse assemblage of benthic macroinvertebrates as well as eggs and early life stages of numerous fish species. Macroinvertebrates represent a substantial portion of the diet available to various fish species.

Filling of interstitial spaces (i.e. the gaps between rocks on the stream bottom) with fine sediment (particles < 2 mm in size) eliminates habitat for many macroinvertebrates. Fish eggs and early life stages can also be buried and smothered when interstitial spaces are embedded with fine sediment. Winter habitat for juvenile salmonids is also lost as interstitial spaces are embedded with fine sediment.

Embeddedness was not rated in at the time stream surveys were completed (1989) on Cottonwood Creek, Cat Creek or Alder Creek.

Pebble counts were completed during the 1997 stream surveys on Cottonwood Creek and Alder Creek. Pebble counts determined that both Cottonwood Creek (~9% embedded) and Alder Creek (~13% embedded) met Forest Plan standards for cobble embeddedness. Wolman pebble counts were not conducted on Cat Creek or Cougar Creek.

Width-to-Depth Ratio

The Forest Plan DFC/RMO for width-to-depth ratio is based on wetted width and depth. A large wetted width-to-depth ratio indicates wide shallow stream channel morphology. Wide shallow streams are prone to increases in stream temperatures due to their high surface area to volume ratio. Shallow streams also provide little habitat for fish, due to the lack of water depth.

Width to depth ratios can be increased by increases in peak flows, direct bank alteration, or increases in sediment or a combination of these factors. Conversely, reductions in these factors can lead to reductions in width to depth ratios.

Bank Stability

The Forest Plan DFC for stream bank stability is for 90% of the banks to be stable. Channel types differ in their sensitivity to management activities due to differences in bank erosion potential and the influence of streamside vegetation on bank stability. Data available from the 1993 stream surveys was not adequate to type streams based on Rosgen stream classification; therefore channel typing was not done on any of the streams within the analysis area.

Environmental Consequences

Summary and Explanation of Some Mitigation Measures for Harvest

Locate all timber harvest units (except certain aspen stands in RHCAs), landings, and all temporary roads outside RHCAs. Restricting these activities to areas outside of RHCAs would

prevent adverse impacts to existing stream shading and would minimize the potential for sediment delivery to fish bearing streams. Commercial and/or pre-commercial thinning within RHCAs may reduce overstocking and help to grow larger trees. In such instances the fisheries biologist and/or hydrologist will be closely involved in layout and monitoring to ensure thinning is for the long-term benefit of the RHCA.

Summary and Explanation of Some Mitigation Measures for Prescribed Burning Activities

Prescribed fire activities may occur in RHCAs. Ensure burning activities mimic low intensity fires that are characteristic of natural burning patterns that tend to occur in riparian areas. Ignition of prescribed fire may occur within RHCAs on less than 30% of the total RHCA acres and would occur under strict burn prescriptions. In other burn blocks, fire from upslope burning units which is within prescription, would be allowed to back into RHCAs. Design elements include retention of at least 95% of stream shade and a goal of less than 5% actual exposed mineral soil within RHCAs. The prescribed burning would occur when moisture and climate conditions would minimize the potential for a high intensity burn. Ignition within RHCAs will be by hand (lighters using drip torches). Refilling of the drip torches or fuel storage will not occur within the RHCAs. Objectives and design measures for prescribed burning in RHCAs are used to develop the burning prescription. A number of parameters such as weather (temperature, wind, and humidity), fuel moistures, time of day, and topography, are utilized to establish burn parameters. In addition, differing lighting patterns can be used to control intensity. Lighting in the RHCAs will generally occur on the low end of the burn prescription to ensure objectives are met. Ongoing monitoring during ignition will also help ensure objectives are met. Generally within 25 feet of a stream, the shading and humidity are higher that the uplands. Especially in the spring, fire is less likely to burn in areas of higher humidity and higher moisture levels. Ignition won't necessarily occur 25 feet from the stream; it may occur 50 feet from the stream and mosaic burn from that point.

Prescribed fire activities would occur in RHCAs. Burning activities would mimic low intensity fires that are characteristic of natural burning patterns in riparian areas. This technique would result in a patchy distribution of burned and unburned areas in RHCAs. Using these techniques, mortality of understory trees may occur in burned patches but few overstory trees would be killed. Fire intensities would not be high enough to consume trees or downed wood large enough to function as LWD (> 20" dbh) in stream channels therefore burning activities would not result in a reduction of pool habitat. Consumption of coarse wood near stream channels greater than 4"dbh would be minimized. Beche et al. (2005) found that prescribed fire did not change the amount or movement of LWD in their study reach relative to unburned streams. They did note, however, that in other less intensely studied reaches snags fell into the stream channel.

Summary and Explanation of Some Mitigation Measures for Water Withdrawals

Water withdrawals would be in accordance with the 2005 Malheur National Forest Road Maintenance Biological Assessment (BA) and NMFS guidance (with the exception that drafting would be permitted before sunrise and after sunset). During logging operations, water trucks take advantage of cooler temperatures and lack of evaporation by watering before sunrise to maximize efficiency of water treatment. Use of these procedures would ensure that water withdrawals do not result in a measurable increase in water temperatures.

Summary and Explanation of Some Mitigation Measures for Road Maintenance and Haul Routes

The Malheur National Forest has a policy (with direction from INFISH RF-2) to regulate traffic during wet periods to minimize erosion and sediment delivery. This includes log haul, as well as, any other vehicle traffic. Mitigation measures such as dust abatement (mainly for safety reasons), hauling on dry or frozen ground, and ceasing haul activities during muddy conditions are highly effective at minimizing sediment input to streams. Ensure haul roads (especially native surface roads) receive pre/during and post haul maintenance, commensurate with use. Project design elements and protective measures from the 2005 Malheur National Forest Road Maintenance BA would be followed for the replacement, removal, or installation of ditch-relief culverts. See mitigation above for direction regarding need for spill plan and erosion control measures.

Dust abatement procedures would adhere to the Road Maintenance Specification in the Dust Abatement plan. Only water would be used for dust abatement, as needed, during periods of heavier vehicle use associated with commercial timber harvest activities and/or rock haul activities. Water for application would come from designated water sources (see Fisheries mitigation above regarding need for pump containment kit and NMFS approved mesh size for all pumping activities).

Felling of danger trees for human safety along haul routes in RHCAs has the potential to reduce the supply of LWD to stream channels and therefore pool habitat. Under INFISH, trees may be felled in RHCAs when they pose a safety risk (INFISH Standard RA-2). All trees felled in RHCAs for safety reasons would be kept on site in accordance with INFISH Standard RA-2 to meet woody debris objectives. Proposed road maintenance, road reconstruction and/or haul activities would not likely result in a reduction of LWD to Category 1, 2, or 4 stream channels because in most cases, trees that can only safely be felled across the road, often have a lean away from the stream channel and would be less likely to fall into stream channels where they could function in the formation of pools and/or contribute coarse particulate organic matter directly to the stream.

Direct and Indirect Effects

Alternative 1 – No Action

Temperature

With no vegetative treatments, haul activities or prescribed burning in riparian areas, there would be no short term effect on water temperature. Riparian areas within this planning area are not large enough to act as fire breaks for higher intensity wildfires. Since fuels would remain untreated under this alternative, all streams in the analysis area with existing conifer or hardwood shading would be at risk for losing shade and incurring increasing summer water temperatures in the future due to an increasing risk, over time, of an uncharacteristic wildfire. Increased width to depth WID ratios from sediment pulses following such a wildfire could raise stream temperatures by increasing the surface area exposed to solar radiation. Additionally, the immediate water temperature increase resulting from a high intensity fire as it burns through a riparian area (over the stream) can lead to direct mortality of fish and spotted frogs.

Ongoing road maintenance activities located within RHCAs would not reduce existing stream canopy cover so as to adversely affect streamside shading or water temperature. Considering the risk of an uncharacteristic wildfire under the No Action Alternative, there is the slight potential for adverse direct and indirect water temperature affects to aquatic TES species over the long term.

Sediment

The activities with the highest potential for affecting sediment input to streams are related to road maintenance, or a lack thereof. Road related impacts most likely to contribute high sediment inputs would be plugged culverts leading to washed out road fills, undersized culverts at stream crossings leading to high water velocities and subsequent erosion at culvert outlets, or sediment channeled on road surfaces and routed through road-side ditches and cross-drain culverts to streams. Under this alternative, there would be no road management activities other than routine road maintenance. This can be considered a no effect, or no change from the existing condition, in the short term, however, at existing funding levels road maintenance is not expected to keep up with all needs. This alternative would not do anything to reduce impacts of the existing road system. Therefore it would be expected that sedimentation from existing open and closed roads would increase over time, unless other projects are implemented to address these impacts.

The quality of fish habitat could be reduced because fuels would remain untreated under this alternative. A high intensity, stand replacement wildfire could result in a scale and severity of effects that is uncharacteristic of this habitat type. Such a wildfire may transport fine ash, remove soil cover, kill bank-stabilizing plant roots, and potentially increase water run-off rates. The quality of fish habitat would decline until vegetation along burned portions of streams recovered (an estimated 5-10 years). Indirectly, given the risk of a high intensity, stand replacement wildfire under the No Action Alternative, a higher erosion potential exists for a certain period following such an event. Intense storm events (greater than a 6 year event) immediately following a wildfire that burned in steep terrain and had large areas of high severity burn may result in concentrated run-off, resulting in more sediment transport directly into fish bearing streams and potentially resulting in increased width-to-depth ratios. This could result in short term adverse affects and a recovery of the stream ecosystem from the effects of fire that is slower, more sporadic, and potentially incomplete, in cases where natural stream processes are already impaired (see below).

As noted by Dunham et al. (2003), the effects of wildfires depend on a variety of factors including their timing, location, area, extent, and intensity. Other factors include the characteristics of the ecosystems and the species affected along with other indirect physical and ecological linkages. While such events can cause short term negative effects, such as those listed below, over long time periods the resulting habitat conditions may be more productive then in areas where natural disturbance has been suppressed. Wildfires can have a number of detrimental effects to stream channels such as decreasing stream channel stability, increasing discharge and affecting discharge variability, altering coarse woody debris delivery and storage, increasing nutrient availability, increasing sediment delivery and transport, increasing solar radiation and altering water temperature regimes (Dunham et al. 2003). In cases where natural stream processes are already impaired the recovery of the stream ecosystem from the effects of severe wildfire is likely to be slower, more sporadic, and potentially incomplete (Minshall 2003).

In summary, these future impacts could reach a magnitude of "May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species" for redband trout and Columbia spotted frogs. The short term water temperature increase due to a high intensity fire burning through the riparian area could lead to direct mortality of fish or spotted frogs in the stream(s) at that time. These impacts would not cover a large enough area to result in a WIFV determination for redband trout or Columbia spotted frog (see Table F-6 definitions).

Alternative 2 – Proposed Action

Temperature

Timber harvest units, landings, and all temporary roads would be located outside of RHCAs under Alternative 2. Restricting these activities to areas outside of RHCAs would prevent adverse impacts to existing stream shading. Hand thinning, prescribed burning, limited pile burning and aspen release is planned for some units within RHCAs. No thinning would occur within 25 feet of perennial streams or within bankfull channel or lower benches, and trees would not be directionally felled into the no cut zone and removed. Additionally, hand piles in RHCAs will be located at least 50 feet away from live and intermittent stream channels and not in riparian vegetation (See Watershed Design Elements). Proposed actions to improve stand conditions by pre-commercial thinning would remove vegetation only from the outer portions of fish-bearing and intermittent RHCAs, consequently there are not expected to be any measurable effects on stream temperature.

Enhancement of approximately 95 acres of aspen stands within both uplands and RHCAs under this alternative would include felling conifers to reduce shading of and competition with young aspen and protecting regeneration from big game and cattle browsing by installing fencing or placement of the fallen material. Generally conifers would be felled where they interfere with the growth of existing aspen or where they block light from reaching aspen sprouts. Conifers may be preferentially felled across streams under the guidance of a hydrologist or other designated specialist. Felled trees may be used for fencing. Residual slash (limbs and tops) from felled trees would be lopped and scattered. Existing large wood debris would be left in place and protected from burning by piling slash away from the debris or by designating ignition locations during prescribed burning. Some aspen stands would be fenced to protect regeneration. Felling of conifers within RHCA aspen stands would not result in measurable increases in stream temperature to fish bearing streams because the aspen overstory would remain intact and the number of conifer to be felled which could act to shade the stream are minimal.

Prescribed fire activities would occur in RHCAs. Burning activities would mimic low intensity fires that are characteristic of natural burning patterns that tend to occur in riparian areas. This technique would result in a patchy distribution of burned and unburned areas in RHCAs based on the Malheur National Forest's experience with past prescribed burning activities in RHCAs using the same technique. Ignition for underburning would occur within some site specific segments of RHCAs to reduce fuels and to stimulate hardwood developments and would occur under strict burn prescriptions. In other burn blocks, fire from upslope burning units which is within prescription, would be allowed to back into RHCAs. Design elements include retention of at least 95% of stream shade and a goal of less than 5% actual exposed mineral soil within RHCAs. The prescribed burning would occur when moisture and climate conditions would minimize the potential for a high intensity burn. Although some mortality of overstory trees may occur, loss of

shade which could affect stream temperature is not expected to occur. Burning in the ponderosa pine communities along fish bearing streams within the planning area is expected to be low intensity and rarely kill trees in this fire adapted community. Longer term beneficial effects could result from increased riparian vegetative vigor, as a result of these low intensity, mosaic burns in riparian areas. In a recent study, Beche et al. (2005) found that a fall prescribed fire within the riparian zone of a mixed-conifer forest in El Dorado County, California was patchy in terms of intensity, consumption, and severity. Additionally they found that although 49.4% of all tagged trees (>11.5 cm/4.5 in.) and snags were scorched by the prescribed fire, only 4.4% of all tagged trees were dead one year after the prescribed fire. In general the trees killed by the prescribed fire were small and located near areas of high litter accumulation (Beche et al. 2005).

Water for application (water withdrawals) would come from the following designated water sources: Buttermilk Pit and Crane Creek at FSR 1663. Water withdrawals would be in accordance with the 2005 Malheur National Forest Road Maintenance Biological Assessment (BA) and NMFS guidance (with the exception that drafting would be permitted before sunrise and after sunset). Use of these procedures would ensure that water withdrawals do not result in a measurable increase in water temperatures.

Road decommissioning and closure actions would not have any immediate effect on shade. Removal of danger trees in RHCAs for closure/decommissioning activities is not anticipated. Conifers would be planted in decommissioned road segments as part of the decommissioning process. Over the long-term (50 to 70 years) shading will increase as planted conifers become established and grow to a size that where they provide shading.

Sediment

Commercial harvest units, landings, and temporary roads would not be located in RHCAs under Alternative 2. Restricting these activities to areas outside of RHCAs would minimize the potential for sediment delivery to fish bearing streams. There would be soil disturbance associated with commercial thinning and other proposed activities, primarily as a result of tractor skidding, and some subsoiling of skid trails and landings. The risk of sediment from these activities reaching streams providing fish habitat is negligible, due to the likelihood that sediment will remain within unit boundaries as described in the Soils Report. The Soils Report goes on to state that sediment normally is deposited less than 15 feet down slope from skid trails as the water is slowed by ground cover and percolates into the soil. This is true even on slopes up to 45%. In most cases sediment generated from these activities, which has the potential to move off-site during rare large storm events, would be captured in the RHCA buffer.

There is also the potential for generating sediment from non-commercial thinning operations, burning hand piles, and felling trees across streams or close to streams within RHCAs. The risk of sediment from these activities reaching fish habitat is negligible because they do not involve heavy equipment and design elements have been developed to reduce the risk of sediment delivery to streams (See Chapter 2 of EA - Design Elements: Soils, Watershed and Fisheries). The felling of conifers less than 21” has the potential to generate some sediment and turbidity when felled across perennial streams. Additionally, when bankfull flows occur there is likely to be small amounts of fine sediment generated by erosive action of the high water around or under the felled tree. If felled outside of the instream work window, felling trees into streams has the potential to kill or injure young fish that have not yet emerged from stream gravels. To reduce the risk to redband trout and spotted frogs, all conifers that are preferentially felled into fish

bearing streams will be felled under the guidance of a hydrologist or fishery biologist and instream work window will apply.

While high intensity prescribed fire has the potential to result in exposed soil, which in turn poses a potential for sediment transport off-site, the design elements for the proposed prescribed burning in this project would minimize that risk. Burn plan prescriptions would include parameters for weather and fuel moisture conditions, percent duff removal, percent mineral soils exposed, and others, which will set the sideboards to keep fire intensity to a level that would not result in soil loss. The ignition and limited use of fire within RHCAs described above would result in a low risk of generating sediment along perennial streams. Fire lines would not be permitted within RHCAs, thus reducing the risk of sediment being channeled to intermittent or perennial stream channels. Beche et al. (2005) conducted intense post-prescribed fire monitoring (e.g. pebble counts, longitudinal profiles, cross-sections) and observed little to no change in stream sediment composition 1 year post-fire. Similarly, they observed little to no change in stream channel morphology and no substantial change in erosion or deposition in the surveyed reaches (Beche et al. 2005). The prescribed burning would be expected to burn across Category 4 RHCAs, since these would be dry during the burning operations. However, as mentioned in the Soils Report, because burning would take place so as to avoid decreasing ground cover below Forest Plan standards; the potential for erosion from these areas would not be significant. The potential for some sediment movement in some of these intermittent channels which could reach fish habitat is low, except under rare, intense storm events.

Temporary Road Construction

Approximately 1.5 miles of temporary road are proposed to be constructed. Temporary roads are not part of the Forest road system, and they would be returned to their existing state after use. Personal observations by the soil scientist indicate that sediment generated from temporary road construction and use would be deposited within 50 feet of the road edge (R. McNeil pers. com). All temporary roads are located entirely outside of RHCAs. Because of the location and design elements for these roads, it is not expected that any sediment generated from the construction, use, or "decommissioning" of these roads, would reach fish bearing streams.

Haul Road Use

There will be an opportunity to perform road maintenance on up to approximately 63 miles of Forest roads commensurate with commercial uses associated with project activities. The type of road maintenance activities which may occur on roads used for commercial haul could include:

- Blading and shaping of road surface and ditches
- Blade and shape existing drain dips, grade sags, waterbars and cross ditches
- Constructing one or two waterbars/cross ditches
- Spot rocking in wet areas of road, including some existing drain dips and grade sags
- Minor brushing for road width
- Falling and removal of danger trees from the road prism
- Minor realigning of road junctions
- Repair damaged culverts
- Seeding roadbed after closing/decommissioning a road

- Removing excess materials from roadway
- Removing debris that has sloughed into the roadway
- Removal and replacement of culverts with same size or larger up to 36" in diameter

Because the maintenance work accomplishments will be commensurate with use, the amount actually accomplished will vary depending on existing road conditions, season of use and other factors. When road maintenance work is accomplished, commensurate with use, it would help to ensure that haul roads are kept in an appropriate condition so as to avoid deterioration of conditions and reduce erosion and sediment output from haul roads.

The Malheur National Forest has a policy (with direction from INFISH RF-2) to regulate traffic during wet periods to minimize erosion and sediment delivery. This includes log haul, as well as, any other vehicle traffic. Mitigation measures such as dust abatement (mainly for safety reasons), hauling on dry or frozen ground, and ceasing haul activities during muddy conditions are highly effective at minimizing sediment input to streams.

Because haul roads would receive pre/during and post haul maintenance, commensurate with use, the magnitude of haul road use on sedimentation is insignificant, and therefore would result in a neutral effect.

Road Maintenance

Roads used within the sale area would receive road maintenance at a level commensurate with use. Road maintenance includes several activities that potentially result in sedimentation from the road prism to the ditch line, or the adjacent slope. Typical road maintenance activities could include: blade and shape road including existing drainage dips, grade sags, and waterbars, repair damaged culverts, place rock in some existing drainage dips and grade sags, place rock in wet areas of road, brushing, remove hazard trees, and dust abatement.

Project design elements and protective measures from the 2005 Malheur National Forest Road Maintenance BA would be followed for the replacement, removal, or installation of ditch-relief culverts.

The longer term effects of road maintenance, commensurate with use, are to maintain or improve existing road conditions. Road maintenance, commensurate with use, may decrease chronic sedimentation in some locations. Improving drainage, removing ruts and rills from the driving surface, and adding less erosive surfacing material would reduce detachment and transport of sediment. This is especially important for roads within RHCAs. Because road maintenance activities would be commensurate with use, it is possible that if winter logging occurs, little to no road maintenance may be necessary and therefore would not occur. Alternatively, if operations occur in the summer, road maintenance, commensurate with use, may occur on all or nearly all of the roads.

Road Reconstruction

The following work is classified as maintenance under the definition listed in the Federal Register but will be listed as reconstruction in any contracts that are signed:

- Widening roadbed to meet standard width
- Constructing new drain dips and grade sags
- Major brushing

- Removing large amounts of excess material
- Rocking roadbed and/or drain dips and grade sags
- Removal and replacement of culverts with the same size or larger culverts greater than 36” in diameter
- Major realignment

Blading and reshaping road surfaces, damaged ditch-relief culverts, applying rocking, constructing new drain dips and waterbars and constructing new outlet ditches would all reduce erosion. Machinery would be kept on the road prism.

Road Closure/Decommissioning Activities

About 38 miles of roads are proposed to be closed or decommissioned within the subwatershed. Closed roads are those roads on which motorized traffic has been excluded by regulation, barricade blockage, or by obscuring the entrance. A closed road is still an operating facility on which motorized traffic has been removed (year-long or seasonal) and remains on the Forest Road Transportation System. Closed roads will be left in a stable condition and maintained. Drainage structures will be self-maintaining after closure. Closure of these roads poses a negligible risk of sedimentation to fish bearing streams because dry land "filtration" lies between the closure sites and any streams, and because the amount of land disturbed during berm or gate construction is too small and too flat to produce significant sediment. However, since these roads are being kept as part of the Forest road system, the benefits of the closures would likely not be "permanent."

Total road density after planned decommissioning and road closures would decrease to about 2.8 mi/mi^2 in the subwatershed (minus private lands) which would result in long-term beneficial impacts to redband trout. The effects of road decommissioning are beneficial effects for water quality and fish habitat, starting about 2 years after the decommissioning. The improved infiltration and ground cover conditions of the decommissioned roads will help restore natural watershed function, including reduced sediment yield from the road prism.

Cross ditches would be constructed to maintain drainage and reduce the potential for surface erosion. These measures would be implemented during decommissioning to "hydrologically disconnect" the road from streams, to reduce sediment entering streams and affecting fish habitat.

Additional soil stabilization measures that may be used include:

- Scarification or sub-soiling to increase infiltration and facilitate vegetative recovery.
- Seeding with native grass to stabilize soils.
- Planting conifers on decommissioned road segments located in RHCAs where conditions will support establishment and growth.

Road decommissioning activities may result in increases in fine sediment, especially where RHCA road segments are decommissioned. About 1.5 miles of road would be decommissioned within Category 1 RHCAs.

There is a short-term risk of generating sediment during and shortly after decommissioning activities which could reach streams, and could affect fish and fish habitat in those streams. This risk is primarily associated with the scarification, or subsoiling which may be needed on some

road segments to discourage vehicle use and improve infiltration. Design criteria include culvert removal guidelines, as well as standard contract clauses, which incorporate BMPs. The proposed design criteria and application of BMPs would reduce the probability and magnitude of this short-term risk.

Due to the proximity of the work to some stream channels, there is a low level of risk of affecting juvenile redband trout rearing habitat.

After about 2 years, the effects of road decommissioning are beneficial effects for water quality and fish habitat. The improved infiltration and ground cover conditions of the decommissioned roads will help restore natural watershed function, including reduced sediment yield from the road prism.

Chemical Contaminations/Nutrients

The Forest Service would require the purchaser to adhere to all requirements within the timber sale contract related to oil spills and hazardous substances. Refueling and fuel storage sites would be located at least 150 feet away from live streams. Other chemicals used may include saw gas and oil, and fuels used to ignite fires. All have the potential to adversely affect aquatic TES species, if they were to enter nearby stream systems. Handling procedures and spill plans would minimize the risk of potential effects. In the event of the need for fire suppression actions, no chemicals or retardant would be used within 300 feet of water or wetlands. There is minimal risk of an accidental spill from logging equipment, vehicles used to transport crews, equipment, ignition materials, or fire suppression activities in the event of an escaped prescribed burn.

Beche et al. (2005) found that ash deposition from the prescribed fire appeared to have a minimal impact on stream water chemistry with increases in some water chemistry parameters (SO4-, total P, CA2+, and Mg2+). It should be noted that their study area had low to moderate hillslopes and so accelerated erosion and ash delivery would not be expected. It might be expected that these same water chemistry parameters would also increase with the proposed prescribed burning in this alternative, at least temporarily.

Dust abatement procedures would adhere to the Road Maintenance Specification in the Dust Abatement plan. Only water would be used for dust abatement, as needed, during periods of heavier vehicle use associated with commercial timber harvest activities and/or rock haul activities. Water for application would come from the following designated water sources: Buttermilk Pit and Crane Creek at FSR 1663.

Because handling procedures, refueling restrictions and spill plans would be in place and there is a low probability of a fuel spill when lighting in RHCAs, there is a neutral effect of the project to streams from chemical or nutrient contamination. No change to baseline levels of nutrients or chemical contaminants are expected.

Large Woody Debris (LWD)

Felling of danger trees for human safety along haul routes in RHCAs has the potential to reduce the supply of LWD to stream channels and therefore pool habitat. Under INFISH, trees may be felled in RHCAs when they pose a safety risk (INFISH Standard RA-2). All trees felled in RHCAs for safety reasons would be kept on site in accordance with INFISH Standard RA-2 to meet woody debris objectives. Proposed road maintenance and haul activities would not likely result in a reduction of LWD to Category 1, 2, or 4 stream channels because in most cases, trees

that can only safely be felled across the road, often have a lean away from the stream channel and would be less likely to fall into stream channels where they could function in the formation of pools and/or contribute coarse particulate organic matter directly to the stream.

Prescribed fire activities would occur in RHCAs. Burning activities would mimic low intensity fires that are characteristic of natural burning patterns in riparian areas. This technique would result in a patchy distribution of burned and unburned areas in RHCAs. Using these techniques, mortality of understory trees may occur in burned patches but few overstory trees would be killed. Fire intensities would not be high enough to consume trees or downed wood large enough to function as LWD (>20" dbh) in stream channels therefore burning activities would not result in a reduction of pool habitat. Consumption of coarse wood near stream channels greater than 4" dbh would be minimized. Beche et al. (2005) found that prescribed fire did not change the amount or movement of LWD in their study reach relative to unburned streams. They did note, however, that in other less intensely studied reaches snags fell into the stream channel.

There may be an increase of downed wood in the riparian areas contributing to stream function as conifers are cut and left. There is a neutral or slightly positive effect to LWD and its recruitment from the project because instream wood will not be physically removed from RHCAs where it has the potential to fall into live streams, snags may fall into streams as a result of prescribed fire activities, and as a result of aspen treatments LWD may be felled into the stream under this alternative. Some roadside danger trees may be felled into stream channels, ephemeral draws or floodplains, and the reduction in stocking densities following burning activities may increase the vigor of larger trees in the overstory.

Alternative 3

Temperature

All landings and all temporary roads would be located outside of RHCAs under Alternative 3. Restricting these activities to areas outside of RHCAs would prevent adverse impacts to existing stream shading. Hand thinning, prescribed burning, limited pile burning and aspen release is planned for some units within RHCAs. Potential effects would be the same as those described for Alternative 2. Water withdrawals and road decommissioning would also occur under Alternative 3 and potential effects would be the same as described under Alternative 2.

Enhancement of approximately 60 acres of aspen both upland and within RHCAs would occur under this alternative and would include felling conifers to reduce shading of and competition with young aspen and protecting regeneration from big game and cattle browsing by installing fencing or placement of the fallen material. Felling of conifers within RHCA aspen stands would not result in increases in stream temperature to fish bearing streams because the aspen overstory would remain intact and the number of conifer to be felled which could act to shade the stream are minimal. Under Alternative 3, commercial conifer removal would occur in 35 RHCA acres (4% of RHCAs in the subwatershed). Felled trees adjacent to or contributing to stream function would not be removed. Trees that are removed would be surplus to the needs and function of the riparian area. Stream shading should not be affected because the aspen overstory will remain intact and the number of conifer to be felled and/or removed that contribute to stream shading are minimal. The re-introduction of fire should also increase aspen sprouting and will accelerate habitat for beaver.

Sediment

All landings and all temporary roads would be located outside of RHCAs under Alternative 3. Restricting these ground disturbing activities to areas outside of RHCAs, along with erosion control BMPs for skidding, roads, and temporary roads, would prevent additional increases in existing levels of fine sediment from these activities. INFISH RHCA buffer widths were designed to trap fine sediment that may be generated from upslope activities such as timber harvest. All temporary roads would be decommissioned after use. Decommissioning would eliminate future use of the road with the objective of restoring hydrological function. This will include subsoiling and seeding as necessary. As described in the Soils Report, road closure would have no effect on soil and road decommissioning would partially restore the productivity of a tiny amount of land. Effects from constructing 1.14 miles of temporary road, haul road use, road maintenance, road closure, road decommissioning, prescribed fire would be similar to those described under Alternative 2.

In summary, the risk of sediment from Alternatives 2 or 3 reaching streams providing fish habitat is negligible, due to the likelihood that sediment will remain within unit boundaries or would be deposited within 15 feet of skid trails, the fact that all temporary roads would be located outside of RHCAs, and the likelihood that sediment generated from temporary road construction and use would be deposited within 50 feet of the road edge. In most cases sediment generated from proposed activities, which has the potential to move off-site during rare large storm events, would be captured in the RHCA buffer. The overall effect of the proposed action to the baseline conditions of sediment is that the negligible effects over the short or long term would be insignificant to measurably increase the baseline levels of sediment in spawning or rearing habitat of redband trout.

The effects determination for Alternatives 2 and 3 is “May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species” for redband trout and spotted frogs (see Table F-6).

Cumulative Effects

Cumulative Effects under All Alternatives

All of the activities in the EA, Appendix C (past activities, past wildfires, present activities, and foreseeable activities) and the current project proposal have been considered for their cumulative effects on aquatic habitat and associated aquatic species. The following discussion focuses on the past, ongoing and foreseeable future activities that may contribute positive or negative effects. The analysis area for aquatic species and the cumulative effects boundary are the same as used for aquatic habitat.

Past actions include logging, roads, fuel treatments, fire suppression, grazing, firewood cutting, and off-road vehicles. The effects of these past actions are described in the "Existing Condition" section above. Ongoing actions, such as grazing, firewood cutting, and ORV use, would continue to compact a negligible amount of soil, at about the same rate as in the past. This compaction would be counter-balanced by recovery from similar impacts in the past, so the level of detrimental impacts from these ongoing and foreseeable actions would remain at about current levels. Road building, grazing, and lack of disturbance from beaver and low intensity, high frequency fires have all had negative effects on the stream and riparian systems in the Tamarack

Creek Subwatershed. These conditions have led to streams that are disconnected from their floodplains and a reduction of subsurface cool water storage.

This project will not result in measurable increases in stream temperature or fine sediment to fish bearing streams, and there will be no removal of trees that contribute to the function and health of the streams. This project attempts to begin restoration of stream function by releasing aspen and re-introducing fire to the ecosystem. There are not likely to be adverse cumulative effects from implementation of this project.

If a wildfire occurs, the hazard of erosion would greatly increase on severely burned areas due to inadequate ground cover and possibly hydrophobic soil. In addition nutrients and organic matter would be lost and redband trout or spotted frogs may die after exposure to high water temperatures as a result of wildfire passing over the stream(s).

Appendix C has been reviewed and lists no foreseeable future actions, except continuation of ongoing actions.

Alternatives 2 and 3

These cumulative effects are in addition to those discussed under Alternative 1. As described in the Fire/Fuels Specialist Report, Alternatives 2 and 3 would break up the continuity of hazardous fuels across the project area, thereby reducing the increased potential for uncharacteristic, crown fire behavior across the project area.

Under the proposed action, commercial/precommercial thinning, log and rock haul, prescribed burning, and road maintenance may result in negligible increases in fine sediment; however it is unlikely that these increases would result in cumulative adverse effects when combined with other past, ongoing, or future actions.

Short-term increases in fine sediment from prescribed burning are unlikely to result in measurable increases in fine sediment in stream channels. Timber harvest units, landings, and all temporary roads would be located outside of RHCAs under Alternative 2. Restricting these activities to areas outside of RHCAs would prevent adverse impacts to existing stream shading and reduce the chance of sediment input to streams.

Of the activities proposed under Alternatives 2, only prescribed burning, pile burning, limited precommercial thinning, and certain road maintenance and haul activities could affect sediment input to fish bearing streams. Under Alternative 3 there is a slight risk of generating sediment from commercial conifer removal in 35 RHCA acres. However, this risk is minimal because felled trees adjacent to or contributing to stream function would not be removed and trees that are removed would be surplus to the needs and function of the riparian area. Additionally, commercial and precommercial thinning within 10 feet of the intermittent stream channels or within 25 feet of the live stream channels would be avoided where there is a potential for adverse effects. All other activities would occur outside of RHCAs, and associated buffering should be sufficient to trap any mobilized soil resulting from external ground disturbance. Prescribed burning, as described in the direct and indirect effects section, could creep down to streams and remove soil cover and although ground cover would decrease, especially during fall burns, effects from prescribed burning would be minor. Burning would take place so as to avoid decreasing ground cover below Forest Plan standards, so erosion would not be significant (see Soils Report). As a result, the cumulative increase in sediment would likely be brief and not measurable. Consequently no cumulative effects on Cottonwood Creek, Alder Creek, Cat Creek

or Cougar Creek are expected to develop from the proposed activities following common run-off events.

Irreversible and Irretrievable Commitments

Irreversible effects are not expected. Reduced population viability for redband trout and Columbia spotted frog is not expected. INFISH established explicit goals and objectives for resident fish habitat condition and function. By following INFISH standards and guidelines as well as design elements specific to this project, irretrievable commitment of this resource can be avoided in the alternatives. The goal is to achieve a high level of habitat diversity and complexity through a combination of habitat features.

Consistency with Direction and Regulations

Alternative 1 - No Action

Alternative 1 would be consistent with: MA-3A standards, and INFISH standards and guidelines. Roads that are having known adverse impacts to aquatic resources would remain in their current condition under Alternative 1.

Alternatives 2 and 3

Alternatives 2 and 3 are consistent with the following applicable MA-3A and INFISH standards:

- INFISH RF-2b: Proposed temporary roads and landings are located outside of RHCAs.
- INFISH RF-3a & b: Roads that will be used for proposed vegetation management activities will have drainage problems repaired and will be brought up to standards prior to haul.
- INFISH RA-2: Hazard trees felled in RHCAs will be left on site where woody debris objectives are not being met.
- Forest Plan DFCs/RMOs: Activities proposed under Alternative 2 would not retard the attainment of Forest Plan RMOs for aquatic habitat (LWD, replacement LWD, pool frequency, bank stability, width-to-depth ratio, sediment/substrate, shading, and water temperature). Design elements will be used to minimize the amount of fine sediment resulting from proposed activities.
- Design prescribed burn projects and prescriptions to contribute to the attainment of RMOs (INFISH Standard FM-4).
- Prohibit storage of fuels and other toxicants within RHCAs. Prohibit refueling within RHCAs unless there are no other alternatives. Refueling sites within a RHCA must be approved by the Forest Service and have an approved spill containment plan (INFISH Standard RA-4).
- Locate water drafting sites to avoid adverse effects to inland native fish and instream flows, and in a manner that does not retard or prevent attainment of RMOs (INFISH Standard RA-5).
- Design fuel treatment and fire suppression strategies, practices, and actions 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 log-term ecosystem function or inland native fish (INFISH Standard FM-1).

Endangered Species Act

The Endangered Species Act requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the USFWS or the NMFS if a proposed activity may affect the population or habitat of a listed species.

On January 31, 2008, Regional Forester Linda Goodman released an updated Sensitive Species List which includes federally listed, federally proposed and sensitive species lists. In the cover letter for the updated species list the Regional Forester states that projects initiated prior to January 31, 2008 may use the updated sensitive species list or the list that was in effect when the project was initiated. The Responsible Official for the project has the authority to decide which list to use. "Initiated" means that a signed and dated document such as a project initiation letter (PIL), scoping letter, or Federal Register Notice for the project exists. The PIL was signed on February 14, 2007. Consequently, the 2004 Regional Forester's Sensitive Species list in effect at that time was used for field reconnaissance and the Aquatic Biological Evaluation.

The following is a summary of effects determinations for alternatives documented from the Aquatic Biological Evaluation for the Knox Project (Table F-6):

Table F-6. Threatened, Endangered & Sensitive Species Considered in this Analysis of the Knox Project & the Effects Determination for the No Action & Action Alternatives.

Aquatic Species	Status	Alt. 1	Alt. 2 & 3
Columbia River Bull Trout (*Salvelinus confluentus*)	T, MIS	NE	NE
Columbia River Bull Trout Designated Critical Habitat	D – private lands only in Malheur Subbasin	NE	NE
Mid-Columbia River Steelhead (*Oncorhynchus mykiss*)	T, MIS	NE	NE
Mid-Columbia Steelhead Designated Critical Habitat	D	NE	NE
Chinook Salmon EFH[1]	MS	NAE	NAE
Interior Redband Trout (*Oncorhynchus mykiss*)	S, MIS	MIIH	MIIH
Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*)	S, MIS	NI	NI
Mid-Columbia River Spring Chinook (*Oncorhynchus tshawytscha*)	S	NI	NI
Columbia Spotted Frog (*Rana luteiventris*)	S, C	MIIH	MIIH
Malheur Mottled Sculpin (*Cottus bairdi* ssp.)	S	NI	NI

[1]Chinook salmon waters are designated Essential Fish Habitat by the Magnuson-Stevens Act.

Table F-7. Federal Listing Status Abbreviations.

T	Federally Threatened
S	Sensitive species from Regional Forester's list
C	Candidate species under Endangered Species Act
MIS	Management Indicator Species
D	Designated Critical Habitat
MS	Magnuson-Stevens Act designated Essential Fish Habitat

Table F-8. Threatened and Endangered Species Effects Determinations Abbreviations.

NE	No Effect
NLAA	May Effect, Not Likely to Adversely Affect
LAA	May Effect, Likely to Adversely Affect
BE	Beneficial Effect

Table F-9. Sensitive Species Determinations Abbreviations.

NI	No Impact
MIIH	May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
WIFV	Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
BI	Beneficial Impact

Table F-10. Designated Critical Habitat Effects Determinations Abbreviations.

NE	No Effect
LAA	May Effect, Likely to Adversely Affect
NLAA	May Effect, Not Likely to Adversely Affect

Table F-11. Chinook Salmon Essential Fish Habitat Effects Determinations Abbreviations.

NAE	No Adverse Effect
AE	Adverse Effect

Recreational Fisheries

Alternative 1 – No Action

Alternative 1 would maintain the current aquatic habitat conditions. The current aquatic habitat conditions are not resulting in reduced recreational fishing opportunities.

Alternatives 2 and 3

Alternatives 2 and 3 are not likely to impact the quantity, function, sustainable productivity, and distribution of recreational fisheries per Executive Order 12962, Recreational Fisheries.

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Fisheries Specialist Report located in the project record.

Engineering

Affected Environment

Introduction

The most current information available from the Travel Routes portion of the Forest Service Information Systems Database (INFRA) was used to determine road lengths and maintenance levels for roads within the project areas and for roads proposed as haul routes outside of the project areas.

This section describes the effects on access/travel management and the maintenance of National Forest System roads from activities proposed in each alternative. Road closures, decommissioning, maintenance, reconstruction, and temporary road construction are the proposed activities that would potentially affect access and travel management and maintenance. These activities can affect resources such as wildlife habitat, water quality and fish habitat. The management and maintenance of the open roads comes at cost to the federal government. The fewer the number of miles of open roads the less cost to the tax payer.

Regulatory Framework

A Sub-Forest roads analysis was completed for the Tamarack Creek Subwatershed. The subwatershed boundary is the same as the project area. An interdisciplinary process was used involving members of the Prairie City Ranger District staff to complete this analysis for the Knox Project. The team was charged with analyzing all the roads in the area and recommending whether to keep them open, closed, re-opening closed roads or decommission them. This determination was based on the guidelines included in the Malheur National Forest Roads Analysis dated December 2005. The roads decisions are documented in the Knox Roads Analysis List with associated maps attached.

Sub-Forest road analyses need to continue to strive to meet long-range road density goals by identifying opportunities to reduce both open road densities and total road densities. The results of those efforts should focus on reducing the amount of funding needed for road maintenance, reducing road related impacts to fish and wildlife and reducing the spread of exotic plants and noxious weeds.

Existing Condition

The primary access into the project area is Forest Service Road (FSR) 16. The road surface is double lane asphalt and starts in Seneca, Oregon and ends at 60.6 miles to the East at the Forest Boundary. For this project, the portion of the 16 Road that will be used is 2.6 miles from FSR 14 to County Road 62. Other main Forest Service roads that access the Knox Project Area include all or portions of FSRs 14, 1420 and 1663.

FSR 14 is a Maintenance level (ML) 3 which is a crushed aggregate surface. FSRs 1420 and 1663 are ML 2 roads. The road surface for ML 2 roads is normally native, but there are a few roads in the project area that the road surface has been improved with an aggregate surface.

The transportation system associated with the Knox Project consists of 228 roads in the analysis area, which includes three Forest Service roads that go to private property. Under Forest Service

jurisdiction, approximately 10 miles (7%) of these roads are ML 3 which means they will receive maintenance as called for under the Malheur National Forest Road Maintenance Plan. Approximately 117 miles (82%) are ML 2 roads which means the roads will receive minimal maintenance other than when they are used for projects such as timber sales. Approximately 15 miles (11%) are ML 1 roads which are intended to be closed or have motorized traffic restrictions. Motorized use is typically authorized by permit only for specific needs.

Roads that are ML 3 or 4 generally receive periodic maintenance with appropriated funding. The majority of the proposed haul roads are currently classified as either ML 1 or 2. ML 2 roads are typically maintained at a level to provide access for high clearance vehicles. Passenger car traffic is allowed but not encouraged. Traffic on ML 2 roads is normally low and usually consists of administrative, recreational or other specialized uses and can include commercial activities. ML 1 roads generally receive only basic custodial maintenance to prevent damage to adjacent resources; the road is basically in storage but available when needed for future management activities. Emphasis is given to assuring functional drainage prior to closure. While these roads are closed to motorized vehicles they remain open to non-motorized travel. When a ML1 road is needed for specific projects activities that extend beyond a brief period such as timber harvest they can be temporarily changed to a ML 2 status. Providing road systems that are safe and responsive to public need, environmentally sound, affordable and efficient to manage is among the agency's top priorities.

The Knox Project Area covers 20,147 acres which equals 31.5 square miles. The existing total road density for the treatment area is 4.01 miles per square mile. Most of the roads in the Knox Project Area will need maintenance to meet current road maintenance objectives and classification standards.

Maintenance: the upkeep of the entire forest transportation facility including surface and shoulders, parking and side areas, structures and such traffic-control devices are necessary for its safe and efficient utilization.

Most of the total road miles within the project area are Forest Service roads and were constructed in the past to support timber related land management objectives.

Roads that are used for timber haul normally receive road maintenance at a level commensurate with use, either maintaining or improving existing road conditions to support timber haul. Because the maintenance is commensurate with use, it is possible that if winter logging occurs, little or no road maintenance would be necessary on specific roads. Alternately if haul operations occur in the summer road maintenance commensurate with use is likely to occur on all or nearly all of the haul roads.

Road Densities

The Malheur Forest Plan provides direction to address road related concerns for fish and wildlife by establishing open road density goals in the Tamarack Creek Subwatershed within the Upper Malheur Watershed of no greater than 3.2 miles/square mile in summer range, and 2.2 miles/square mile in winter range (1999). When considering wildlife and other resource concerns, open road densities are normally calculated on a subwatershed or 6th field Hydrologic Unit Code (HUC). Open road densities at the 6th level HUC are displayed in the Terrestrial Wildlife discussion earlier in this Chapter. The Malheur Land and Resource Management Plan (LRMP) standards for open road densities were intended to be monitored on a watershed or 5th

field HUC basis (Chapter IV-29 Standard 32 – Wildlife, and Chapter IV-72 Standard 24 and MA-20A, Chapter IV-124 Standard 21).

Table N-1. Existing Road Miles Inside the Knox Project Area.

Operational Maintenance Level	Miles
OML 1 (closed roads)	15.0
OML 2 (open roads)	117.0
OML 3 (open roads)	9.7
OML 2 and 3 (Total Open Roads)	126.7
All Roads	141.7 total miles

Road closures (Roads 1400275, 1400645, 1400672, 1420788, 1420856 and 1420887) analyzed in the Phoenix EA (1992) are ongoing, however were not updated in the INFRA database to ML 1, and are still inventoried as ML 2 (open). These roads will be changed in INFRA to ML 1 (closed), for a total of 2.33 miles inside the Tamarack Creek Subwatershed. During the Knox Project Roads Analysis process some roads proposed to be closed in the Phoenix EA are now proposed to be left open to provide for fire access or for range administration purposes. These include Roads 1400271, 1400668, and 1420856 for a total of 2.01 miles inside the Tamarack Creek Subwatershed. The above changes are reflected the proposed road closures and decommissionings described in Chapter 2 and Appendix E – Knox Road List.

Environmental Consequences

Direct and Indirect Effects

Common to All Action Alternatives

All action alternatives include the same number of planned road closures and decommissioning. This was designed to maintain an adequate transportation system for the public and forest management activities such as wildfire suppression. Access to identified dispersed camping sites was generally not closed unless there were identified problems with the road such as sedimentation.

The majority of roads proposed for closure or decommissioning are currently classified at ML 2, which provide access for high clearance vehicles. Passenger car traffic is not encouraged.

With increasing budget constraints, the agency cannot adequately maintain the majority of road miles at their designed maintenance level. Failure to maintain these roads may impair water quality by eroding and/or contributing sedimentation to streams. Closure of these roads would increase big game security, improve water quality, and reduce maintenance costs.

When roads are closed, they are assigned a ML 1 status. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to minimally perpetuate the road to facilitate future management activities. Emphasis is given to assuring drainage structures suitable for the runoff pattern are in place and functional prior to closure. These newly closed roads are inspected annually for 2 or 3 years to assure the drainage facilities are adequate and self maintaining. Planned road deterioration, such as increased vegetation growth and bank slough to natural slope repose may occur at this level. While these roads are closed to motorized vehicles, they remain open and suitable for non-motorized travel.

Decommissioned roads are permanently closed and no longer maintained. Soil compaction may be reduced where feasible, and cut or fill slopes may be returned to natural contours. Manufactured drainage structures (culverts) are removed. Where appropriate, bank cuts or ditches created by the removal of these structures may be contoured to provide natural drainage and prevent erosion. Decisions to decommission some of the roads that are not part of the potential minimum primary road system are expected to occur over time as an outcome of sub-Forest level analyses. When those decisions are implemented, any annual and deferred maintenance cost for roads that are decommissioned will be eliminated. Depending on the type road and decommissioning effort, the cost would range from as low as $1,000 per mile to greater than $10,000 per mile.

Road maintenance activities are proposed to correct erosion problems associated with roads used for commercial harvesting. Direct beneficial effects from this proposed activity would be improved road conditions. Blading road surfaces and cleaning ditches would have no negative impact on access, as roads remain open during these activities.

A total of 84.8 miles of road would remain open for public use. Sixty roads totaling 26.3 miles would be closed. Twenty four roads totaling 11.7 miles would be decommissioned. The road miles include three roads that access private land. Due to lack of funding to close or permanently decommission these roads it could take up to 5 years to complete, but once completed, maintenance should not have to be done again. Table N-2 shows the road closure comparison between alternatives.

These roads would be treated according to the recommendations in the Knox Roads Analysis, which would reduce the miles of open roads in the subwatershed by 33% compared to existing conditions and Alternative 1. The work that would be done under Alternatives 2 and 3 would lower the open road densities and the total road densities and improve fish habitat by closing and/or decommissioning some roads in the RHCAs.

Table N-2: Summary of Proposed Road Closures and Decommissioning Activities During and After Timber Sale Harvest.

Activity	Method of Measurement	Alt. 1	Alt. 2	Alt. 3
Roads to be Left Open	Miles	84.8	84.8	84.8
Roads to be Closed	Miles	0.0	26.3	26.3
Roads to be Decommissioned	Miles	0.0	11.7	11.7
Roads to be Opened and Re-Closed after Timber Sale	Miles	0.0	4.9	2.6
Total Miles		84.8	130.3	125.4

Note: Rounding road miles during calculations may result in minor (0.1) mile discrepancies between alternatives

New temporary roads, authorized under the timber sale contract would provide access for timber harvest activities. Since temporary roads are not intended to be part of the Forest Transportation system they would be decommissioned after timber sale activities were completed.

Alternative 1 – No Action

Under the No Action Alternative, all existing open roads would remain open and all existing closed roads will remain closed and left in the same condition they are in now. Access would be provided at existing levels, but there would be no opportunity to improve drainage by installing additional drainage dips, waterbars, or cross ditches. This alternative would continue to deliver sedimentation into streams at the current level or higher and would remain at the same cost to the Federal Government to meet road maintenance standards.

Brush and tree encroachment over time will result in decreased sight distance on most roads; a few roads may close naturally as a result of encroaching vegetation and very little use. There would be no foreseeable opportunities to improve existing road conditions through funded maintenance activities. The roads would continue to deteriorate over time until and unless other funding opportunities become available. The agency would continue to expend limited funds for maintenance of unneeded roads.

The amount of funding and opportunities available to complete annual maintenances needs has drastically declined over the past decade. As a result the Forest has a large backlog of deferred maintenance needs, which continue to grow in magnitude.

The most important road related environmental issue is the effects of roads on aquatic resources in general, specifically threatened endangered and sensitive aquatic species. The magnitude of those effects is largely dependent on how well the roads are maintained. This alternative would not provide opportunities to fund any maintenance, which have drastically declined over the past decade.

This alternative would have the least impact on access. The road density within the subwatershed would remain above Forest Plan objectives. Alternative 1 would not follow the Malheur Forest Roads Analysis, dated April 2005, for recommendations.

Alternative 2 – Proposed Action

This alternative proposes the highest level of road maintenance work through timber harvest activities. This alternative would need to open and close nine roads as part of the work done with the timber harvest activities.

With this alternative there would be an opportunity to perform road maintenance on up to 63 miles of forest roads commensurate with any commercial uses associated with project activities. Under this alternative 84.8 miles of road would remain open to public use after all timber harvest activities, road closures and decommissioning is completed. Under this alternative, over the next five years an additional 60 roads would be closed (26.3 miles) and 24 roads would be decommissioned (11.7 miles).

Included in the maintenance requirements for timber haul roads is the following work which can be performed as maintenance in any timber sale contract:

- Blade and shape roadbed
- Blade and shape existing drain dips, grade sags, waterbars and cross ditches
- Constructing one or two waterbars/cross ditches
- Seeding roadbed after closing/decommissioning a road
- Spot rocking in wet areas of road, including some existing drain dips and grade sags
- Minor brushing for road width
- Falling and removal of hazard trees from the road prism
- Minor realigning of road junction
- Repair damaged culverts
- Removing debris that has sloughed into the roadway
- Removal and replacement of culverts with same size or larger up to 36” in diameter

The following work is classified as maintenance under the definition listed in the Federal Register but will be listed as reconstruction in any contracts that are signed:

- Widening roadbed to meet standard width
- Constructing new drain dips and grade sags
- Major brushing
- Removing large amounts of excess material
- Rocking roadbed and/or drain dips and grade sags
- Removal and replacement of culverts with the same size or larger culverts greater than 36" in diameter
- Major realignment

1.5 miles of temporary road construction would be constructed and utilized for harvest operations and scarified (if needed), and permanently closed at the conclusion of harvest operations.

Alternative 3- Alternative to the Proposed Action

This alternative would result in less road maintenance work for timber harvest activities compared to Alternative 2. This alternative would need to open and close six roads through timber harvest activities. With this alternative there would be an opportunity to perform road maintenance on up to 48 miles of forest roads commensurate with any commercial uses associated with project activities. Under this alternative, 84.8 miles of road would remain open to public use after all timber harvest activities, road closures and decommissioning is completed. Under this alternative, over the next 5 years an additional 60 roads would be closed (26.3 miles) and 11.7 miles of road would be decommissioned.

1.14 miles of temporary road construction would be constructed and utilized for harvest operations and scarified (if needed), and permanently closed at the conclusion of harvest operations.

Cumulative Effects

All Action Alternatives

The existing road system assigned Maintenance Levels were developed in association with past timber harvest and other activities (refer to Appendix C). Past road construction was very limited prior to 1940, but intensified from then until 1980 to the point where road density exceeded 3.0 to 4.0 miles per square mile on most of the Forest. A lot of roads built during that period were poorly located requiring frequent maintenance. The proposed road closures of these poorly located roads would reduce the cumulative effects related to the maintenance costs for the entire road system.

The cumulative effects of these alternatives and road closures that are likely in the future would be a reduction in sedimentation, improve water quality, fewer roads to maintain, less money spent on maintenance, reduce access for all motorized users, increased response time for fire crews, and less disturbance to wildlife. Phoenix road closures are ongoing and are included in this analysis with some changes. See description below Table N-1, on page 181.

There will be ongoing and future actions that could affect roads and access. These include replacing culverts for fish passage and removing culverts on roads that will be decommissioned.

Irreversible and Irretrievable Commitments

All alternatives could use rock on roads for spot rocking. This would be an irreversible commitment of rock (considered to be a resource). This rock would come from the Tamarack Material Source on the 1663558 road or the Alder Material Source on the 1400674 road.

There would be a short-term loss of productivity where temporary roads are proposed in Alternatives 2 and 3. Those areas would be returned to productivity when the roads are rehabilitated.

Consistency with Direction and Regulations

Alternative 1 – No action would not bring road related effects within the project area any closer to meeting the Standards and Guidelines for road densities, fish habitat or water quality as contained in the Malheur Forest Plan.

Alternatives 2 and 3 would improve drainage and surface conditions on haul routes and would be consistent with Forest Plan direction and regulations. These improvements would result in a reduction in road related impacts to nearby water quality and fish habitat for an extended period on roads that are closed and for an estimated 5 to 10 years on roads to remain open. Alternatives 2 and 3 would follow the General Road Management guidelines recommended in the Malheur National Forest Roads Analysis (page 47) and would help move the Forest closer to meeting those guidelines.

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Engineering Specialist Report located in the project record.

Range Resources and Noxious Weeds

Affected Environment

Introduction

This section discusses management direction, current conditions, and environmental consequences of proposed alternatives on range resources and noxious weeds. The range resource evaluation includes the entire Knox Project Area and the four allotments in the project area (Spring Creek, Bluebucket, Antelope and Ott). The noxious weed evaluation consists of the Knox Project area and associated roads that serve as corridors for transport of noxious weed seed or propagules.

The proposed activities have the potential to impact range resources such as forage availability, livestock distribution, existing range improvements, and permittee access. The permittees that may be affected have been contacted in the development stage of this project, and will continue to be kept informed throughout the process during the regularly scheduled permittee meetings.

Additionally, noxious weed populations could be affected or introduced as a result of project activities. Invasive species Executive Order 13112 (1999) combined with the USDA Forest Service National Strategic Plan directs the Forest Service to: (1) determine factors that favor establishment and spread of noxious weeds, (2) analyze weed risks in resource management projects, and (3) design management practices to reduce these risks.

Regulatory Framework

The Malheur National Forest Land Resource and Management Plan (LRMP; USDA Forest Service 1990) provides standards and guides for the management of forest wide resources in addition to guidance for designated management areas within the forest. The project is located within Management Areas 1 (General Forest), Management Area 2 (Rangeland), Management Area 3A (Non-Anadromous Riparian Areas), Management Area 4A (Big Game Winter Range), and Management Area 13 (Old Growth).

LRMP management direction and goals related to this project are summarized here.

Range

Forest wide rangeland management goals are:

- to provide a sustained production of palatable forage for grazing and dependent wildlife species,
- to manage rangelands to meet the needs of other resources and uses at a level which is responsive to site-specific objectives, and
- to permit livestock use on suitable range when the permittee manages livestock using prescribed practices (LRMP, Chapter 4, p. 2).

Forest wide range standards are:

- to manage big game and livestock numbers at a level which utilizes available forage while maintaining plant vigor, composition and density, and
- to inventory and analyze forage resource production, condition and trend.

Management Area 1 standards are:

- to manage allotments to utilize available forage while maintaining vegetation and site productivity,
- to create and utilize transitory forage resulting from timber harvest if restocking of cutover areas within planned regeneration period is assured,
- to design structures which facilitate livestock distribution, and
- to protect tree regeneration, and to plan and implement range forage seeding that are not detrimental to tree restocking of harvest area within planned regeneration periods.

Management Area 2 standards, (which consist primarily of nonforested grasslands and low-site ponderosa pine lands that are unsuitable for timber production) are to emphasize forage production on the nonforested areas on a sustained yield basis while providing for other resources and values.

The Malheur National Forest Post Fire Interim Grazing Guidelines (2003) is an interim providing direction that establishes minimum timeframes an area would be rested from grazing following a fire (wild and prescribed fires).

Management Area 3A standards domestic livestock grazing is permitted at Range Management Strategy B and C. Management controls livestock numbers so that livestock use is within present grazing capacity. Distribution is achieved through riding, herding, and/or salting. Improvements are minimal and constructed only to the extent needed to cost effectively maintain stewardship of the range in presence of grazing.

Management Area 4A standards prioritize forage utilization to provide for big game species at levels derived in consultation with the Oregon Department of Fish and Wildlife for each area. Include the forage needs of big game in late fall when preparing or updating allotment management plans and when considering seasonal extensions of livestock grazing.

Management Area 13 standards livestock grazing is permitted in accordance with Forest-wide Standards.

Noxious Weeds

Forest wide standards are to implement a weed control program to confine present infestations and prevent establishment of noxious weeds in new areas. The Malheur National Forest strives to implement the Pacific Northwest (PNW) Regional Strategy for Noxious Weeds and Non-native Invasive Plant Management that is tiered to the National Forest Service Strategic Plan. The Malheur National Forest conducts annual noxious weed surveys. Noxious weed control measures on the forest presently consist of mechanical and hand pulling of weeds in affected areas.

This EA is tiered tothe Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program, 2005, hereby referred to as the R6 2005 FEIS). The R6 2005 FEIS culminated in a Record of Decision (R6 2005 ROD) that amended the Malheur National Forest Plan by adding management direction relative to invasive plants. This project is intended to comply with the new management direction. This project will also be in compliance with the 1988 Record of Decision for Managing Competing and Unwanted Vegetation (1988 ROD) and the 1989 Mediated Agreement.

- All heavy equipment will be cleaned prior to entering National Forest System Lands.
- Seed, straw, and other materials used for road decommission and erosion control will be certified to be free of noxious weed seed.
- Use only gravel, fill, sand, and rock that are judged to be weed free by District weed specialists if needed for project.
- Native plant materials are required for revegetation unless accepted extenuating circumstances are identified.

Analysis Method

Range vegetation monitoring has been conducted on an annual basis on the grazing allotments located within the Knox Project Area and Tamarack Creek Subwatershed. Range administration is conducted yearly by both the Forest Service and the permittees to meet the terms and conditions of the grazing permit.

Qualitative ecological analysis of the Spring Creek, Bluebucket, Antelope and Ott allotments was conducted by Land EKG, Inc. (Bozeman, MT) in the fall of 2004. This analysis, including recommendations, was used as an indicator of vegetative health and function for the area.

Noxious weed surveys have been conducted throughout the Malheur National Forest. All documented weed sites from these surveys are recorded in a National database, Natural Resources Information System (NRIS). The data base includes individual site records indicating the location, size of infestation, plant numbers and density, type of treatment implemented, follow-up treatments and effectiveness. A noxious weeds survey was conducted in the Knox Project Area all information from this survey was added to the GIS layer as well as the NRIS database.

Other sources of information used in this analysis include:

- Spring Creek, Bluebucket, Antelope and Ott Grazing Permits,
- Malheur National Forest GIS data base,
- Malheur National Forest Land and Resource Management Plan,
- Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program, 2005, and
- 1988 Record of Decision for Managing Competing and Unwanted Vegetation (1988 ROD) and the 1989 Mediated Agreement.

Existing Condition - Range

Four grazing allotments, Spring Creek, Bluebucket, Antelope and Ott, are within the project and surrounding area (Table R-1).

Table R-1. Allotment and Pasture Acreages within the Knox Project Area.

Allotment	Pasture	Project Area Acres*	Total Acres*
Antelope	North	26	2,345
Antelope	South	22	1842
Bluebucket	Dry Meadow	176	5,327
Ott	Cottonwood Holding	46	46
Ott	Cottonwood Riparian	2,124	2,141

Allotment	Pasture	Project Area Acres*	Total Acres*
Ott	Anderson Creek Holding	27	27
Ott	Knox Meadows	62	62
Ott	Ott	6,654	7,252
Ott	Ott Meadow	40	40
Ott	East Buttermilk	7,476	7,559
Ott	Rattlesnake	653	6,016
Ott	West Buttermilk	1,441	6,028
Spring Creek	Buttermilk Flat	724	1,003
Spring Creek	Buttermilk Horse Pasture	2	80
Spring Creek	Cougar Holding	43	43
Spring Creek	Buck Trough	50	2,999
Spring Creek	Mahogany	221	841
Total acres:		**19,787**	**43,651**

*Acreage determined by GIS coverages

The Antelope grazing permit allows grazing for 215 cow/calf pair during June 10th through September 25th.

The Bluebucket grazing permit has two permittees. One permittee runs 50 cow/calf pair during June 1st through September 30th. The other permittee runs 330 cow/calf pair during June 1st through September 30th.

The Ott grazing permit allows grazing for 430 cow/calf pairs during June 1st through September 30th.

The Spring Creek grazing permit has three permittees. One permittee only runs cattle, and the other two permittees run a combination of cattle and sheep. Identified below is a typical grazing scenario for the Spring Creek Allotment grazing period June 10 through October 25:

- 40 cow/calf pair, and
- a combination permit consisting of 560 cow/calf pair or 2,800 ewe/lamb pair or a combination therein to meet the allotted animal unit months (AUMs).

The predominant vegetation in the project area consists primarily of elk-sedge, pinegrass, Idaho fescue and wheeler's bluegrass. In the sagebrush areas it consists of Idaho fescue and Sandberg's bluegrass (2006 Production use study for this area). Qualitative ecological analysis of the Antelope, Bluebucket, Ott and Spring Creek allotments conducted by Land EKG, Inc. (Bozeman, MT) in the fall of 2004 indicated that most sites within these four allotments were functioning, "at or near to very stable conditions," and exceeding native herbaceous production potential. Land EKG monitoring system provides a qualitative functional rating of 19 ecological indicators that are associated with four basic ecological processes: nutrient cycling, water cycling, biotic state, and energy flow. Recommendations based on their analysis included continuing current management prescription levels that maintain or improve desired riparian and stream function. The vegetative cover recorded within these plots consisted of pinegrass, elksedge, and bunchgrasses with a mixed-conifer overstory.

Existing Condition - Noxious Weeds

Prairie City Ranger District personnel continually identify new noxious weed infestations and report occurrences to the District Weed Specialist for inclusion into the national/forest/district

database, Natural Resources Information System (NRIS). This database includes individual species site records that include location and size of infestation, plant numbers and density, type of treatment implemented, follow-up treatments and effectiveness of treatments. Noxious weed species occurring in the Malheur National Forest and Prairie City Ranger District are houndstongue (*Cynoglossum officinale*), spotted and diffuse knapweeds (*Centaurea* sp.), Canada thistle (*Cirsium arvense*), dalmation toadflax (*Linaria dalmatica*), whitetop (*Cardaria draba*) cheatgrass (*Bromus tectorum*) and scotch thistle (*Onopordum acanthium*). Within the project area the following noxious weeds occur: cheatgrass (13.9 acres), Canada thistle (1.4 acres), and scotch thistle (3.5 acres) is reported to occur through out the project area). Species known to occur along highways and roadsides accessing the project area are Canada thistle, scotch thistle, and cheatgrass. These areas can be vectors for the spread of weeds into other areas in the Malheur National Forest.

Table R-2. Monitoring Prescription for Noxious Weeds.

Monitoring (by Resource Area)	Description of Monitoring
Range	
R-1	Distribution and utilization monitoring should be done annually for 2 to 4 years post project across the area affected by the project activities.
Noxious Weeds	
Nx-1	Noxious weed inventory and monitoring should be done annually for 3 to 5 year post-project on all open and closed system and temporary roads affected by the project activities.

Environmental Consequences

Direct and Indirect Effects

Effects Common to all Action Alternatives

Any prescribed burning in the area of the grazing allotments would affect the amount of area that is available for grazing as well as effect the distribution of livestock.

Any timber sale activity in the grazing allotment will have an effect on the distribution of livestock. Do to the fact that the livestock will avoid the area of the sale activity while it is going on, which in turn may cause a short term effect on other areas of the allotment being utilized heavier. In the long run the area treated will be transformed into transitory range which will benefit the overall effectiveness of the allotment.

Overall treatment in this subwatershed may decrease available forage in the subwatershed after the first year the treatment has occurred. However, in the long term the increase in the forage and livestock distribution far outweigh the short term decrease which occurred. With these areas being treated over several years their overall effect on the management of the grazing allotment is very minimal.

Increased traffic in the area may increase the instances of gates being left open, fences being cut and let down and increase the possibility of cattle getting hit on roads used by logging trucks or other vehicles. If the fences, gates and natural barriers are not left intact, the grazing system

would not met its' planned objectives and the integrity of the allotment boundary would not be maintained. The removal of non-designated trees from the fence line will need to be stopped. This way the integrity of the fence line will be maintained.

The existing population of Noxious Weeds and Unwanted Vegetation (Cheatgrass, Canada thistle and scotch thistle) at this point in time the only means of treatment is limited to manual methods. Current rate of spread will increase in size of population and area of distribution. For further information see the Noxious Weed Vegetation Management Plan for the Knox Project in the analysis file.

Road closures, proposed for Alternative 2 and 3, are to close or decommission approximately 38 miles of roads within the project area. Road closures that deny access to fences, troughs and ponds will also increase the operating costs of the grazing permittee.

Alternative 1 - No Action

Range

Current grazing practices would continue on all allotments in the project area. The No Action Alternative would have no overall short-term impact to the range resource. However, long-term effects of the No Action Alternative may result in a reduction in forage availability and distribution of livestock due to increased shading and duff layer. The herbaceous component of the plant community will diminish over time.

Forage Availability and Distribution of Livestock

Forage availability under the No Action Alternative would remain the same or may decrease due to increased plant competition that occurs when overstory shading increases over time. Decreases in forage availability would affect livestock distribution within the allotments.

Range Improvements

Existing spring developments and fence lines would require normal maintenance. Some minor increases in maintenance costs may be incurred in the long term as the forest ages to repair fence damage from falling snags and to maintain fence rights-of way.

Permittee/Range Management Access

Long-term accumulation of woody debris may impede the movement of cattle and permittee access.

Noxious Weeds

Monitoring and control measures for noxious weeds conducted by the Malheur National Forest would continue. There is low potential for spread of noxious weed under the No Action Alternative, however foreseeable uses of the forest for hunting, grazing, and firewood cutting, could contribute the spread of weeds. Present control measures should not cause a major increase in noxious weeds in the project area for the short or long term.

Alternative 2 – Proposed Action

Range

Forest stand commercial, precommercial thinning and prescribed burning would positively affect both the short- and long-term range conditions by reducing conifer density in stands, reducing ground fuel loading that restricts livestock movement, and increasing transitory range forage. All proposed action treatments would have a positive effect on range conditions and increase available forage for livestock.

Of the 1,733 acres of commercial thinning proposed, within these treatment areas 261 acres will be commercial thinned only, 306 acres will be commercial thinned with a follow-up treatment of precommercial thinning and 974 acres will be commercial thinned with prescribed fire as the follow-up treatment and 192 acres will be commercial thinned followed by precommercial thinning and prescribed fire.

Of the 1,128 acres identified as precommercial thinning proposed, 497 acres have already been addressed in the commercial thinning acres stated above. Within these treatment areas 111 acres will precommercial thinned only and 520 acres will be precommercial thinned followed by prescribed fire.

Of the 6,557 acres of prescribed burning, 1,685 acres have already been identified under the commercial and precommercial thinning treatments. The remaining 4,872 acres will be treated with prescribed fire only. All of the above mentioned activities would have a beneficial long-term effect for livestock grazing on approximately 7,236 acres[2]. Predominate vegetation will recover very quickly after underburning and rest period from grazing is not anticipated, therefore we do not anticipate an impact on grazing permittee operations. Fuel treatment areas are predominately composed of elk sedge and pinegrass. These herbaceous species are fire tolerate species that evolved with a fire regime, and are less desirable as forage by livestock. Treatment areas of the grazing units tend to be used very lightly by permitted livestock because of the vegetation type.

After the project is initiated grazing management practices will be implemented to achieve desired use levels. These practices may include deferment or electric fencing, adjustment of pasture management, placement of salt blocks, or other management practices that would promote use by livestock in portions of the pasture away from treatment areas. Grazing management adjustments would be developed in coordination with the allotment permittee and incorporated into the annual allotment plan. These proposed actions are consistent with the Malheur National Forest Post-Fire Interim Guidelines which states that vegetation types such as elk sedge and pine grass require little or no recovery time after a light burn.

The grazing permittee may be burdened financially in the short term if required to keep cattle out of a prescribed burn or reforestation unit for an extended period of time.

The range vegetation will continue to be in satisfactory condition. The amount of transitory range will be increased as harvest activities are completed.

[2] This is based on the acres of commercial, precommercial thinning, and prescribed burn treatments.

Forage Availability

It is not anticipated that forage availability will be heavily impacted the first year. Long-term availability of forage would be increased due to reduced competition from shrubs and trees, increased soil nutrient availability, and increased sunlight as a result of treatments.

Distribution of Livestock

Treatments would reduce and eliminate dead and down woody material and would enable increased livestock distribution resulting in improved utilization of forage, water, and salt. With the projected increase in the quantity of available forage there is increased potential to reduce impacts on riparian herbaceous and hardwood species, as well as aspen.

There maybe an impact to distribution effects from aspen-reinvigorating treatments since there are a large number of sites that are over an acre in size and a few of these sites are over 4 acres in size.

Range Improvements

Maintenance may increase initially to repair improvements in the event of damage caused by project activities, however long-term maintenance costs would be reduced due to improved access along fences and water sources.

Permittee/Range Management Access

Due to the fire tolerant nature of the predominant species in the project area, elk sedge and pine grass, the need for rest is not anticipated. In the Idaho fescue and Sandberg's bluegrass predominant species areas there may be a need for rest depending on the intensity of the burn. The predominant species of elk sedge and pinegrass are also not preferred forage by the livestock in the area however; the Idaho fescue and Sandberg's bluegrass are preferred forage by livestock. If monitoring determines that burning occurred at a higher intensity than expected or vegetation does not recover as expected, deferment or rest of the units in the project area may be necessary. Grazing management adjustments would be developed in coordination with the allotment permittee and incorporated into the annual allotment instructions to insure the goals and objectives of the project are met. Overall, long-term access to the area by the permittee and the ability to move livestock would be improved as the result of thinning and ground fuel reductions.

Noxious Weeds

Activities associated with timber cutting, site preparation for planting, road maintenance, and temporary road construction all disturb the soil to some degree. Ground-disturbing activity would increase the risk for spread of non-native, invasive plants because if seeds are introduced they can germinate more readily than if the soil surface was intact (Gelbard & Belnap 2003; Silveri et al. 2001). This weed seed could come from a nearby weed patch, be carried in soil clinging to equipment, or be introduced from some other source (birds, animals, recreation). Contractors mobilizing equipment from other areas have the potential to introduce new noxious weeds into the area, and noxious weeds may increase in commercially thinned areas due to the transport of weed propagules along existing access roads. With only one presently known noxious weed occurrence, design features and monitoring protocols incorporated into this project would limit the potential noxious weed spread and the effect is expected to be minor.

Prescribed burning may increase noxious weed populations (Maret and Wilson 2000, and Briese 1996). Burned areas do provide nutrients and space for noxious weeds to establish. However, no known weed sites will be burned through, and fire is expected to be low intensity which reduces the risk of increasing weed populations. A monitoring study done in the Malheur National Forest noted that an increase in noxious weeds was closely related to the intensity of a fire. Lower intensity fires had fewer weeds develop on the site (Kerns et al. 2006). Therefore, because low intensity fires are proposed in these project noxious weeds are not expected to increase.

Alternative 3

Range

Forest stand commercial, group select, precommercial thinning and prescribed burning would positively affect both the short- and long-term range conditions by reducing conifer density in stands, reducing ground fuel loading that restricts livestock movement, and increasing transitory range forage. All proposed action treatments would have a positive effect on range conditions and increase available forage for livestock.

Of the 513 aces of commercial thinning proposed, within these treatment areas 97 acres will be commercial thinned only, 115 acres will be commercial thinned with a follow-up treatment of precommercial thinning, 104 acres will be commercial thinned with follow-up treatments of precommercial thinned with prescribed fire, 197 acres will be commercial thinned followed by prescribed fire.

Of the 507 acres of group selection proposed, within these treatment areas 260 acres will group selected followed by precommercial thinned, 223 acres will be group selected with follow-up treatment of prescribed fire, 24 acres will be group selected with precommercial thinned followed by prescribed fire.

Of the 1,269 acres identified as precommercial thinning proposed, 503 acres have already been addressed in the commercial thinning and group selection acres stated above. Within these treatment areas 138 acres will be precommercial thinned only and 628 acres will be precommercial thinned followed by prescribed fire.

Of the 6,557 acres of prescribed burning, 1,178 acres have already been identified under commercial, precommercial thinning and group selection treatments. The remaining 5,379 acres will be treated with prescribed fire only. All of the above mentioned activities would have a beneficial long-term effect for livestock grazing on approximately 7,668 acres[3]. Predominate vegetation will recover very quickly after underburning and rest period from grazing is not anticipated, therefore we do not anticipate an impact on grazing permittee operations. Fuel treatment areas are predominately composed of elk sedge and pinegrass. These herbaceous species are fire tolerate species that evolved with a fire regime, and are less desirable as forage by livestock. Treatment areas of the grazing units tend to be used very lightly by permitted livestock because of the vegetation type.

After the project is initiated grazing management practices will be implemented to achieve desired use levels. These practices may include deferment or electric fencing, adjustment of pasture management, placement of salt blocks, or other management practices that would

[3] This is based on the acres of commercial, precommercial thinning, group selection and prescribed burn treatments.

promote use by livestock in portions of the pasture away from treatment areas. Grazing management adjustments would be developed in coordination with the allotment permittee and incorporated into the annual allotment plan. These proposed actions are consistent with the Malheur National Forest Post-Fire Interim Guidelines which states that vegetation types such as elk sedge and pine grass require little or no recovery time after a light burn.

Forage Availability

It is not anticipated that forage availability will be heavily impacted the first year. Long-term availability of forage would be increased due to reduced competition from shrubs and trees, increased soil nutrient availability, and increased sunlight as a result of treatments.

Distribution of Livestock

Treatments would reduce and eliminate dead and down woody material and would enable increased livestock distribution resulting in improved utilization of forage, water, and salt. With the projected increase in the quantity of available forage there is increased potential to reduce impacts on riparian herbaceous and hardwood species, as well as aspen.

There maybe an impact to distribution effects from aspen-reinvigorating treatments since there are a large number of sites that are over an acre in size and a few of these sites are over 4 acres in size.

Range Improvements

Maintenance may increase initially to repair improvements in the event of damage caused by project activities, however long-term maintenance costs would be reduced due to improved access along fences and water sources.

Permittee/Range Management Access

Due to the fire tolerant nature of the predominant species in the project area, elk sedge and pine grass, the need for rest is not anticipated. The predominant species are also not preferred forage by the livestock in the area. If monitoring determines that burning occurred at a higher intensity than expected or vegetation does not recover as expected, deferment or rest of the units in the project area may be necessary. Grazing management adjustments would be developed in coordination with the allotment permittee and incorporated into the annual allotment instructions to insure the goals and objectives of the project are met. Overall, long-term access to the area by the permittee and the ability to move livestock would be improved as the result of thinning and ground fuel reductions.

Noxious Weeds

Activities associated with timber cutting, site preparation for planting, road maintenance, and temporary road construction all disturb the soil to some degree. Ground-disturbing activity would increase the risk for spread of non-native, invasive plants because if seeds are introduced they can germinate more readily than if the soil surface was intact (Gelbard & Belnap 2003; Silveri et al. 2001). This weed seed could come from a nearby weed patch, be carried in soil clinging to equipment, or be introduced from some other source (birds, animals, recreationists). Contractors mobilizing equipment from other areas have the potential to introduce new noxious weeds into the area, and noxious weeds may increase in commercially thinned areas due to the transport of weed propagules along existing access roads. With only one presently known

noxious weed occurrence, design features and monitoring protocols incorporated into this project would limit the potential noxious weed spread and the effect is expected to be minor.

Prescribed burning may increase noxious weed populations (Maret and Wilson 2000, and Briese 1996). Burned areas do provide nutrients and space for noxious weeds to establish. However, no known weed sites will be burned through, and fire is expected to be low intensity which reduces the risk of increasing weed populations. A monitoring study done in the Malheur National Forest noted that an increase in noxious weeds was closely related to the intensity of a fire. Lower intensity fires had fewer weeds develop on the site (Kerns et al. 2006). Therefore, because low intensity fires are proposed in this project noxious weed are not expected to increase.

Summary

Table R-3 summarizes the direct/indirect effects of the alternatives on the range resources, noxious weeds.

Table R-3: Summary of Effect of Alternatives on Range and Noxious Weeds.

Resource	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Range Resource	No effect in the short term. Long-term loss of transitory range due to increased timber density.	Slight effects to forage availability in the short term and no deferment or rest anticipated based on pre-implementation pasture analysis of plant community. Beneficial short and long-term effects to range condition.	Slight effects to forage availability in the short term and no deferment or rest anticipated based on pre-implementation pasture analysis of plant community. Beneficial short and long-term effects to range condition.
Forage Availability	No effect in the short term. Long-term loss due to increased competition (light, nutrients) and overuse due to increased woody debris on the forest floor.	Possible short-term impacts as a result of type of vegetation impacted. Forage availability is not expected to be heavily impacted in the short-term. Beneficial long-term impacts due to reduced competition, and increased soil nutrient availability.	Possible short-term impacts as a result of type of vegetation impacted. Forage availability is not expected to be heavily impacted in the short-term. Beneficial long-term impacts due to reduced competition, and increased soil nutrient availability
Distribution of Livestock	No effect in the short term. Decreased distribution of livestock due to loss of forage and minor increases of woody debris in the long term.	Beneficial impacts due to the reduction or elimination of dead and down woody material resulting in more even distribution and utilization of forage, water, and salt resources.	Beneficial impacts due to the reduction or elimination of dead and down woody material resulting in more even distribution and utilization of forage, water, & salt resources.
Range Improve-ments	No effect in the short term. Long-term, improvements would be impacted. Some minor increases in maintenance may be required to maintain improvement damage caused by occasional snags falling on fence lines.	Initial costs may increase to repair or maintain existing improvements. Long-term maintenance costs would be reduced due to easier access to improvement areas.	Initial costs may increase to repair or maintain existing improvements. Long-term maintenance costs would be reduced due to easier access to improvement areas
Permittee/ Range Management	No effect in the short term. Long-term, accumulation of woody debris may impede	Due to the herbaceous vegetation component present in this area the need to rest after	Due to the herbaceous vegetation component present in this area the need to rest after

Resource	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Access	cattle movement and permittee access. Road closures associated with the Phoenix project will occur in the project area. An estimated 2.2 miles of road closures will occur in the subwatershed over the next several years.	these treatments have occurred in not anticipated. Adjustments, based on monitoring, to promote grazing away from treatment areas may also be implemented as determined by the Prairie City District Range Resources Specialist. Grazing management adjustments would be developed in coordination with the allotment permittees and incorporated into the annual allotment instructions. Overall, long-term access to the range infrastructure will be affect greatly the permittee will be not given access to the improvements to keep them maintained and the value of these infrastructures will decrease more rapidly due the to the lack of access by the amount of road to be closed in the total project area (38 miles).	these treatments have occurred in not anticipated. Adjustments, based on monitoring, to promote grazing away from treatment areas may also be implemented as determined by the Prairie City District Range Resources specialist. Grazing management adjustments would be developed in coordination with the allotment permittees and incorporated into the annual allotment instructions. Overall, long-term access to the range infrastructure will be affect greatly the permittee will be not given access to the improvements to keep them maintained and the value of these infrastructures will decrease more rapidly due the to the lack of access by the amount of road to be closed in the total project area (38 miles).
Noxious Weeds	Low potential for spread of noxious weeds. Current levels of infestation would be treated as directed by Malheur weed management practices. Short and long-term levels of noxious weeds are expected to vary with methods of control, species-specific methods of infestation, and introduction of new species to the area by other users of the forest.	There is a low possibility of spread of noxious weeds within this project area. Implementation of the design features during project implementation will reduce the potential for introduction of any new noxious weeds, or spread of existing sites within the project area.	There is a low possibility of spread of noxious weeds within this project area. Implementation of the design features during project implementation will reduce the potential for introduction of any new noxious weeds, or spread of existing sites within the project area.

Cumulative Effects

Scope of the Cumulative Effects Analysis

This section presents cumulative effects analysis for range and noxious weed resources. The analysis area is defined, a list of past, ongoing and reasonably foreseeable future actions (refer to Appendix C) are disclosed, and cumulative effects are estimated.

The cumulative effects analysis boundary for this project consists of the affected grazing allotments (Antelope, Bluebucket, Ott and Spring Creek; see maps in the project record). The project area comprises a large portion of the Ott allotment and only a small portion of the other three allotments yet effects from the proposed project activities have the potential to affect the allotment and administration of these allotments as a whole. The affected allotments comprise approximately 115,282 acres. The temporal scale selected for this project is from 1990 to 2015. The reasoning for this time scale is supported by:

- Harvest activity records indicate these four allotments have experienced timber harvest since 1973 and more than likely have experienced harvest activity prior to 1973.
- Information is lacking as to the condition of these allotments during that period of time to the present except for a 1983 vegetation map of the project area and 2004 qualitative ecological analysis.
- There have not been any major wildfires in the area since 1910.
- The future planned activities proposed by the Malheur National Forest are, in general, on a 10-year planning cycle.

Past, Present and Reasonably Foreseeable Future Actions

Past actions in or near the project area include timber management, wildland fuel management, fire suppression, grazing, recreation, firewood cutting, big-game management, and road and facilities construction and maintenance. All activities have influenced the current forest composition and structure, and the management infrastructure of the area. Thus, these activities are still reflected, with individual variance, in the current condition of the area's natural resources and human environmental values. The following list identifies past, present, and future projects within the analysis area:

- Past harvest activities (consisting of various harvesting methods) on the allotments indicate that the majority of harvest was conducted between 1973 and 1989. A total of 15,567 acres 20 projects were harvested (Table R-4). These projects had a beneficial impact on range resources.

Table R-4. Acres harvested (using various methods) in Antelope, Bluebucket, Ott and Spring Creek Allotments, 1973 - 1989 (based on GIS harvest layer).

Project Name	Year	Allotment	Acres Harvested
Alder Ed	1992	Ott	98
Bearmilk	1991	Ott	91
Cottam	1982-1985	Ott	1,191
Cougar	1987-1989	Ott	732
Crane Creek	1973	Ott & Spring Crk	2,419
Gotcha	1983-1984	Bluebucket & Ott	522
Juniper	1987	Ott	0
Lazy	1987	Ott & Spring Crk	135
Leftover	1986-1987	Ott	1,341
McAllister	1987	Ott	0
Ott	1983-1984	Ott	1,004
Palmer Spring	1973	Antelope & Ott	35
Panther	1996	Bluebucket & Ott	231
Pit	1989-1991	Ott	886
Rim	1986	Ott	977
Skagway	1983-1984	Ott & Spring Crk	239
Termite	1983	Ott	513
Three Bear	1986-1987	Ott	528
Yogurt	1978	Ott	283
Zero BD	1976	Ott	4,342
Total Acres			**15,567**

- Prescribed fire treatments (data available: 1983-2000) within allotments total 9,045 acres. Prescribed fire treatments generally have positive direct, indirect, and cumulative effects by providing soil nutrients and reducing competition between forage and encroaching conifers.
- Future weed control treatments

Summary of Cumulative Effects

Range and Livestock

Cumulative effects of past, present and foreseeable projects in association with the proposed action would have a positive effect on transitory range availability and livestock distribution in the affected allotments. Previous harvest and thinning activities have generally had a positive impact on all range resources by reducing the overstory and allowing forage species to thrive. This project would treat forested stands by thinning and burning, which would also increase forage availability, improve livestock distribution, and long-term protection of range improvements. There are no expected negative cumulative effects.

Future road closures and decommissioning associated with the Phoenix Project and this project will reduce permittee access for allotment activities. Occasional travel permits on closed roads may be granted to permittees for range improvement maintenance.

Noxious Weeds

Past and ongoing actions have more than likely increased noxious weed populations within the project area. The Malheur National Forest has a weed management program consisting of annual surveys combined with mechanical and hand pulling treatments. Some weed control treatments are anticipated in the future in the project area and grazing allotment areas by the Prairie City Ranger District weed crew. The most common treatment is expected to be manual removal. Noxious weeds are not expected to increase in the short term due to the proposed project activities. Post-project surveys of the area annually for 3 to 5 years would provide for early detection and treatment if weeds do establish in the project area.

Irreversible and Irretrievable Commitments

There are no irreversible and irretrievable commitments of resources that may result from the proposed action or alternatives with respect to rangeland management.

Consistency with Direction and Regulations

All alternatives are consistent with Forest wide standards for rangeland resources and noxious weeds, including Forest plan modifications made by the Pacific Northwest Region Invasive Plant Program FEIS. Range permittees were contacted during the scoping period to solicit comments on activities.

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Rangeland Resources / Noxious Weeds Specialist Report located in the project record.

Recreation Resources and Visuals/Scenery

Affected Environment

Introduction

This landscape aesthetics section is an integrated look at the project area and its resources in order to define the desired landscape character, assess existing conditions, and determine what means would be necessary and appropriate to maintain, and/or move the conditions of the area toward the desired landscape character.

Many factors affect the character of the landscape. Landscape attributes such as landform, vegetative pattern and species makeup, water characteristics, and architectural elements, all contribute to the aesthetic character in this area. Desired landscape character, as used in this report, is the combination of attributes that contribute to a moderate sustainable experience. This report addresses social, physical and biological elements of the ecosystem we are operating within. The desires of the people who value this area determine what is desired and the conditions defined by the historical range of variability indicate what is sustainable, or desirable.

The terms scenic stability and scenic integrity are used as general ratings of the existing landscape character. Scenic stability refers to the ability of a landscape to sustain desirable characteristics over time, how healthy is the system. As one looks at scenic stability, it would not be unrealistic to be looking out 50 years or more in the future. Scenic integrity is a measure of the degree to which a landscape, an existing structure or management activity, or proposal deviates from the desired landscape character. It can be used to reference a proposed action, an existing situation, or a desired condition. It is much more dramatic, immediate, and understood, many times reflecting changes being introduced by timber harvest or road construction. The framework for both ratings is the public lands within the planning area, as seen from within the planning area or from afar, according to land management standards. Scenic integrity in this case is driven by viewpoints within or immediately adjacent to the planning area.

Regulatory Framework

Guidelines from the Malheur National Forest Land and Resource Management Plan 1990 are used to determine the condition of facilities and dispersed campsites.

The Forest Plan direction is to mange General Forest and Rangeland (MA-1 and 2) to construct, relocate, or protect designated system trails/trailheads and facilities during management activities. To maintain dispersed camping opportunities in a roaded setting and to manage these areas for partial retention and to provide for roaded recreation opportunities.

Recreation in MA-3A (Non-Anadromous Riparian) is managed as roaded modified but standards include limiting and distributing recreation use as necessary to protect and/or rehabilitate riparian areas.

The Landscape Aesthetics Handbook requires an analysis that considers more than effects that impact natural appearing landscapes. We are directed "to prescribe management which promotes sustainability" (Agriculture Handbook number 701, Landscape Aesthetic, A Handbook for Scenery Management, 1995, pg. 23.) We are directed to use an interdisciplinary process that

integrates the physical, biological and cultural/social information available to us relative to the ground we manage. It is not only the existing landscape against which we base comparisons, but what is ecologically sustainable and desirable.

Analysis Method

The National Forest System lands encompassed within the Knox Project have been inventoried using the Recreation Opportunity Spectrum (ROS) system to determine what recreation opportunities and settings are available to visitors. Currently the area meets Roaded Modified, Roaded Natural and Semiprimitive. Management direction for recreation as outlined in the Forest Plan is to continue to maintain existing ROS settings.

The project area falls within the Roaded Natural class of the Recreation Opportunity Spectrum. Roaded natural is characterized by predominately natural appearing environment with moderate evidence of sights and sounds of man. Resource modifications and utilization practices are evident by harmonize with the natural environment. Interaction between users may be moderate to high, with evidence of other users prevalent. Motorized use is allowed.

Areas within the roaded modified classification are characterized by substantially modified natural environments. Roads, landings, slash and debris may be strongly dominant from within, yet remain subordinated from distant roads and highways. There is moderate to heavy evidence of other use on the main road with low to moderate evidence of other use on arterial roads. Areas with the semiprimitive motorized classification offers a long season of use and diverse range of recreational opportunities. In most cases, recreation activities are commensurate with settings and experiences sought. Primary activities include big-game hunting for deer, elk and antelope. Secondary activities include bird hunting, camping, sightseeing, and firewood gathering. Other dispersed uses include snowmobiling and Off Highway Vehicle use.

Methodology for Recreation Analysis

Recreation is considered an essential resource and receives equal consideration with other resources when managing the land. The Malheur National Forest used ROS classes to develop management direction for recreation on the forest. Therefore, this analysis will use the ROS classes assigned during Forest Plan development as the basis of recreation assessment. Other tools that will be used or created for the recreation analysis are ROS direction contained in management area descriptions and a ROS map provided by the Forest.

To assist with the analysis, the following USDA handbooks will be used: National Forest Landscape Management, Volume 2, Chapter 8, Recreation (Agriculture Handbook No. 666) and the ROS Users Guide, United States Department of Agriculture Forest Service. In addition, National Forest Landscape Management, Volume 2, Chapter 5, Timber (Agriculture Handbook No. 559) and National Forest Landscape Management, Volume 2, Chapter 4, Roads (Agriculture Handbook No. 483) will be used in the analysis process.

The source of the recreation information is the Forest GIS data base that was compiled from gathered data to formulate recreation inventory information.

First, the treatment layer was determined. Second, the treatment layer was over laid with the MAs, ROSs and the recreation sites layer to determine the design features needed to meet the applicable ROS Class for each area. Last, the design features were written based on the treatment descriptions assigned to each VQO per MA following the ROSs guidelines. Listed

below are the ROS class guidelines that were applied to this project area. Roaded natural, roaded modified and semiprimitive motorized falls within the project area.

Methodology for Visuals/Scenery Analysis

This section addresses the effects to Visual Quality and Landscape Aesthetics of the Knox Project. Effects to Visual Quality are measured in terms of whether alternatives, or elements of a proposal, meet the visual quality level outlined in the Forest Plan. Existing scenic integrity represents the current status of the landscape. Effects to landscape aesthetics are measured in terms of benchmarks. It serves as a historical record of the degree, location, and extent of physical alteration of the landscape at given points in time. Scenic integrity measures the degree of deviation from the existing landscape character. It s a measure of the wholeness of the landscape, to what level has a proposal deviated from a natural appearing vegetative patterns and features, water, rock, and landforms. Direct human alterations may be included if they have become accepted over time as positive landscape character. Impacts that introduce low integrity elements to the landscape reduce the scenic integrity. In general, activities that deviate from the character valued for its aesthetic appeal. Activities that reduce the sustainability of natural forest ecosystems decrease scenic stability. Impacts that improve or support sustainability of the forest ecosystem increase forest stability by decreasing the visual contrast of the deviation being viewed. Scenic integrity is viewed from existing travelways, use areas, or observation positions.

Existing Condition - Recreation

Currently the area's predominate recreation uses are snowmobiling, hunting, and recreational driving and sight seeing. During the winter months the majority of the project area is primarily accessed by the snowmobile recreation users. Other winter recreation uses, such as Nordic skiing, snowshoeing, or sledding, are very limited within the project area.

Developed Sites

There are no developed campgrounds within the project area.

Snowmobile Trails

A snowmobile trail is shown in GIS that follows Forest Service Roads 14 and 1420 within the project area. Forest Road 14 is a groomed snowmobile route with approximately 5 miles of groomed route within the project area and 1420 is an ungroomed route with approximately 3 miles within the project area. Use of these road during the winter recreational season, is generally December 15th through April 15th (though timing varies with snow conditions).

Dispersed Sites

The analysis area receives low to moderate recreation use, which is spread throughout a 6 month period starting in late May and running through mid-November. Under the GIS layer there are ten dispersed campsites located within the project area. These areas offer recreationists a more primitive camping experience away from highly developed campgrounds. There may be dispersed campsites that are not recorded in GIS because there is little or no current use at these sites. Dispersed campsites offer the recreationist a more primitive camping experience. The dispersed campsites are rustic in nature with common features of meat poles, rock fire rings and benches. User constructed toilets can be found at some sites. Campsites are concentrated primarily in flat areas off main transportation systems where water can be accessed. Many are

near springs or creeks. There is a wide range in size and amount of disturbance for all the dispersed camps. Camp size ranges from very small to fairly large. Use of these sites varies throughout the year. Fall hunting season use is moderate to high with use distributed throughout archery, deer and elk seasons. Hunter use of the dispersed sited varies depending on number of hunting tags for a unit and the number of "new" hunters in the area. Dispersed recreation is managed as roaded modified.

Off Highway Vehicle Use (OHV)

A portion of the project area is designated as Big Game Winter Range. To protect big game, OHV use is prohibited on all roads between December 1 and April 1, except for designated routes that are compatible with management area emphasis.

Other Uses

Currently, the Knox Project Area plays an important role by providing settings for various types of outdoor recreation hunting, camping, driving in the woods, hiking, berry picking and winter activities. Due to ease of access from Forest Service Road (FSR) 14, this area is popular with recreationists. FSR 1450 and 1663 provides the main access for roaded admission into the project area. The major roads are gravel-surfaced, one-lane, and native surface routes initially developed to provide timer access, which now provides access for recreation type activities. Recreational hunting for shed deer and elk antlers, viewing scenery and enjoying the landscape is a part of all these activities.

The Knox Project Area lies within the Malheur Big Game Management Units. This area is popular during general big game bow season and controlled big game rifle hunts for deer and elk. Seasons are during late summer and fall. Use generally is spread throughout a six month period starting in late May and running through mid-November. Because of the remote location and limited access, overall visitor density is generally low. Road corridors, however, support substantially higher than average use especially during big-game hunting seasons.

The project area is in close proximity to two developed campgrounds where people do camp and disperse from there to do recreation activities.

Desired Future Condition - Recreation

The desired future condition of the project area under recreation would continue to be a variety of recreation settings in which activities and experiences can be enjoyed. Dispersed recreation opportunities will be emphasized. These areas will be sought after by recreationists in an attempt to deviate from the swift pace of urban living (LRMP, IV [4-8]). The project area will be managed for semiprimitive motorized, roaded modified and roaded natural. The area is characterized by a natural environment that has been substantially modified by developed roads and vegetative manipulation. Sights and sounds of humans are readily evident with moderate to high interactions between users.

Existing Condition – Visuals/Scenery

Scenic Integrity

Currently this area shows a moderate, obvious level of evidence of past logging but does meet or exceed visual quality objectives of maximum modification, the standard for the area. Throughout the project area many stands currently have a structure of old-forest multi-strata (OFMS),

which is within the Historic Range of Variation (HRV), but on the high side of the range. The HRV shows that historically much of the area was old-forest single-stratum (OFSS), which is very limited within the area. It is proposed to convert 14 stands of OFMS to OFSS. The conversion stands are within the hotter, drier biophysical environment. Harvesting through commercial thinning and partial cutting has occurred in zones visible as travel corridors. All are currently fully re-stocked or over stocked, meeting or exceeding current stocking level guidelines Past over story removals followed by pre-commercial thinning have left us a lot of stand structure for manipulation to meet various objectives. The scenic stability has suffered as a result of past developments. Due to high fuel loadings and high stocking levels, stability has begun to decline, as well as scenic integrity. Visual quality objectives of modification offer good opportunities to meet visual quality objectives and address forest health concerns, once the issues surrounding over stocked stands, high fuel loadings, and poor species composition have been dealt with. There is a fair amount of natural and induced variety.

Scenic Stability

Existing scenic stability is an indication of the sustainability of a landscape. A landscape with a low rating would likely be difficult to manage, or maintain over time, even with extensive vegetative management intervention. The existing scenic stability is determined by considering the current condition of key resources and the current trends that exist.

Currently, there are numerous trends in this planning area that indicate that the scenic stability is in poor condition, or would be rated low. The coniferous forest is generally overstocked, in both ponderosa pine types as well as mixed fir types, with excess ground fuels and ladder fuels. This condition will make it difficult to keep wildfire starts from expanding rapidly and burning intensely. These conditions will make it difficult to maintain insect levels at endemic levels. The suppression of fires has resulted in a change in species and structural stage composition. These developmental trends are critical to the scenic stability of this landscape because these trends and the condition of the forest affect so many other resources. These trends are difficult to maintain.

It is not realistic to expect to achieve the balance of stand types in the planning area that would be desirable in a short period of time. It may never be accomplished. However it is desirable to move in that direction. From a visual standpoint, it is desirable to work within ecological frameworks and meet established visual quality objectives, or work towards that end in the long term. It is desirable to work in conjunction with other resource areas and identify sustainable situations, as well as conditions that lead to a mutually beneficial treatment or even a maintenance of the existing situation.

Desired Future Condition – Visuals/Scenery

The Knox Project Area is outside the viewshed corridors and this area will have an altered appearance. A mosaic of cutting patterns of varying shapes, sizes, and arrangement will become more evident and the average tree size will be reduced. Fewer large-diameter old growth ponderosa pines will be found outside of viewshed corridors, old growth areas and semiprimitive areas.

Manage for maximum modification visual quality objective in the background. Stand species compositions would reflect those expected on the sites given historic fire regimes. Majority of the area is in the Warm Dry Biophysical Environment.

It is desirable to have a forest environment that is visually pleasing, healthy, sustainable, and that supports the uses of today's constituents. Recreationists enjoy the open park like character of the large ponderosa pine and larch stands that can be sustained by low intensity frequent burnings. Many enjoy the diversity and escapement cover for wildlife offered by dense, over stocked stands. The historic features of this area are enjoyed by many.

A sustainable environment that provides a mosaic of open, park-like stands with pockets of more densely spaced trees to provide cover for game animals, healthy riparian areas and infrastructure for dispersed camping and vehicular access is the desired landscape character.

Environmental Consequences

Direct and Indirect Effects - Recreation

Alternative 1 – No Action

The Knox Project lies within the Malheur Big Game Management Units. The area is popular during general big game bow seasons and controlled big game hunts. Seasons are in late summer and fall. It is anticipated that Oregon Department of Fish and Wildlife will continue to offer hunting opportunities in this area as part of their management of big game. General bow-hunting and controlled hunts will have similar seasons and numbers of tags. Bow-hunter numbers have increased in recent years and this trend may continue. Under the No Action Alternative no change is anticipated with tags.

Dispersed camping is associated with hunting and there will be no change in the availability of dispersed camping.

No impacts on recreationists and forest recreation settings from restoration activities, and there would be no timber hauling from National Forest Lands to conflict with recreational traffic. There would be no change in road miles available for public travel.

Impacts associated with no action are a continued high number of acres at risk from severe disturbances from fire, insect or disease, which may reduce the amount of area suitable for recreation activities, and recreation facilities could be negatively impacted. Hazard trees would still be removed on an annual basis along public roads. No road segments would be closed and there would be no additional non-motorized trail opportunities. There would be no impacts to these areas from timber harvest and post-harvest activities. Scenic quality would continue to decline due to the high stand densities.

There would not be any prescribed burning to create smoke that could drift over Forest Road 14 and dispersed camps.

Alternative 2 and 3

Effects to recreation are measured in terms of change in the recreation opportunity spectrum (ROS). There would be no effect on the ROS class for this area. There will be little change from the existing condition.

Tree harvest and fuel reduction activities may displace recreationists to new areas to camp, hunt, or to travel due to decreased aesthetic appeal of the Forest. Harvest and fuel reduction activities may result in displacement of some forest visitors over a broader area on the landscape. Noise

may be heard from harvest actions resulting in some impacts on recreationists during this type of activity and may affect the experiences of some people in the short-term, particularly those who cannot tolerate changes to their traditional recreation setting, therefore would result in some level of changes to the recreation setting. Displacement may be due to physically closing access to areas during vegetation management activities and, indirectly by altering the setting. Harvest and post-harvest activities would have the longest duration effect on use by recreationists, while prescribed burning would only physically prevent recreationists from visiting areas during implementation of the activity. The recreational experience may also be changed in the short term by the smoke caused by the fuel treatment. The possible effects include the apparent smoke affecting someone who has trouble breathing and their vision may be obscured for a short period of time. In addition, hauling timber along forest roads may also affect visitors by increasing the perceived hazard of traveling along narrow forest roads with log trucks. Tree harvest and fuel reduction activities that occur during seasons other than summer and fall would impact fewer recreationists.

Removal of hazard trees along haul routes and recreation sites would have a positive effect on both the actual and perceived safety of recreation sites and travel routes.

Haul routes will be heavily used by logging traffic, creating a higher level of safety concern for the recreating public using roads. Closure of some roads within the project area to public use during logging and hauling activities would improve public safety, but would have a short-term negative effect on recreational access to the area. Changes in road access can change the ability of visitors to access recreation sites. Closing roads (either temporary or long-term) to vehicle use restricts vehicle access, but can result in additional non-motorized trail opportunities (walking, biking and horseback riding) and motorized off road vehicle travel cross country.

An indirect effect from opening dense stands in this project area is the increased ability for people to drive vehicles through the open forest, so there may be an increased risk of off road vehicle use if the forest is easier to drive through.

The recreational experiences available may be changed in the short term by logging activities. The possible effects include increased sights and sounds of equipment and people within the planning area during harvest activities for a short period of time. The recreational experiences may also be changed in the short term by the smoke caused by pile burning at the landings. The possible effects include smoke affecting someone who has trouble breathing and their visibility may be obscured for a short period of time.

Large-scale disturbances from wildfire, insect or disease, can result in broad changes in recreation settings, particularly by altering the aesthetic quality of settings, the quality of riparian habitat that supports fishing, and by reducing the thermal cover from high summer temperatures and exposure (Evers 2000, Omi 1997). Recreationists would also not be able to visit forest areas during wildfire suppression activities. The reduced fire risk would allow more use of the forest in the future.

Since the negative impacts on scenic quality are expected to be short-term (see the Visual Resources section) and are expected to enhance the scenic quality over the long term, it is not expected that recreationists would be displace due to a change in the forest setting. In fact, since driving for pleasure and sightseeing is an important activity in the project area, it is expected that the proposed action would improve the quality of this activity.

This action would maintain most of the existing road miles and resulting in virtually no change in the opportunity for the public to drive on forest roads within the project area.

Proposed activity may affect the quality of hunting and fishing in the project area. Changes to the riparian areas are not expected to be very noticeable to recreationists, so setting for fishing may not change in the short-term. Big game hunting is another popular recreation activity in the area, with displacement of deer and elk in the short term a possibility.

Snowmobile activity in this area is a mix of travel on un-groomed designated trails and on other area roads. Winter log /biomass haul could cause displacement of snowmobiles to other areas nearby. Proposed road closures or decommissioning will not affect existing designated snow-mobile trails in the Knox Project Area.

Cumulative Effects

Past, present and reasonably foreseeable future activities including road closures in the analysis area have or may potentially affect recreationists (refer to Appendix C). Proposed road closures will reduce areas that the visiting public will be able to drive, disperse camp and view scenery. Other foreseeable future activities include post harvest activities associated with the project. Once stands are treated to reduce the current fuel loads they will be in suitable condition to begin reintroducing fire into blocks of land within the project area.

In areas where vegetation is treated within or immediately adjacent to a dispersed site, trailheads, or facilities recreationists may not use that site again for many years. If recreationists feel that treatment may disperse animals out of traditional hunting areas, they may decide to hunt elsewhere. Other recreationists could feel that hunting success may increase after treatment of the area. Hunting experience may be changed. As ground cover grows, it will provide more forage for big game animals. Hunting may be less desirable until new understory vegetation is established. Although future recreation use within the project area is difficult to determine, visitation has increased rapidly in the past few years. As the project area changes over time, so may the make-up of visitors and the activities they pursue. Recreationists will have to either adapt to the new situations or seek another area in which to recreate.

Direct and Indirect Effects – Visuals/Scenery

Alternative 1 – No Action

Scenic Stability

The perpetuation of existing trends would negatively impact scenic stability. Many of the stands are currently overstocked and fuel loadings are high. As long as these conditions exist, the potential for epidemics of insects or disease, or large stand replacement fire is high and continues to increase because the forest landscape has lost its characteristics of sustainability. Tree form and development is being driven by less than natural conditions. In the event of an uncharacteristic fire, fueled by a build up of dead material and over stocked stands, many of the desirable elements of landscape character would be lost for an extended period of time. If nothing is done to deal with forest characteristics associated with over stocking and high fuel loading, large, intense wildfires will occur more frequently, insect levels would continue to build and continue the cycle of rising fuel loadings.

The Malheur National Forest has experienced large replacement type fires in the last decade. Summit Fire burned about 38,000 acres and Flagtail Fire burned about 7,000 acres. Shake Table burned about 14,000 acres. Conditions in these areas burned acres that were in similar condition to those found in this area.

Scenic Integrity

The effects of no action to the Visual Quality of the area are minimal. The visual quality objectives would be maintained. The existing landscape character would not be directly altered.

The condition of overstocked stands reduces the visual interest by reducing sight distances, restricting light from reaching the forest floor, prompting trees to grow shorter crowns and reducing the variety of color, line and form. These are direct effects to scenic variety. The desired landscape character of open park-like stands of pine and larch is being diminished. The No Action Alternative will perpetuate this trend. Many of the natural elements of the landscape system are currently being reduced, and show little promise of retuning naturally. The indirect effect to scenic integrity would be greater due to the existing trends that would not be addressed. The scenic integrity would be low to very low in 25+ years. An opportunity to introduce visual variety to a somewhat mundane landscape and improve landscape viewing quality would be foregone by not pursuing treatment of stands at this time.

Alternatives 2 and 3

The visual management goal for Management Areas 1 (General Forest) and 4A (Big Game Winter Range) is to manage for maximum modification, which is heavily altered appearance. Effects of prescribed burning on scenic quality in the forest are usually limited. Fire scars and burned ground usually are less noticeable in a few years after the fire. If thinning takes place prior to burning, stumps are usually only apparent for a short time following burning, and slash is not at all apparent. The loss of some individual trees and some scattered clumps is to be expected and should not diminish scenic quality.

This area has been logged in the past. Much of it is over stocked, and the trees and stands are showing signs of overstocking. There is a significant amount of visual variety offered by natural, shallow soiled openings. There are pockets of mixed conifer where the canopy takes on a deeper, denser appearance. Large ponderosa pine and Douglas-fir stumps are present throughout. The prescribed treatments will move the existing stands to being composed of large overstory ponderosa pine and Douglas-fir mixed with a healthy mix of intermediate sized trees, with scattered pockets of regeneration becoming established. Over stocked pockets of mixed conifer and ponderosa pine will be maintained throughout for escapement cover. There are low levels of large trees. The large trees will be more visible over time, intermediate trees will be maintained to replace these large trees, and the area can be under burned to maintain this appearance. The scenic integrity and stability of the area would be improved as the health and vigor returns to the trees as a result of lower level stocking.

Commercial Thinning and Understory Removal

Scenic Integrity

Commercial thinning creates minimal negative impacts to scenic integrity. This practice could improve the landscape character by opening up the foreground views and allowing more light to the forest floor, which would create a more pleasing visual appearance. Tree form would

improve. The effects would include improved health by reducing competition for those fire resilient tree species that are left, a shifting in size classes as openings are invaded by pioneer species, and improved growth rates in trees left on the site.

Commercial thinning at variable densities can successfully introduce variation and desirable change into even the most closely scrutinized foreground views. Changes in form, structure and color can result from commercial thinning.

Scenic Sustainability

Commercial thinning would reduce stand densities, and produce more favorable conditions for the ponderosa pine and western larch species. Shade tolerant species would be discriminated against in the presence of more sunlight reaching the forest floor. Effects would include lowered risk of stand replacement fire that is impacted by the presence of mid canopy layers, and/or epidemics of insects and disease. Individual tree form would improve over time as crowns expand and produce higher crown ratios.

Harvesting Procedures

Associated with silvicultural treatments are the elements of logging practices that can negatively impact the scenic integrity of the area. The evidence of past logging is evident in this area, there are several regeneration harvest units that have been implemented in the last ten years, and pre-commercial and commercial thinning have been used throughout. Harvesting in the foreground and middle ground views has been done with mixed success. Some did not meet visual quality objectives. Much, however, has healed over time, and increased growth rates and natural regeneration in shade tolerant species has improved scenery conditions. During harvest operations, logging activities will disrupt the visual experience. Slash will create unsightly views until it has been treated. Stumps will appear unnatural until weathering takes place. These impacts will diminish over a relative short period of time, and some, such as those imposed.

Tractor Skidding

Tractor skidding will directly impact foreground views. These effects consist of soil, duff and vegetation ground cover disturbance. The impact is not wide spread but will be evident for 1 to 5 years after harvest. Tractor skidding will be evident in some foreground views for 1 to 5 years.

Prescribed Fire and Associated Activities

Prescribed fire often creates a natural mosaic pattern of tree scorch and crown fires. However, there are events that create pockets of torched trees that can impact foreground views if they occur along roads or trails. Hand line and machine line placed to control prescribed fire are very necessary but create a line of disturbed soil and vegetation that detracts from the natural setting. Hand lines will be evident for 1 to 5 years.

Fuel treatments are expected to consist of hand piling and burning, which will be evident for a short period.

Visual Quality Objectives

The current visual quality objectives would be met by proposed harvesting, thinning and burning. Proposing treatments in response to insect and disease conditions as well as in response to unnatural fuel conditions in a high risk area. This will result in a landscape with healthier

more natural appearing boles, and more diversity of age classes and habitat type, and a higher level of scenic (landscape) stability.

Roads

Roads in the project area gracefully winds throughout. The road alignment borrows from the landforms. Soil color contrasts are minimal. Road cutbanks blend well. The strong patterns of the natural landscape character help to reduce the dominance of the roads. People view the issue of roads in very different ways. Many people enjoy and appreciate the access to the area provided by roads. Others desire a roadless experience. From a visual perspective, roads are created lines that are not natural appearing, often with cut and fill slopes that detract from the natural view. These effects will not be that evident.

Roads can have a major impact on visual quality. The proposed action calls for approximately 1 mile of new temporary road. Propose to close or decommission 38 miles of roads. In the long-term the landscape will have a more natural appearance with the decommissioned roads.

Cumulative Effects – Visuals/Scenery

No visual cumulative effects of past, ongoing, or foreseeable activities are anticipated with implementation of proposed activities.

Irreversible and Irretrievable Commitments

There are no irreversible and irretrievable commitments associated with the consequences of any of the alternatives analyzed to the recreation resource. The project as described will not result in any irreversible or irretrievable effects to the scenery resource.

Consistency with Direction and Regulations

This proposed project is consistent with Forest Plan direction and regulations for recreation and scenery. The proposed project will meet Forest Plan Standards for the Recreation (ROS) of roaded natural and roaded modified. Proposed activities are consistent with Forest Plan direction to manage General Forest and Rangeland (MA-1 and 2) to maintain dispersed camping opportunities in a roaded setting and manage these areas for partial retention as roaded natural, and to provide roaded recreation opportunities.

Recreation in MA-3A (Non-Anadromous Riparian) is managed as roaded natural but standards include limiting and distributing recreation use as necessary to protect and/or rehabilitate riparian areas.

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Recreation Resources / Visual - Scenery Specialist Report located in the project record.

Botany Resources

Affected Environment

Introduction

This section analyzes effects or impacts from the proposed action and alternatives to plants listed threatened or endangered species, or proposed for listing, and Forest Service sensitive plant species. The objectives of the section are to:

1) ensure that Forest Service actions do not contribute to the loss of viability of any native or desired non-native plant animal species or contribute to trends toward Federal listing of any species;
2) comply with the requirements of the Endangered Species Act (ESA) that actions of Federal agencies not jeopardize or adversely modify critical habitat of Federally listed species; and
3) provide a process and standard by which to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decision making process.

Regulatory Framework

This section evaluates plants from the Pacific Northwest Region Regional Forester's Sensitive Species list known or suspected to occur on the Malheur National Forest.

On January 31, 2008, Regional Forester Linda Goodman released an updated Sensitive Species List which includes federally listed, federally proposed and sensitive species lists. In her letter to implement the updated species list, the Regional Forest stated that projects initiated prior to January 21, 2008 may use the updated sensitive species list or the list that was in effect when the project was initiated. The Responsible Official for the project has authority to decide which list to use. "Initiated" means that a signed and dated document such as a project initiation letter, scoping letter, or Federal Register Notice for the project exists. The Knox Project meets the criteria for "initiated" prior to January 31, 2008 because the Project Initiation Letter was signed February 14, 2007. This Biological Evaluation uses the list issued by the Regional Forester on July 21, 2004.

Complete lists of Forest Service sensitive species in Oregon and Washington National Forests can be viewed at this website: http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/. Federally listed endangered or threatened plants or plants proposed for federal listing under the ESA are not known or suspected to occur on the Malheur National Forest.

Analysis Method

The Forest Geographic Information System (GIS) was examined to locate sensitive plants previously documented in or near the project planning area. Within the northern portion of the project area, one species, *Lomatium ravenii* (Raven's *Desert Parsley*), is located on five sites (see project records, Botany Report, Maps 1 and 2). Three *L. ravenii* sites (nos. 040049, 040050, 040056) are situated adjacent commercial thin - fuels underburn units. One small aspen treatment unit sits within the mapped perimeter *L. ravenii* site no. 040056. However, it should be noted that *L. ravenii* is highly unlikely to grow within the aspen stand because aspen does not

provide the habitat that is needed by *L. ravenii*. In the Blue Mountains aspen grows in deep, moist soils with nearly 100% cover of herbaceous and shrubby vegetation (Crowe and Clausnitzer 1997, Hall 1973). *Lomatium ravenii* is found exclusively on very shallow soils with scant plant cover, often less than 10%. In other words, the small aspen grove is an inclusion of a different habitat type within a larger area inhabited by *L. ravenii*.

In addition to the documented sensitive plant populations, the project area may provide suitable habitat for the sensitive plants listed below in Table B-1.

Table B-1. Species with Suitable Habitat in the Project Planning Area.

SENSITIVE SPECIES	Documented or Suspected	Habitat Type	Ecoclass*
Achnatherum hendersonii *Achnatherum wallowaensis*	S	Lithosolic substrate, scablands	GB4911 GB9111 SD9111 SD9221
Botrychium crenulatum	S	Riparian, fens	CW, CE series
Carex interior	S	Fens, wet meadows,	MW
Carex parryana ssp. idahoa	S	Dry-Moist Meadows	MD, MW
Lomatium ravenii	**D**	Lithosolic substrate, scablands	GB4911 GB9111 SD9111 SD9221

*Ecoclass codes per Johnson and Clausnitzer (1992), Hall (1973), Crowe and Clausnitzer (1997).

Much of project area was inventoried for sensitive plants during the 1990s. All the *Lomatium ravenii* sites were mapped during that time. The other plants listed above suspected to occur in the planning area were not detected.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action

With Alternative 1, no actions would occur with the Knox Project. There would be no indirect effects from not conducting prescribed burns or harvest because activity units are not located within known populations of sensitive plants. Natural changes in the state of these communities would not affect adjacent vegetation.

The project would therefore have no impact to any sensitive plant species.

Alternatives 2 & 3

Achnatherum hendersonii (Henderson ricegrass)
Achnatherum wallowensis (Wallowa ricegrass)

These two closely related grasses grow in the same habitat. Both are rare in the Blue Mountains and have not been found on the Malheur National Forest, but both species are located west of the project area on the neighboring Ochoco National Forest. These two plants grow on lithosol substrates, shallow-soiled areas of fewer than 10" soil depth that support only a very light cover of vegetation. Plant communities supporting *Achnatherum hendersonii* and *A. wallowensis* are found in the *Artemisia rigida*/*Poa sandbergii*, *Artemisia arbuscula*/*Poa sandbergii*, and *Poa sandbergii –Danthonia unispicata* plant associations (Johnson and Clausnitzer 1992). This habitat is nearly identical to the habitat that supports *Lomatium ravenii*.

Direct and Indirect Effects

Habitats known to harbor *Achnatherum hendersonii* and *A. wallowensis* were inventoried during the 1990s and these species were not located. These plants are therefore assumed not present in the project area.

Determination

The Knox Project will result in no impact to *Achnatherum hendersonii* or *A. wallowensis*.

Botrychium crenulatum

Botrychium crenulatum is known from small populations scattered across several western states and Canadian provinces (Farrar 2005). *Botrychium crenulatum* grows in saturated soils of fens, seeps, springs and similar habitats along streams, often among dense vegetation in shaded sites at mid to high elevations. In the Blue Mountains, *Botrychium crenulatum* sites are usually within forests comprised of Engelmann spruce, lodgepole pine or grand fir.

Direct and Indirect Effects

Botrychium crenulatum requires soil moisture throughout growing season. In the Blue Mountains, this need is met near streams, springs, seeps or areas with a relatively high water table (moist – wet meadows). These riparian habitats have been excluded from harvest actions through buffers for Riparian Habitat Conservation Areas. Under the conditions of prescription, if a prescribed fire were to back into these areas, fuels would not likely burn because of the moisture present. Furthermore, prescribed fires would be conducted during the early spring or autumn, a time when *Botrychium crenulatum* is dormant and underground. Therefore, the Knox Project would not affect this plant.

Determination

The Knox Project will result in no impact to *Botrychium crenulatum.*

Carex interior (Inland Sedge)

Carex interior is restricted to very saturated soils in wet meadows, fens, springs, and along stream banks at moderate to higher elevations (Hurd 1998). In the project area, these habitats are confined to Riparian Habitat Conservation Areas, which have been excluded from project design.

Direct and Indirect Effects

Carex interior habitat has been excluded from harvest activities in the Knox Project. If a prescribed fire were to back into these areas, under the conditions of prescription, fuels would not likely burn because of the moisture present. Furthermore, prescribed fires would be conducted during the early spring or autumn, a time when *Carex interior* is dormant and underground in the form a rhizome.

Determination

The Knox Project will result in no impact to *Carex interior.*

Lomatium ravenii (Raven Lomatium)

Lomatium ravenii grows on very arid, shallow-soiled plant communities supporting scant vegetation. These communities are usually within the *Artemisia rigida*/*Poa sandbergii* plant

association, but the species is also found in association with *Artemisia arbuscula*. In the Blue Mountains this plant is found on a basalt or basalt-andesite substrate. Although its habitat is strikingly similar to *Achnatherum wallowensis*, the two species have not been reported in association. Lomatium ravenii is a very early blooming plant, emerging from the soil in April and flowering and fruiting in May. By early June, the plant has dispersed its seed, senesced, and has gone dormant until the following year.

Lomatium ravenii habitat does not support the growth of trees, so there is not usually a conflict with timber harvest activities. Where *Lomatium ravenii* sites are adjacent harvest or thinning units, there is a possibility of impacts from machinery being driven on or fuels being piled and burned atop plants.

Direct and Indirect Effects

Habitats known to harbor *Lomatium ravenii* have been identified and avoided through project design for Alternatives 2 and 3. Harvest units have eliminated these areas from entry. The following measures have been incorporated as mitigation for the Knox Project:

- Avoid harvest operations in sensitive plant locations,
- Vehicles and heavy machinery shall avoid sensitive plant locations, and
- Slash and fuels shall not be piled and burned on or immediately adjacent to sensitive plant locations.

These measures will ensure that the habitats used by these plant species should not be impacted by project activities. There exists a possibility that a very small percentage of *Lomatium ravenii* habitat and plants may be impacted by stray vehicles and machinery. However, this is expected be much less than 1% of the habitat and plants because of the relatively small perimeter of harvest units that sit adjacent much larger areas of *Lomatium ravenii* habitat (see project record, Botany Report). Prescribed fire would not impact *Lomatium ravenii* because the habitat for this plant is too low in fuels to support a fire.

Cumulative Effects

When considering the cumulative effects of past, present or reasonably foreseeable future actions (refer to Appendix C) that have or will occur in the project area, only livestock grazing poses a possible effect to *Lomatium ravenii*. The plant is generally ground hugging, except for the short fruiting scape, and so grazing impacts are not likely[4]. Trampling by livestock, especially during May, could damage plants, especially root crowns if the soil is still wet. Because livestock turnout usually does not commence until late May – early June, *Lomatium ravenii*, will have completed nearly all its life cycle and avoided any trampling impacts. Because of the very light cover in vegetation in Lomatium ravenii habitat, there is little forage for livestock; these scabland habitats are not capable of supporting much grazing, and there is little incentive for livestock to wander through sites. Livestock have not been observed to linger in *Lomatium ravenii* habitats. Any movement of livestock through these sites is usually to get from one desirable spot to another. Therefore, any impacts to *Lomatium ravenii* from livestock grazing are expected to be immeasurable and insignificant.

[4] The author, in ten years past employment as a botanist for the Malheur National Forest, has never observed *Lomatium ravenii* to be grazed by livestock.

Determination

The Knox Project may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species *Lomatium ravenii.*

Table B-2. Summary Determination of Effects.

SENSITIVE SPECIES	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Achnatherum hendersonii	NI	NI	NI
Achnatherum wallowaensis	NI	NI	NI
Botrychium crenulatum	NI	NI	NI
Carex interior	NI	NI	NI
Carex parryana ssp. idahoa	NI	NI	NI
Lomatium ravenii	NI	MIIH	MIIH

Irreversible and Irretrievable Commitments

This analysis has shown that the Knox Project may impact individuals of some sensitive plant species, but would not result in the loss of population or species viability nor cause a trend toward federal listing under the Endangered Species Act. For these reasons, the Knox Project alternatives should not result in an irretrievable and irreversible commitment of this resource.

Consistency with Direction and Regulations

Table B-3 below displays the relevant Forest Plan direction guiding management of sensitive plant resources. The Knox Project is consistent with the Forest Plan standards and Forest Service Manual direction for threatened, endangered and sensitive species. Forest Plan Direction for Unique and Sensitive Habitats requires buffers of "approximately 100 feet." Much of the suitable habitat for sensitive plants falls into the habitat types described below for Unique and Sensitive Habitats (Forest Plan Standard #56). Project design elements did not include an "approximate 100-foot" buffer for sensitive plant suitable habitat. However, project design elements did "utilize additional mitigation/enhancement measures," e.g., avoid harvest activities in *Lomatium ravenii* sites, to avoid and indirect direct impacts to the sensitive plant resources. These measures were incorporated into project design, as specified in Forest Plan Standard #65.

Table B-3. Forest Plan Direction (Forest-Wide Standards).

Unique and Sensitive Habitats

#56. Maintain the integrity of unique habitats including meadows, rimrock, talus slopes, cliffs, animal dens, wallows, bogs, seeps and springs by incorporating cover buffers of approximately 100 feet in width. Utilize additional mitigation/enhancement measures identified through project analysis.

Threatened, Endangered and Sensitive Species

#65. Specify all protection or mitigation requirements (36 CFR 219.27(a) (8)) before project implementation begins.

#66. Perform a biological (field) evaluation for use in planning of proposed projects when sensitive species are present or suspected. Conduct surveys in cooperation with other agencies and groups to document the locations of sensitive species populations and to provide more specific information on habitat requirements and relative management guidelines.

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Botany Biological Evaluation and Specialist Report located in the project record.

Heritage Resources

Affected Environment

Introduction

Cultural resources are fragile and irreplaceable resources that chronicle the history of people utilizing the forested environment. Cultural resources, or Heritage resources, include:

- Historic properties, places which are eligible for inclusion to the National Register of Historic Places (NRHP) by virtue of their historic, archaeological, architectural, engineering, or cultural significance. Buildings, structures, sites, and non-portable objects (e.g., signs, heavy equipment) may be considered historic properties. Traditional Cultural Properties (TCP's), localities that are considered significant in light of the role it plays in a community's historically rooted beliefs, customs, and practices (Parker and King, 1998), are also considered historic properties. Historic properties are subject to the National Historic Preservation Act's Section 106 review process.
- American Indian sacred sites located on federal lands. These may or may not be historic properties.
- Cultural uses of the natural environment (e.g., subsistence use of plants or animals), which must be considered under the National Environmental Policy Act (NEPA).

Regulatory Framework

The legal framework that mandates the Forest to consider the effects of its actions on cultural resources is wide-ranging. In this case, Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992) is the foremost legislation that governs the treatment of cultural resources during project planning and implementation. Implementing regulations that clarify and expand upon the NHPA include 36 CFR 800 (Protection of Historic Properties), 36 CFR 63 (Determination of Eligibility to the National Register of Historic Places), and 36 CFR 296 (Protection of Archaeological Resources). The Pacific Northwest Region (R6) of the Forest Service, the Advisory Council on Historic Preservation (ACHP), and the Oregon State Historic Preservation Office (SHPO), signed a programmatic agreement (PA) regarding the management of cultural resources on National Forest system lands in 2004. The 2004 PA outlines specific procedures for the identification, evaluation, and protection of cultural resources during activities or projects sponsored by the Forest Service. It also establishes the process that the SHPO utilizes to review Forest Service undertakings for NHPA compliance.

The National Environmental Policy Act of 1969 (as amended) is also a cultural resource management directive as it calls for agencies to analyze the effects of their actions on sociocultural elements of the environment. Laws such as the National Forest Management Act (NFMA) of 1976, the Archaeological Resources Protection Act (ARPA) of 1979, the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, and Executive Order 13007 (Indian Sacred Sites) also guide Forest Service decision-making as it relates to Heritage. The American Indian Religious Freedom Act (AIRFA) of 1978 requires that federal agencies consider the impacts of their projects on the free exercise of traditional Indian religions.

The Malheur National Forest Land and Resource Management Plan (1990), as amended, tiers to the previously mentioned laws and corresponding Forest Service manual direction as it sets forth resource management goals, objectives, and standards. Forest-wide management standards that are pertinent for this cultural resource effects analysis include:

- Conduct a professionally supervised cultural resource survey on National Forest lands to identify cultural resource properties. Use sound survey strategies and the Malheur National Forest Cultural Resource Inventory Survey Design (Thomas 1991).
- Evaluate the significance of sites by applying the criteria for eligibility to the National Register of Historic Places.
- Consider the effects of all Forest Service undertakings on cultural resources. Coordinate the formulation and evaluation of alternatives with the State cultural resource plan, the State Historic Preservation Office and State Archaeologist, other State and Federal agencies, and with traditional and religious leaders of Native American Indian groups and tribes with historic ties to the project planning area.

Consultation with Others

Many of the previously described laws, regulations, and directives instruct the Forest Service to consult with American Indian tribes, the state, and other interested parties on cultural resource management issues. This consultation has been conducted through the NEPA process and under the terms of existing agreements with American Indian Tribes. To date, there have been no concerns raised during scoping regarding the effects of thinning fuels activities on cultural resources. Documentation of compliance with the NHPA is currently being prepared for referral to the Oregon SHPO in accordance with the 2004 PA, and consultation with that agency will be completed prior to the publication of the Knox Project Final Environmental Analysis.

Tribal consultation on a government-to-government basis is ongoing with the Burns Paiute Tribe, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of Warm Springs Reservation. At this point in the consultation process no concerns regarding the effects of the Knox Project proposal on cultural resources have been identified.

Analysis Method

The Knox Project Area includes all National Forest System lands administered by the Prairie City Ranger District that are within the designated boundary established for this project. The cultural resources effects analysis, including cumulative effects, will focus on cultural properties identified within the Knox Project Area. The proposed action does not have potential to have indirect effects (i.e., visual, auditory, atmospheric) on cultural resources that are distant from the project activities.

Existing Condition

Cultural resource identification efforts in the vicinity of the Knox Project Area have focused on three primary types of resources: prehistoric archaeological sites, historic archaeological sites, and places that support resources of contemporary tribal interest.

Although there have been ten cultural resource inventories previously conducted within the Knox Project Area, only two (Cottonwood Creek Rehabilitation Project MNF646-90/092 and Lion Analysis Area MNF646-93/123) are considered adequate and meet current inventory standards

as outlined in the Malheur National Forest Cultural Resource Inventory Plan (Thomas 1991). In 2007 two areas of about 700 total acres not previously inventoried during the Cottonwood Creek Rehabilitation or Lion Analysis Projects were surveyed using current inventory standards (Thomas 1991). Other previous cultural resource inventories that were conducted in the planning area are associated with 1980 timber sales. These projects were either never submitted to the State Historic Preservation Office (SHPO), submitted but did not receive SHPO concurrence, or the survey strategies do not meet current inventory standards.

These surveys have thus far resulted in the discovery of 52 heritage sites within the project area boundary. Of these, there are 40 prehistoric sites, five historic sites, and eight sites that have both prehistoric and historic components. Forty-four of these sites are considered eligible for inclusion on the National Register of Historic Places (NRHP), three are ineligible, and the eligibility of five sites is undetermined.

The Knox Project Area boundaries consist almost entirely of natural ridges separating Cottonwood Creek drainage from that of Crane Creek to the west and north, the North Fork Malheur River to the east and south, Bluebucket Creek to the south, and the Malheur River to the west. Aspects are generally north-facing and elevations range from about 5,200 feet along Cottonwood Creek in the north to 6,456 feet at Antelope Lookout at the southern boundary. There are numerous flat, prairie-type areas with dry-wet meadows throughout the project area surrounded by broad upland rolling hills.

The perennial streams in the project area such as Elder and Cottonwood Creek are generally northward flowing. Streams currently classed as intermittent, Cougar and Cat Creeks, and several unnamed creeks flowing from at least 12 springs which dot the area, may have also been perennial before the advent of historic grazing and the resultant drop in the water table. Some of the springs listed for this area are Cottonwood, Anderson, Fir Tree, Alder, Whitney, Cabin, and Camp along with numerous unnamed springs.

A wide range of resources were utilized including seeds, roots, berries, fish and game. Plant resources commonly used by Native Americans are distributed throughout the project area and have been observed to be associated with the prehistoric sites recorded. These culturally important plant species include lomatium, camas, wild onion, biscuitroot, balsamroot, and bitterroot.

The Southern Blue Mountains were home to people representing the adaptive traditions of both the northern Great Basin and the southern Columbia Plateau (Burtchard 1998). Known prehistoric sites in the project area consist primarily of waste flakes associated with the manufacture of stone tools, and tool fragments. Obsidian and basalt materials dominate the lithic assemblages, although quartz, andesite, argillite, ignimbrite, and other cryptocrystalline silicate (CCS) materials have also been noted, but in smaller quantities. There are several basalt outcrops in the southern half of the project area. Of the 40 prehistoric archaeological sites noted within the project area, 18 of them are over 10 acres in size. Many of these lithic scatter sites display potential for buried archaeological deposits and support the ethnographic data that this area just southeast of Crane Prairie was utilized by American Indian groups.

The ground stone tools observed at several of the sites are rare artifact types for the Malheur National Forest and suggest processing of seeds and root plants. The functions of these lithic scatter sites have been further identified as possible basalt procurement areas, stone tool manufacturing and reduction camps, and hunting and gathering base camps. Although the size of

many of these lithic scatter sites is quite large, the sites are still likely associated with seasonal use of the area for hunting and gathering. Dates associated with age diagnostic projectile points indicate at least moderate to heavy use of the area throughout much of the Holocene Epoch.

Historically, following the decline of the eastern Oregon gold rush in the late 19th century, the principal land use in the southern Blue Mountains was livestock grazing. Sheep allotments were the first to be established in the project area in the late 1800s. Bands of sheep grazed the Spring Creek and Flag Prairie allotments during the summer and early fall months. Center Stock Driveway signs along a two mile stretch of what used to be Ott #3 Driveway for sheep and cattle are located on trees along the west boundary of the project area.

Other historic uses of the Knox Project Area involved the administration of National Forest System lands, fire suppression, and wagon roads. Phone lines were constructed by the Forest Service for direct communication to all field officers as a means of fire control. The USFS telephone communication lines network was the first line built on the forest from 1909 to the 1940s and went from Seneca to the Flagtail Ranger Station. The portion that goes through the project area was built in 1915 and went from Crane Prairie Ranger Station (now known as Crane Prairie Guard Station) to the Ott Ranger Station to the south. The line was used until the mid-1930s when the Forest Service suspended use of the ranger station. This telephone system was a critical part of the Forest fire suppression system until 1949 when a decision was made to use radios.

The historic Ott Ranger Station was located in the southern portion of the project area and was used from 1907 to the mid-1930s. After its abandonment by the Forest Service it became the Ott Cow Camp. Activities at the early ranger station and cow camp may account for some of the historic remains observed and recorded in the area.

About one mile of the historic Creighton Road, which was originally used to transport hay from the Grande Ronde Valley to Fort Harney in the 1860s and 1870s, is located on the east boundary of the project area where it is confined to Forest Service Road 1420. Although the historic road is confined to Forest Service Roads and these native surface roads are currently used, they are still classified as primitive roads and have had very little maintenance.

Environmental Consequences

Direct Effects

Common to all Alternatives

All alternatives are expected to have no, or extremely minor, direct effects on all known heritage sites within the project area. In most cases sites will be avoided throughout the lifetime of any of the proposed actions.

Alternative 1 – No Action

Alternative 1, the No Action Alternative, would cause no direct effects to known or unknown cultural resources.

Alternatives 2 and 3

Alternatives 2 and 3 could possibly cause direct effects on undiscovered heritage resources. This possibility is addressed in the project design elements that state that if cultural resources are located during project implementation, work will be halted and the Zone Archaeologist will be notified. The cultural resource will be evaluated, and a mitigation plan developed in consultation with the Oregon State Historic Preservation Office, if necessary. In most cases these effects, should they occur, would be minor and unlikely to cause a significant impact.

Some habitat for plants that are traditionally important to the regional tribes of American Indians may be enhanced by the vegetation treatments of this alternative. Riparian dependent species such as quaking aspen will realize some long-term benefits as fuel loading is reduced and there is a natural reestablishment of native vegetation. Cultural plant stands in upland areas may realize a limited positive effect under the alternative as fuel loading is addressed across the landscape.

Indirect Effects

Common to all Alternatives

The primary indirect effect of all alternatives on heritage resources would be the potential for increased erosion of the site matrix for those sites with intact buried components. Most of the prehistoric sites are associated with the streams and springs. These sites have tools and debitage located in depositional environments and/or the artifacts have been exposed in game trails, road beds, stream cutbanks, and rodent burrow back dirt indicating the presence of significant subsurface components at these sites. There also has been subsurface testing at several of the sites which proved positive for subsurface cultural material.

Since all known sites will be avoided/protected and extensive soil protection project design features are in place, no or minimal indirect effect on known and unknown heritage resources are expected under all alternatives.

Also, indirectly, reducing the accumulations of fuels through commercial thinning will reduce the severity of potential wildfires and will enhance the long term stability of archaeological and historic resources within lands adjacent to the Knox Project.

Cumulative Effects

Past, ongoing and foreseeable actions that have effected and may continue to effect heritage resources in the project area include previous timber harvest projects, livestock grazing, wildfires, road construction, dispersed recreational use and Forest Service administration (see Appendix C). Cattle and sheep grazing, particularly before the middle twentieth century, likely caused direct effects through trampling of artifacts and indirect effects through soil erosion. Some level of artifact removal by workers and recreational visitors has most certainly occurred, and likely continues at a reduced rate. Past road construction and maintenance has caused the most significant direct effects to those sites where a road passed through. Timber harvest has mostly occurred relatively recently and to a limited extent. Direct and indirect effects to heritage sites by timber harvest activities have been minimal.

However, most potential impacts that heritage sites might incur from such foreseeable future actions as noxious weed treatment, prescribed burning, hazard tree removal and livestock grazing and improvements would be mitigated as per Stipulation III. A. of the 2004 Programmatic Agreement with Oregon SHPO.

Alternative 1 – No Action

Alternative 1, the No Action Alternative, would cause no cumulative impacts to known or unknown cultural resources.

Alternatives 2 and 3

Alternatives 2 and 3 could possibly cause limited cumulative impacts to known and unknown heritage resources. These could include unintentional direct effects to unknown sites and potential for artifact removal. Overall these potential cumulative impacts, should they occur, will only result in a minimal effect to heritage site integrity.

With the implementation of the project design elements for cultural resources, there is minimal risk of additional incremental degradation of historic properties associated with the alternatives.

Irreversible and Irretrievable Commitments

There are no irreversible and irretrievable commitments of resources that may result from the alternatives with respect to cultural resources. Ground disturbing activities will avoid all NRHP eligible and potentially eligible (unevaluated) cultural properties.

Consistency with Direction and Regulations

Heritage and Tribal interests are regulated by federal laws that direct and guide the Forest Service in identifying, evaluating and protecting heritage resources. All of the alternatives would comply with federal laws. The Malheur National Forest Plan tiers to these laws, therefore the proposed action alternatives will meet Forest Plan Standards. With the completion of the Heritage inventory under the terms of the 2004 PA with Oregon SHPO and by providing the interdisciplinary team with appropriate input as per NEPA, all relevant laws and regulations have been met.

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Heritage Resources Specialist Report located in the project record.

Economics / Social Resources

Affected Environment

Introduction

Forest product economy in an important component of the affected human environment, for two reasons: first, commercial timber would be sold and removed in conjunction with the proposed activities; and second, the businesses that buy and remove timber, and manufacture forest products, are major contributors to the economic well-being of the area. For example, in the combined economies of Grant and Harney Counties, 15 to 20% of employment is provided by the timber and forest products industry (Forest Plan Final EIS, USDA Forest Service 1990a).

Regulatory Framework

The Forest Plan emphasizes timber harvest from suitable acres to attain various public goals. The analysis of changes to the forest product economy that would occur under each alternative is focused on the following environmental factors:

- Timber Supplied to the area forest products industry;
- Timber, forest products and related jobs sustained in the area economy for 1 year; and
- Total income generated.

Executive order 12898 requires that federal agencies adopt strategies to address environmental justice concerns within the context of the agency operations. The analysis also addresses potential effects to minority populations, disabled persons, and low income groups.

Analysis Method

Scale of Analysis

Although individuals and communities over a wide geographic area use national forest resources, the residents and businesses of counties near the forest depend most heavily on the availability of those resources. Consequently, the effects of forest management on social and economic factors are strongest within these areas. For this reason, the Malheur National Forest's primary zone of influence is defined as Grant and Harney Counties in Oregon.

Methodology and Assumptions

The social and economic effects of the proposed management alternative were assessed in terms of viability of harvestable timber, employment and income contributed, and economic efficiency. The following sections describe each of these criteria and assumptions in detail.

Viability of Harvestable Timber

Although the Knox Project has a commercial and a non-commercial component, harvest viability is only relevant to the commercial component. Therefore, viability of harvest was only analyzed

for those units that had a commercial component. The computer program TEA_ECON[5], was used to estimate the sale revenues based upon the estimated tentative advertised bid rates per hundred cubic feet ($/ccf) for the commercial acres of the action alternative. These bid rates indicated the economic viability of harvesting timber. The estimates of these bid rates were based on the most current estimates of the following:

Alternative 2

Estimated volume per acre — estimated from local knowledge of stands. All volume is in hundreds of cubic feet (ccf). An average commercial thin unit volume was estimated at 1.6 ccf per acre. An average group select or commercial removal in aspen unit volume was estimated at 6.00 ccf per acre.

Species Composition — based upon sawlog volume, estimates are estimated at 95% ponderosa pine and 5% other species for the sale as a whole.

Alternative 3

Estimated volume per acre — estimated from local knowledge of stands. All volume is in hundreds of cubic feet (ccf). An average commercial unit volume was estimated at 4.00 ccf per acre. An average group select or commercial removal in aspen unit volume was estimated at 6.00 ccf per acre.

Species Composition — based upon sawlog volume, estimates are estimated at 36% ponderosa pine and 64% other species for the sale as a whole. Estimated Volumes of sawtimber are shown in Table E-1.

Table E-1. Commercial Acreage and Volume Estimates.

	No Action	Alternative 2	Alternative 3
Commercial Units & Aspen (Acres)	0	1,788	1,110
Ponderosa Pine Sawtimber (ccf)	0	2,778	2,052
Other Sawtimber (ccf)	0	330	3,582
Total Sawtimber (ccf)	0	3,108	5,634

Preliminary Value of Timber Removed — based on a weighted average for all sales actually sold within Appraisal Zone 3 (primarily Blue Mountain forests) within the last 12 months.

Costs — logging systems, log haul, road maintenance, contractual, brush disposal, erosion control, and other development. These costs are shown in Table E-2 and were discounted to present net values at a rate of 4%.

Table E-2. Assumed Costs of Commercial Sale.

Cost Center	Alt 2 Cost ($/ccf)	Alt 3 Cost ($/ccf)	Year
Sale Preparation	16.00	16.00	0
Sale Administration	10.00	10.00	1-2
Stump to Truck	95.13	92.07	2
Log Haul	40.07	40.07	2
Road Maintenance	2.32	2.32	2
Brush Disposal and Erosion Control	3.00	3.00	2

[5] TEA_ECON: An economic analysis tool that allows the user to perform timber sale accounting at the planning or sale layout level. The program uses price and cost data and the quarterly updated regional record of timber sale transactions to generate gross timber values, estimated advertised rates, and cash flow estimates.

An initial tentative advertised sawtimber bid rate ($/ccf) was determined by subtracting the costs associated with logging from the base period prices[6] adjusted for the quality of the material and current market conditions. This rate was reduced by 10% per current appraisal methods (Transaction Evidence Appraisal) to account for competition between bidders. It is important to note that advertised bid rates have fluctuated over the last few years reflecting the volatility of the timber market. Prices would likely change in the future (e.g. when the actual sale appraisal occurs), depending on market conditions at that time. Therefore, these estimates should only be considered rough approximations of future conditions. As a result, calculated bid rates were rounded to the nearest dollar. Timber sale revenues were also discounted to present values at a rate of 4%.

Employment and Income Contributed

Employment and income effects from the commercial units were derived from multipliers obtained from the IMPLAN (Impact Analysis for Planning) model, and from the forest-level Timber Sale Program Information Reporting System (TSPIRS) analysis in fiscal years 1996 to 1998 (USDA 1998, USDA 2000). Analysis of employment (jobs) and income assumed that all harvesting would occur over the next 1 to 2 years (2 years was used for this analysis).

- *Alternative 2* - Employment coefficients were .0008 direct jobs per ccf and .0005 indirect jobs per ccf. Action direct income coefficient is $83.48 per ccf and $50.12 indirect and induced income per ccf.

- *Alternative 3* - Employment coefficients were .0010 direct jobs per ccf and .0006 indirect jobs per ccf. Action direct income coefficient is $83.49 per ccf and $50.12 indirect and induced income per ccf.

Job estimates were based on the assumption of a direct relationship between changes in harvest volumes and manufactured output. In other words, a percentage change in harvest volume would result in an equal percentage change in manufactured output and employment. The model assumed that the price of timber is constant in response to changes in the supply of timber. The mills would not adjust their use of the factors of production (labor and equipment) to increase efficiency as a response to changes in the price or supply of timber. Also, the mills would not change their output per timber input in response to changes in timber supplies or changes to their mix of labor and equipment. Job estimates included temporary, permanent full time, and part-time employment. Employment effects from recreation and domestic-livestock grazing activities were not analyzed because only minor or no changes were expected in the level of use for these activities. The estimates provided by this analysis also did not include unpaid family workers or sole proprietors. Estimates apply to communities and counties in the regional impact zone and not necessarily to any one county.

Levels of harvest volume by alternative would affect employment and income in several ways:

- Directly - (employment associated with harvesting, logging, mills and processing plants for sawtimber, pulp, chips, veneer and plywood)
- Indirectly - (industries that supply materials, equipment, and services to these businesses)
- Induced - (personal spending by the business owners, employees, and related industries)

[6] Base Period Price: The volume-weighted average bid price of competitively sold timber sales in the previous four quarters. This value is updated quarterly.

Several factors would influence the ability of any one county or community to experience the largest extent of the harvest-related employment and income effects. The financial viability of the timber sale proposals would influence whether potential purchasers closest to the project area could compete with other purchasers to acquire the majority of the supply. Changes to bid rates would likely occur during appraisal, depending on actual market conditions at that time. Employment projections would depend on other factors, such as market conditions, quality and quantity of the volume offered for sale, timing of the offerings, and financial conditions of local firms.

There are no IMPLAN employment multipliers for noncommercial thinning projects, so direct and indirect employment from the thinning of the noncommercial units could not be estimated. However, the cost paid for this work was assumed to go directly into the local economy as direct income. Indirect income was estimated as being in the same proportion to direct income as in a commercial timber sale.

Economic Efficiency [7]

"Economic efficiency is a term used to describe how well inputs are used to achieve outputs when all inputs (activities) and all outputs (including market and non-market) are identified and valued. All costs and all benefits to society are included; amounts of each output are not pre-established but are produced in amounts that maximize net public benefits" (Forest Service Handbook [FSH]1909.17, §11.1).

Due to unavailable information, the non-wood outputs from this project could not be valued. Therefore, the economic efficiency of this project was measured by cost effectiveness, as recommended by FSH 1909.17. Cost effectiveness analyses attempt to determine the least costly alternative to produce the desired result. The objective of the cost effectiveness analysis was to show a relative measure of difference between alternatives. Where harvest viability was analyzed for only the commercial units, cost effectiveness was analyzed for all units as a whole. The analysis focused on identifiable and quantifiable ecosystem benefits and costs for each alternative in terms of the present net value[8] to assess which alternative came nearest to achieving the purpose and need over the largest land area at the least cost. All dollar values were discounted[9] in terms of the present net value (2004 dollars). The real (exclusive of inflation) discount rate used was 4%.

[7] The measurement of economic efficiency differs from the measurement of harvest viability in that economic efficiency attempts to put values on the full range of inputs and outputs (both market and non-market) associated with the project, while harvest viability is more an accounting procedure that only considers the costs and revenues of the project as expressed in timber markets.

[8] Present net value is defined as the discounted present benefit value (PVB) of the stream of benefits less the discounted present cost value (PVC) of the schedule of costs.

[9] Discounting is a process whereby the dollar values of costs and benefits that occur at different time periods are adjusted to a common time period so that they can be compared.

In this project, cost effectiveness was measured in terms of present net value (PNV) per acre or: PNV/acre = Present Net Costs/acre – Present Net Revenues/acre. Measurable costs and benefits on commercial units were based on costs and revenue from timber volume proposed for harvest and described under the assumptions for harvest viability.

Existing Condition

Viability of Harvestable Timber

The viability of harvest is dependent upon the market prices for raw wood fiber and the costs of harvest that are identified in the above Methodology and Assumptions section. Market prices are determined by the supply and demand relationships that exist for wood fiber on a global scale.

Local sawmills that could bid on the sawtimber from this project are located in La Grande, Pilot Rock, Prairie City, and John Day, Oregon. In addition to local sawmills, three to four large logging contractors usually bid on local timber sales, and if successful, could sell the sawtimber to the same local sawmills. For example, a particle board mill in La Grande uses the chip by-products of the La Grande sawmill for its raw materials.

Employment and Income Contributed

Agriculture, manufacturing (particularly wood products), and food processing are important sources of employment and income in this region. Reliance on timber and forage from federal lands is moderate to high in several counties in the impact zone (Haynes et al. 1997). Many communities in the impact zone are closely tied to the forest in both work activities and recreation. Cattle production and forest products provide the core employment for Grant and Harney Counties. Forest product industries include three major lumber mills and numerous logging companies. Wood product employment totaled 410 direct jobs (i.e., mill workers and loggers) and 102 indirect jobs, which is approximately 5% of the total non-agriculture employment in Grant and Harney Counties (average annual in 2007). Local government, retail trade, and services employ the most people in Grant and Harney Counties (Oregon Employment Department 2007). The area surrounding the project area is rural and has a disproportionately high unemployment compared with the Oregon State average and the National average.

Economic Efficiency

Volumes, costs, and revenues from the commercial units were analyzed for cost effectiveness. The derivation of the commercial unit data is described in the Harvest Viability section above.

Environmental Consequences

Direct and Indirect Effects

Viability of Harvestable Timber

Alternative 1- No action

The Alternative 1 would not harvest timber and so harvest viability would not be affected.

Alternatives 2 and 3

The TEA_ECON program was run for harvest viability. The results of each program run, and the effects of all alternatives on harvest viability, are shown in Table E-3.

Table E-3. Estimated Average Bid Prices and Net Present Value for Commercial Units ($/ccf).

	No Action	Alternative 2 Action	Alternative 3 Action
Average Bid Price ($/ccf)*	0	$46.43	$49.00
Discounted Sale Revenues**	0	$135,074	$259,000
Discounted Sale Costs	0	$93,227	$169,000
Present Net Sale Value	0	$41,847	$90,000

* The average bid price is rounded to the nearest dollar. ** Sale revenues and costs are rounded to the nearest $1,000.

Commercial harvests show positive bid rates. This indicates the proposed action would produce a viable harvest. As shown in Table E-3, Alternative 2 would produce revenue estimated at $135,074 and its costs would be $93,227. This would produce an estimated present net value of $41,847 for the commercial component. Also shown in Table E-3, Alternative 3 would produce revenue estimated at $259,000 and its costs would be $169,000. This would produce an estimated present net value of $90,000 for the commercial component.

Cumulative Effects

Estimates for tentative advertised sawtimber bid rates for the proposed action are within the range of rates experienced by the three Blue Mountain Forests (Malheur, Umatilla, and Wallowa-Whitman) within the last 2 years (Musgrove 2004). Due to the competitiveness of the market and its global nature, the No Action Alternative or the Proposed Action Alternative would not affect prices, costs, or harvest viability of other present or future timber sales in the economic impact zone. There are also residual effects from past timber sales within the subwatershed, which would not have a detrimental effect on the viability of harvest of the proposed action alternative. These past actions are described in detail in Appendix C.

Direct and Indirect Effects

Employment and Income Contributed

Alternative 1 - No Action Alternative

This alternative would not harvest timber, and therefore would not support direct, indirect, and induced employment, or increased income to local economies. Declining trends in timber harvesting from National Forest lands would continue in the future and contribute to declines in wood products employment over the next two decades. Changes in the economic base and wood products infrastructure for the impact area would also continue to be influenced by fluctuations in market prices, international market conditions, changes in technology, and industry restructuring.

Alternatives 2 and 3

In general, the primary effect on timber harvest-related employment would occur from commercial harvesting associated with the action alternative over the next two years. Financially viable sales would be necessary to provide opportunities for timber harvest-related employment.

Based upon the harvest data and the IMPLAN multipliers provided, small increases in employment would be expected (Table E-4).

The distribution of economic impacts would depend on the location of the timber purchaser awarded the contracts at the time of the sale, the availability of equipment and skills in the impact area, and the location and availability of the wood processing facilities and related infrastructure. Processors outside of Northeast Oregon could also potentially bid on the sales and distribute the jobs and income effect to other counties in the Blue Mountains or outside of the area entirely.

As Table E-4 shows, the proposed treatment for Alternative 2 would generate between $265,482 and $424,873 in direct, indirect, and induced local income. The proposed treatment for Alternative 3 would generate between $470,354 and $752,746 in direct, indirect, and induced local income.

Table E-4. Employment and Income by Alternative.

	No Action	Alternative 2 Action	Alternative 3 Action
Volume (ccf)	0	3,180	5,634
Direct (Employment)	0	9	17
Indirect (Employment)	0	6	10
Total (Employment)	0	15	26
Income - Direct ($)	0	$265,482	$470,354
Income - Indirect & Induced ($)	0	$159,391	$282,392
Income - Total ($)	0	$424,873	$752,746

Alt 2 Employment coefficients are 0.0008 direct jobs per ccf and 0.0005 indirect jobs per ccf.
Alt 3 Employment coefficients are 0.0010 direct jobs per ccf and 0.0006 indirect jobs per ccf.
Alt 2 Action direct income coefficient is $83.48 per ccf and $50.12 indirect and induced income per ccf.
Alt 3 Action direct income coefficient is $83.49 per ccf and $50.12 indirect and induced income per ccf.
Employment Coefficients for non-commercial thinning projects are unavailable.

Based upon the commercial volume harvested, Alternative 2 would support approximately 15 jobs over the 2 year period, both direct and indirect, and contribute approximately 3.7% toward the 2007 annual average of 410 jobs of timber-related employment. Based upon the commercial volume harvested, Alternative 3 would support approximately 26 jobs over the 2 year period, both direct and indirect, and contribute approximately 4.5% toward the 2007 annual average of 410 jobs of timber-related employment.

Cumulative Effects

The Malheur National Forest Land and Resource Management Plan established an allowable sale quantity (ASQ) for the forest of 38.4 million cubic feet or 211 million board feet (MMBF) average per year. An ASQ is an upper limit for the plan period, not proposals for sale offerings or an assigned target. Actual sale levels depend on factors such as limitations of modeling changes in law and regulations, changes in social-economic values, listing in threatened and endangered species, changes in budgets, and site-specific conditions. The Regional Forester's Eastside Forest Plan Amendment 2 (1995) and INFISH in 1995 are Forest Plan amendments that were developed in response to some of these changing factors. A combination of the factors listed above has resulted in a trend of overall decline in Malheur National Forest's annual offering of timber volume since the 1990 Forest Plan went into effect.

The selection of the No Action Alternative has the potential to continue the decline of timber-related employment in the rural communities of Grant and Harney Counties. Continued

declining trends in timber harvesting from National Forest System lands would potentially continue to impact wood products employment and associated indirect employment. Cumulative loss in timber-related jobs could affect the remaining infrastructure and capacity of the local rural communities, and could disrupt the dependent local goods and services industries.

The Proposed Action Alternative would provide some potential short-term economic relief by utilizing commercially thinned sawlogs. This material would potentially be used to support the three saw mills operating in the John Day/Prairie City area. The amount of local economic relief would be determined by whether the purchaser is local or distant, what mills(s) local or distant actually receives the logs, and the price for the lumber. These cumulative economic effects could cause beneficial "quality of life" social effects, especially when combined with other ongoing Forest Service Timber sales within Grant and Harney Counties that are providing employment and income. There are foreseeable projects in the two counties in various stages of planning that potentially may add to the Forest's annual timber offerings in 2008 or 2009. For example, the Canyon Creek WUI, Balance, and Dads Creek Projects may have 2008 sale offerings. These ongoing and foreseeable projects are expected to add cumulatively to the employment and income of Grant and Harney Counties within the life of the Knox Project.

Economic Efficiency

Direct and Indirect Effects

Alternative 1

The public would incur no costs nor realize any benefits of timber harvest in this area. Alternative 1 would yield a present net value of zero due to the data limitations (described in the "Methodology and Assumptions" section) for quantifying economic benefits and costs beyond those identified at the project level. This value ignores the risks to forest health, vigor, and fire resistance that would increase without implementation of this project, and the resulting losses in timber values and non-market benefits. Data limitations do not allow for the quantification of this risk, however, this risk would negatively affect present net value. Ongoing costs associated with management of the area, including the continuation of economic losses in stand values from recurring forest health problems, would continue.

Market benefits that could occur as a result of the proposed activities include increases in forest productivity and value for the remaining trees by eliminating competitive stress and reducing the risk of growth-limiting insect attack.

Externalized costs such as those resulting from damage to soils, losses in wildlife habitat, and mobilized sediment in local streams are not well defined or measurable at the project level in terms that provide comparison of assigned dollar values. Refer to other sections on environmental consequences in this EA for a discussion whether these external effects would occur. The other sections of this EA also discuss the non-economic benefits to human and environmental resources for a relative comparison between alternatives.

Alternatives 2 and 3

Table E-5 shows that Alternative 2 would present a net value of $41,847 and would have a net value per acre of $23.00.; and that Alternative 3 would present a net value of $90,000 and would have a net value per acre of $81.00.

Table E-5. Summary of Economic Measurement Criteria Estimates for All Alternatives.

	No Action	Alternative 2 Action	Alternative 3 Action
Area Treated (Acres)	0	1,788	1,110
Commercial Volume (ccf)	0	3,108	5,634
Commercial Bid Rates ($/ccf)	0	$46.43	$49.00
Local Employment* (jobs)	0	15	17
Local Income	0	$265,482	$470,354
Discounted Revenue	0	$135,074	$259,000
Discounted Costs	0	$93,227	$169,000
Present Net Value	0	$41,847	$90,000
Present Net Value per Acre	0	$23.00	$81.00

Cumulative Effects

This economic analysis assessed the proposed action in terms of harvest viability, employment and income contributed, and economic efficiency as measured by cost effectiveness. The economic efficiency of other past, ongoing, or foreseeable future activities (refer to Appendix C) would not affect, and not be affected by any effects not already described.

Irreversible and Irretrievable Commitments

There are no irreversible and irretrievable commitments associated with the consequences of any of the alternatives analyzed to the economic and social resources.

Consistency with Direction and Regulations

Forest Plan

This project is consistent with direction set forth in the Forest Plan.

Executive Order 12898: Environmental Justice

Executive Order 12898 requires that federal agencies adopt strategies to address environmental justice concerns within the context of agency operations. With implementation of the proposed action alternative, there would be no disproportionately high and adverse human health or environmental effects on minority or low income populations. The actions would occur in a remote area and nearby communities would mainly be affected by economic impacts as related to contractors implementing harvest and thinning activities. Racial and cultural minority groups are often prevalent in the work forces that would implement prescribed fire, herbicide application, tree planting, or thinning activities. Contracts contain clauses that address worker safety.

Consumers, Minority Groups, and Women

Effects on civil rights, including those of minorities and women, would be minimal. Activities associated with the action alternative would be governed by Forest Service contracts, which are awarded to qualified purchasers regardless of race, color, sex, religion, etc. Such contracts also contain nondiscrimination requirements. While the activities identified here would create jobs and the timber harvest would provide consumer goods, no quantitative output, lack of output, or timing of output associated with these projects would affect the civil rights, privileges, or status quo of consumers, minority groups, and women.

More Detailed Information or Analysis

Additional details about the affected environment and the effects of the alternatives can be found in the Economics / Social Resources Specialist Report located in the project record.

Other Disclosures

NEPA at 40 CFR 1502.25 (a) directs "to the fullest extent possible, agencies shall prepare environmental impact statements concurrently with and integrated with…other environmental review laws and executive orders." The following sections disclose those laws and executive orders.

Air Quality and Clean Air Act of 1977, as Amended

All action alternatives are in compliance with the Clean Air Act and the Oregon State Smoke Management Plan. Burning of any kind would not occur unless prior approval is granted by Oregon Department of Forestry. All amounts of PM 10 and PM 2.5 emissions would be calculated using the CONSUME software in the SmokeTracs reporting system, which is also submitted with planned burn operations to the Oregon Department of Forestry to determine compliance with the Clean Air Act. All burning would occur outside visibility-protection periods set for Central Oregon of July 1 to September 15. Burning would be planned for times when transport winds are sufficient to displace much of the smoke from the area.

American Indian Rights

This proposal would not conflict with any inherent rights or treaty provisions of any tribal group.

Congressionally Designated Areas

Wilderness: There are no lands designated in the project area as wilderness; therefore, there would be no impacts on Wilderness. (See discussion on potential wilderness areas included in this section).

Wilderness Study Areas: There are no lands designated in the project area as Wilderness Study Areas or recommended for wilderness classification; therefore, there would be no impacts on any WSA.

National Recreation Areas: There are no lands designated in the project area as National Recreation Areas; therefore, there would be no impacts to National Recreation Areas.

Clean Water Act of 1982

All alternatives comply with the Clean Water Act (1982) as amended in 1981. All alternatives apply Best Management Practices (BMPs) as specified in "Forest Service R6 General Water Quality Best Management Practices" (1988), and in standards and guidelines in the Forest Plan. The site specific BMPs are listed in Chapter 2 (Integrated Design Elements). See Hydrology section in Chapter 3 for detailed analysis.

Cottonwood and Alder Creeks are on the Oregon 303(d) list for water quality-limited water bodies for high temperatures. None of the alternatives considered singly or cumulatively, would cause measurable increases in stream temperature.

Energy Requirements and Conservation Potential of Alternatives

The potential energy consumption associated with any of the alternatives considered as well as the differences between the alternatives is not measurable.

The Endangered Species Act of 1973, as Amended

The Endangered Species Act requires protection of all species listed as "Threatened" or "Endangered" by Federal regulating agencies (Fish and Wildlife Service and National Marine Fisheries Service). The Forest Service also maintains, through the Federal Register, a list of species which are proposed for classification and official listing under the Endangered Species Act, species which occur on an official State list, or that are recognized by the Regional Forester as needing special management to prevent their being placed on Federal or State lists. On January 31, 2008, Regional Forester Linda Goodman released an updated Sensitive Species List which includes federally listed, federally proposed and sensitive species lists. In the cover letter for the updated species list the Regional Forester states that projects initiated prior to January 31, 2008 may use the updated sensitive species list or the list that was in effect when the project was initiated. The Responsible Official for the project has authority to decide which list to use. "Initiated" means that a signed and dated document such as project initiation letter, scoping letter, or Federal Register Notice for the project exists. The Project Initiation Letter for the Knox Project was issued in February 2007. Consequently, the 2004 Regional Forester Sensitive Species list in effect at that time was used for field reconnaissance and the Biological Evaluation. All alternatives are consistent with the Endangered Species Act, and the requirements of the Regional Forester's Sensitive Species list.

Biological Evaluations have been completed for all threatened, endangered, and sensitive (TES) aquatic and terrestrial wildlife. Alternatives would be expected to have **No Effect** to threatened Canada lynx and the endangered gray wolf. There are no threatened or endangered aquatic species with occurrence or habitat document within the Knox Project area. There is **No Effect** to any threatened or endangered aquatic species or their habitats. Consultation with U.S. Fish and Wildlife Service was therefore not required.

Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898 (February 11, 1994) on Environmental Justice directs federal agencies to consider whether proposed alternatives may have disproportionately high and adverse environmental effects on minority populations, low-income populations, or Indian tribes. The order directs federal agencies to focus attention on the human health and environmental effects to ethnic minorities (American Indians, Hispanics, African Americans, and Asian and Pacific-Islander Americans), disabled people, and low-income groups.

The action alternatives provide a variety of opportunities for potential employment in logging, mill production, reforestation, and other potential contracts. Employment and income would be available to all people, including minority and low income groups. Opportunities for all groups of people to collect species from disturbed and nondisturbed sites would be maintained by all alternatives, and no disproportionate effect is anticipated to subsets of the general population.

None of the alternatives would have disproportionately high and adverse environmental effects on minority populations, low-income populations, or Indian tribes.

Facilitation of Hunting Heritage and Wildlife Conservation **(Executive Order 13443)**

The purpose of this 2007 Order is to direct Federal agencies that have programs and activities that have a measurable effect on public land management, outdoor recreation, and wildlife

management, including the Department of the Interior and Department of Agriculture, to facilitate the expansion and enhancement of hunting opportunities and management of game species and their habitat. Federal agencies shall evaluate the effect of agency actions on trends in hunting participation; consider the economic and recreation values of hunting in agency actions; manage wildlife and wildlife habitat on public lands in a manner that expands and enhances hunting opportunities and work collaboratively with State governments to manage and conserve game species in their habitats.

With the implementation of any of the action alternatives, there will be limited short-term effects to hunters. Harvest activities and smoke from fuel treatment activities may displace some recreationists to new areas to camp, hunt, or to travel. Road closures and decommissioning are not expected to greatly impact recreation access.

The economic values of big-game hunting would depend on changes in population levels and special distribution across the landscape. Hunting opportunities, as managed by Oregon Department of Fish and Wildlife, are expected to be unchanged in all alternatives. Elk population census data for the Malheur River Big Game Management Unit indicates an increasing population trend. It appears that past forest management has not been detrimental to elk populations in these management units. It is not anticipated that planned activities under any of the action alternatives would cause a decline in elk populations either. However, activities would likely cause a redistribution of animals across the landscape.

Floodplains (Executive Order 11988)

Executive Order 11988 says that Federal agencies shall avoid adverse effects to floodplains or minimize potential harm. Floodplains several feet wide occur along much of the Cougar Creek, Cat Creek, and Cottonwood Creek. The floodplains are well within RHCAs, so all alternatives avoid adverse effects to the floodplains, and thus are consistent with Executive Order 11988.

National Landmarks

There are no National Landmarks in the project area. Therefore, no impacts would occur for any National Landmark.

National Forest Management Act (NFMA)

Requirements of 36 CFR 219.28, which are part of the NFMA regulations, will be met. Specifically: 1) Harvest will occur only on suitable timberlands; 2) Following commercial thinning activities, none of the action alternatives will require reforestation activities since the stands will remain fully stocked or overstocked. The National Forest Management Act of 1976 requires the disclosure of any silvicultural prescription that creates an opening larger than 40 acres, using even-aged vegetation management. The project proposed action and alternatives would not create openings greater than 40 acres.

National Historic Preservation Act

State Historic Preservation Office consultation has been conducted under the Programmatic Agreement among the United States Department of Agriculture, Forest Service, Pacific North-west Region (Region 6), the Advisory Council on Historic Preservation, and Washington State Historic Preservation Officer regarding Cultural Resource Management on National Forests

dated June 2004. Identified sites and any newly recorded sites would be avoided / protected from all ground disturbing activities. There would be no effect to any historic property listed in or eligible for listing in the National Register of Historic Places.

Municipal Watersheds

There are no municipal watersheds affected by the project; therefore there would be impacts on any municipal watersheds.

Parklands

There are no lands within the proposed project that would be characterized as parklands; therefore, there would be no impacts on any parkland.

Prime Farmlands, Rangelands, and Forestlands

Prime Farmlands: The project area is not located in or adjacent to prime farmlands; therefore, there would be no impacts to Prime Farmlands.

Prime Rangelands: The project does not contain prime rangeland because of soils and climate, and none of the proposed activities in the project area would covert rangelands to other uses. Therefore, there would be no impacts on Prime Rangelands.

Prime Forestland: The project would not convert forestlands to other uses. All lands designated as forested would be retained and managed as forested; therefore, there would be no negative impacts on Prime Forestlands.

Public Health and Safety

Public health and safety would be improved by reducing the potential for stand replacement wildfires and felling danger trees along open haul routes within the Knox Project Area.

Relationship of 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 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).

This project would result in short-term impacts on various resources but would result in Forest health and fuels reduction benefits, and an economic return to the economy. There would not be any long-term impacts on the productivity of the lands affected.

Research Natural Areas (RNA)

There are no research natural areas in the project area; therefore, there would be no negative impacts to Research Natural Areas.

Social Groups

The project would have no impacts on any social groups, including minorities, Native Americans, women, or the civil liberties of any American citizen.

Unavoidable Adverse Effects

There would be unavoidable short-term negative effects to air quality, soils, watershed, range, fisheries, wildlife, visuals, and recreation from the Proposed Action and all alternatives. See individual resource sections in Chapter 3. At the end of Chapter 2, several tables compare the effects of the alternatives.

Wetlands (Executive Order 11990)

There are no wetlands meeting this definition and therefore the project area would not impact any wetlands.

There are no lands designated for Wild and Scenic Rivers in the project area; therefore, the project would not impact any Wild and Scenic Rivers.

Inventoried Roadless, Potential Wilderness and Areas with Undeveloped Character

Inventoried Roadless Areas

As part of the Land and Resource Management Planning process (LRMP 46 CFR 219.27 (c)) the 1990 Malheur Forest Plan identified areas of at least 5,000 acres, without developed and maintained roads, and substantially natural conditions. These areas were called Inventoried Roadless Areas (IRAs). The IRAs for the Malheur National Forest can be found in Appendix C of the LRMP Final Environmental Assessment.

On 1/12/2001, the Department of Agriculture adopted the Final Roadless Area Conservation Rule (RACR), intended to protect and conserve inventoried roadless areas on National Forest System lands. Since adoption of the 2001 RACR, the term IRA has been defined to refer to areas identified in the set of maps published for the 2000 FEIS for that rule. The IRAs identified in the 1990 Malheur National Forest LRMP, Appendix C were included in the Final EIS RACR.

There are no IRAs within or adjacent to the Knox Project Area, therefore, the proposed treatments are consistent with management direction regarding IRAs in the Malheur Forest Plan (1990).

Potential Wilderness

The Malheur National Forest, in coordination with the Umatilla and Wallowa-Whitman National Forests, is involved in a tri-forest plan revision process, referred to as the Blue Mountain Forest Plan Revision. This process started in 2005 and there have been several reiterations of Forest wilderness potential inventory following the inventory criteria outlined in FSH 1909.12 Chapter 71. Existing inventoried roadless areas (IRAs) served as a starting point for the inventory.

In order to be consistent with the other forests, the Malheur made the following assumptions: forest roads would be buffered with a 300 foot buffer and past timber harvest activities would not meet potential wilderness inventory criteria. A potential wilderness area is an area that qualifies for placement on the potential wilderness inventory if they meet criteria as outlined in Forest

Service Handbook 1909.12, Chapter 71. This inventory of potential wilderness is not a land designation, nor does it imply any particular level of management direction or protection in association with the evaluation of these potential wilderness areas. It is completed with the express purpose of identifying all lands that meet the criteria for being evaluated for wilderness suitability and possible recommendation to Congress for wilderness study or designation.

During the Forest Plan Revision inventory process, maps were consulted to determine what areas met the potential wilderness inventory criteria. Areas with wilderness potential were inventoried in 2005, 2006, and 2007. Within the Knox Project area, there were no areas identified that met wilderness potential criteria as outlined in Forest Service Handbook 1909.12, Chapter 71.

For a project specific review, the Knox Project Area was again reviewed for areas that met the potential wilderness inventory criteria, with the use of GIS generated maps, following guidelines in FSH 1909.12, Chapter 71. Due to the extent and location of forest roads and the amount of past harvest in the project area, the determination of "no areas identified that met wilderness potential criteria" was substantiated because the acres affected by the Knox Project do not contain 5000 acres or more of land that do not contain forest roads, the acres cannot be preserved due to physical terrain and natural conditions, they do not contain acres that are self-contained ecosystems nor are they contiguous to existing wilderness. Since there are no areas that meet the criteria, the Knox Project would not remove any potential wilderness from inventory.

Areas with Undeveloped Character

Areas with undeveloped character include large areas without roads or other developments that may have special characteristics unique to that general area.

The Knox Project Area was reviewed for areas of undeveloped character using GIS generated maps. Similar to the discussion in the Potential Wilderness section, due to the extent and location of forest roads and the amount of past harvest in the project area, there are no undeveloped areas within or adjacent to the Knox Project that provide high quality or undisturbed soil, water, and air; sources of public drinking water; diversity of plant and animal communities; habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land; primitive, semi-primitive non-motorized, and semi-primitive motorized classes of dispersed recreation; reference landscapes; natural appearing landscapes with high scenic quality; traditional cultural properties and sacred sites; nor other locally identified unique characteristics.

Global Warming

The Global Climate Change Prevention Act (*7 USC 6701*) authorizes and directs the Secretary of Agriculture to take steps towards researching climate change, including establishing a Global Climate Change Program; a technical advisory committee; an Office of International Forestry; urban forestry demonstration projects; biomass energy demonstration projects. The Secretary is also directed to study the effects of global climate change on agriculture and forestry, and the interaction between forest greenhouse gas emissions and climate change. Supplemental information on the Global Climate Change Prevention Act (*7 USC 6701*) is in Appendix F.

Section 6701 of the Act directs the Secretary of Agriculture to establish a Global Climate Change Program in order to have within the Department of Agriculture a focal point for coordinating all issues of climate change. The Secretary must designate a director, who shall: coordinate policy

analysis, long range planning research, and response strategies relating to climate change issues; provide liaison with other federal agencies, through the Office of Science and Technology Policy, regarding issues of climate change; perform other enumerated duties. The specific list of Director Tasks includes the following: The Director shall—

(1) coordinate policy analysis, long range planning, research, and response strategies relating to climate change issues;

(2) provide liaison with other Federal agencies, through the Office of Science and Technology Policy, regarding issues of climate change;

(3) inform the Department of scientific developments and policy issues relating to the effects of climate change on agriculture and forestry, including broader issues that affect the impact of climate change on the farms and forests of the United States;

(4) recommend to the Secretary alternative courses of action with which to respond to such scientific developments and policy issues; and

(5) ensure that recognition of the potential for climate change is fully integrated into the research, planning, and decision-making processes of the Department.

Item #5 notes that the Secretary should ensure that the potential for climate change is noted in planning and decision processes of the Department, but nothing in the Act directs the Forest Service to conduct any specific analysis or disclose any specific effects in a NEPA document for specific forestry projects. However, the Forest Service has looked at what modeling of climate change is possible in planning projects. In a recent analysis, three Forest Service research scientists considered a methodology for modeling climate change in forest planning. In a letter to Lisa Freedman, Director of Resource Planning and Monitoring for the Pacific Northwest Region of the Forest Service, Pacific Northwest Research Station Deputy Director Cynthia West stated, "…the science of modeling climate change lacks certainty due to large spatial and temporal variation in the interactions of terrestrial, atmospheric, oceanic and human systems…" 4070 Letter of July 26, 2005 from Cynthia West. In a follow-up policy letter, Ms. Freedman concluded, "…there is no consensus or experience regarding how to model climate change at the subregional scale and it would require substantial research, model development and testing to provide such an approach." 1920 Letter of July 28, 2005 from Lisa Freedman.

It should also be noted that logging itself does not release stored carbon into the atmosphere; that carbon remains stored in the logged wood. The effects are in the loss of carbon-fixing capacity of the trees removed and this capacity begins to return as trees grow again. There is also a potential carbon loss as logging slash decays or is burned.

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. Irreversible and irretrievable commitments of resources are disclosed at the end of each section in Chapter 3.

Appendix A – Treatment Summary Tables

Table T-1. Knox Treatment Units and Prescriptions in the Proposed Action.

UNIT #	Acres	Slope	LOS	HTH	SPC	Aspen	FUB	Slash Treatment	Bio-mass	MAs	Structure
001	11.89	11	N	Y	N	N/A	Y	WTY	Y	4A	SEOC
002	18.49	11	N	Y	N	N/A	Y	WTY	Y	1_2	SEOC
003	13.14	20	N	Y	N	N/A	Y	WTY	N	1_2	SEOC
004	79.32	9	N	N	Y	N/A	Y	Mech	Y	1_2	SEOC
005	74.80	12	N	N	N	N/A	Y	FNT	N	1_2	SEOC
006	29.71	17	Y	N	Y	N/A	Y	Mech	N	4A	OFMS
007	14.59	20	N	Y	N	N/A	Y	WTY	Y	1_2	UR
008	38.64	20	N	Y	N	N/A	Y	WTY	N	4A	UR
009	1.87	12	N	N	Y	N/A	Y	Mech	N	4A	SECC
010	69.24	6	Y	Y	N	N/A	N	WTY	Y	1_2	OFSS
011	22.42	20	N	N	Y	N/A	Y	Mech	N	4A	SECC
012	4.82	17	Y	N	Y	N/A	Y	Mech	N	4A	OFMS
013	11.09	15	N	Y	N	N/A	Y	WTY	N	4A	SECC
014	3.53	15	N	Y	N	N/A	N	WTY	N	4A	SECC
015	28.65	7	Y	N	Y	N/A	N	Mech	Y	1_2	OFMS
016	37.86	26	N	Y	N	N/A	N	WTY	N	4A	SEOC
017	55.07	12	Y	Y	Y	N/A	N	WTY/Mech	Y	1_2	OFMS
018	11.78	12	N	Y	N	N/A	Y	WTY	N	1_2	SECC
019	33.77	38	N	N	Y	N/A	N	Hand	N	4A	YFMS
020	2.22	9	N	N	N	N/A	Y	FNT	N	1_2	SEOC
021	53.48	29	N	Y	Y	N/A	Y	WTY/Mech	Y	4A	SECC
022	61.07	14	N	Y	N	N/A	Y	WTY	N	1_2	SEOC
023	46.47	10	Y	Y	Y	N/A	Y	WTY/Mech	N	1_2	OFMS
024	73.02	11	N	Y	N	N/A	Y	WTY	N	1_2	SECC
025	26.84	39	N	Y	N	N/A	N	WTY	N	4A	SECC
026	8.16	11	N	Y	Y	N/A	N	WTY/Mech	Y	1_2	YFMS
027	9.09	10	Y	N	Y	N/A	N	Mech	Y	1_2	OFSS
028	34.75	15	N	Y	N	N/A	Y	WTY	N	1_2	SECC
029	28.13	6	Y	Y	Y	N/A	Y	WTY/Mech	Y	1_2	OFMS
030	16.66	18	Y	N	Y	N/A	Y	Mech	Y	4A	OFMS
031	20.16	18	Y	N	Y	N/A	Y	Mech	Y	1_2	OFMS
032	184.46	12	N	Y	N	N/A	Y	WTY	N	1_2	UR
033	140.66	17	N	Y	Y	N/A	N	WTY/Mech	Y	1_2	UR
034	33.79	12	N	N	Y	N/A	Y	Mech	Y	1_2	YFMS
035	167.68	9	Y	N	Y	N/A	Y	Mech	Y	1_2	OFMS
035	0.00	9	Y	N	Y	N/A	Y	Mech	Y	1_2	OFMS
035	2.73	9	Y	N	Y	N/A	Y	Mech	Y	1_2	OFMS
036	4.44	24	N	N	Y	N/A	Y	Mech	Y	1_2	SECC
037	16.74	9	N	Y	Y	N/A	Y	WTY/Mech	Y	1_2	SECC
038	24.06	18	Y	Y	N	N/A	Y	WTY	N	4A	OFMS
039	26.72	9	N	Y	N	N/A	Y	WTY	N	1_2	SECC
040	23.23	29	N	Y	N	N/A	Y	WTY	N	4A	SECC
041	13.11	22	N	Y	N	N/A	Y	WTY	N	1_2	SEOC
042	2.09	15	Y	Y	N	N/A	Y	WTY	N	4A	OFMS
043	12.19	12	N	N	N	N/A	Y	FNT	N	1_2	SEOC
044	49.77	13	N	Y	N	N/A	Y	WTY	N	1_2	SECC
046	74.65	11	N	Y	N	N/A	Y	WTY	N	4A	UR
047	7.59	11	N	Y	N	N/A	Y	WTY	N	1_2	UR

UNIT #	Acres	Slope	LOS	HTH	SPC	Aspen	FUB	Slash Treatment	Bio-mass	MAs	Structure
048	21.21	10	Y	Y	Y	N/A	Y	WTY/Mech	Y	4A	OFMS
049	21.27	10	Y	Y	Y	N/A	N	WTY/Mech	Y	4A	OFMS
050	24.30	12	N	Y	Y	N/A	Y	WTY/Mech	Y	1_2	SEOC
051	3.06	12	N	Y	N	N/A	Y	WTY	N	4A	SECC
052	103.34	12	N	Y	N	N/A	Y	WTY	N	1_2	SECC
052	65.41	12	N	Y	N	N/A	Y	WTY	N	1_2	SECC
053	13.12	15	Y	N	Y	N/A	Y	Mech	Y	1_2	OFMS
054	68.87	20	Y	Y	N	N/A	N	WTY	N	1_2	SEOC
055	30.42	12	N	Y	N	N/A	N	WTY	N	1_2	SEOC
056	24.70	4	N	Y	N	N/A	N	WTY	N	1_2	SECC
057	20.16	7	N	Y	N	N/A	Y	WTY	N	1_2	SEOC
058	64.10	27	N	Y	Y	N/A	N	WTY/Mech	Y	1_2	SECC
059	20.41	22	N	Y	N	N/A	Y	WTY	N	1_2	SECC
060	67.15	15	N	Y	N	N/A	Y	WTY	N	1_2	UR
061	2.12	17	N	N	Y	N/A	Y	Mech	Y	4A	YFMS
062	38.80	17	N	N	Y	N/A	Y	Mech	Y	1_2	YFMS
064	25.86	10	N	N	Y	N/A	Y	Mech	Y	1_2	YFMS
065	16.71	12	Y	Y	Y	N/A	N	WTY/Mech	Y	4A	OFMS
066	1.16	12	Y	Y	Y	N/A	Y	WTY/Mech	Y	4A	OFMS
067	8.49	9	N	N	N	N/A	Y	FNT	N	4A	SEOC
068	56.28	41	N	N	Y	N/A	Y	Hand	N	4A	YFMS
069	39.62	13	Y	N	Y	N/A	N	Mech	Y	1_2	OFSS
100	2.10	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
101	0.36	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
101	0.01	<35	N/A	N	N	Release	N	LS	N	UL 3A	N/A
102	2.33	<35	N/A	N	N	Cage	N	FNT	N	UL 3A	N/A
103	0.28	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
104	0.18	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
106	4.55	<35	N/A	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
107	0.46	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
108	0.93	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
108	2.09	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
109	0.63	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
109	0.50	<35	N/A	N	N	Release	N	LS	N	UL 3A	N/A
110	0.61	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
112	0.28	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
113	4.66	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
114	0.50	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
115	0.38	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
116	0.24	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
118	7.23	<35	N/A	N	N	Release	Y	LS	N	RHCA	N/A
119	0.29	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
120	0.29	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
121	0.66	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
121	0.06	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
122	1.89	<35	N/A	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
122	1.25	<35	N/A	N	N	Release	Y	LS	N	RHCA	N/A
123	2.14	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
124	0.54	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
124	0.15	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
125	0.42	<35	N/A	N	N	Release	Y	LS	N	RHCA	N/A

UNIT #	Acres	Slope	LOS	HTH	SPC	Aspen	FUB	Slash Treatment	Bio-mass	MAs	Structure
126	0.46	<35	N/A	N	N	Release	Y	LS	N	RHCA	N/A
127	0.63	<35	N/A	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
128	5.61	<35	N/A	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
129	0.48	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
130	0.02	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
130	0.86	<35	N/A	N	N	Release	Y	LS	N	UL 3A	N/A
131	12.03	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
132	0.62	<35	N/A	N	N	Release	Y	LS	N	UL 3A	N/A
133	0.09	<35	N/A	N	N	Cage	N	FNT	N	RHCA	N/A
133	0.77	<35	N/A	N	N	Cage	N	FNT	N	UL 3A	N/A
134	0.48	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
135	0.25	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
136	0.71	<35	N/A	N	N	Release	Y	LS	N	RHCA	N/A
137	0.25	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
138	1.98	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
139	1.24	<35	N/A	N	N	Release	N	LS	N	UL 3A	N/A
140	2.12	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
141	0.37	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
142	1.95	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
142	0.48	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
143	0.41	<35	N/A	N	N	Release	Y	LS	N	UL 3A	N/A
144	1.11	<35	N/A	N	N	Release	N	LS	N	UL 3A	N/A
145	3.60	<35	N/A	N	N	Release	N	LS	N	UL 3A	N/A
146	22.44	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
147	1.80	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
147	1.58	<35	N/A	N	N	Release	Y	LS	N	UL 3A	N/A
148	0.15	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
148	4.20	<35	N/A	N	N	Release	N	LS	N	UL 3A	N/A
149	0.42	<35	N/A	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
150	0.51	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
150	0.59	<35	N/A	N	N	Release	N	LS	N	UL 3A	N/A
151	0.35	<35	N/A	N	N	Release	Y	LS	N	UL 3A	N/A
152	11.07	<35	N/A	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
153	18.05	<35	N/A	N	N	Release	Y	LS	N	RHCA	N/A
154	0.88	<35	N/A	N	N	Release	Y	LS	N	UL 3A	N/A
155	1.96	<35	N/A	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
156	0.65	>35	N/A	N	N	Release	Y	LS	N	UL 3A	N/A
159	0.07	<35	N/A	N	N	Release	N	LS	N	RHCA	N/A
160	0.33	<35	N/A	N	N	Release	N	LS	N	UL 3A	N/A
161	11.46	<35	N/A	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
162	3.91	<35	N/A	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A

Table T-2. Knox Treatment Units and Prescriptions in Alternative 3.

Unit #	Acres	Slope	LOS	HTH	Group Select	SPC	Aspen	FUB	Slash Treatment	Bio-mass	MAs	Structure
001	11.89	11	N	N	N	Y	N/A	Y	Mech	Y	4A	SEOC
002	18.49	11	N	N	N	Y	N/A	Y	Mech	Y	1_2	SEOC
003	13.14	20	N	Y	N	N	N/A	Y	WTY	N	1_2	SEOC
004	79.32	9	N	N	N	Y	N/A	Y	Mech	Y	1_2	SEOC
005	74.80	12	N	N	N	N	N/A	Y	FNT	N	1_2	SEOC

Unit #	Acres	Slope	LOS	HTH	Group Select	SPC	Aspen	FUB	Slash Treatment	Bio-mass	MAs	Structure
006	29.71	17	Y	N	N	Y	N/A	Y	Mech	N	4A	OFMS
007	14.59	20	N	N	N	Y	N/A	Y	Mech	Y	1_2	UR
008	38.64	20	N	Y	N	N	N/A	Y	WTY	N	4A	UR
009	1.87	12	N	N	N	Y	N/A	Y	Mech	N	4A	SECC
010	69.24	6	Y	Y	N	Y	N/A	N	WTY/Mech	Y	1_2	OFSS
011	22.42	20	N	N	N	Y	N/A	Y	Mech	N	4A	SECC
012	4.82	17	Y	N	N	Y	N/A	Y	Mech	N	4A	OFMS
013	11.09	15	N	Y	N	N	N/A	Y	WTY	N	4A	SECC
014	3.53	15	N	Y	N	N	N/A	N	WTY	N	4A	SECC
015	28.65	7	Y	N	N	Y	N/A	N	Mech	Y	1_2	OFMS
016	37.86	26	N	Y	N	N	N/A	N	WTY	N	4A	SEOC
017	55.07	12	Y	N	Y	Y	N/A	N	WTY/Mech	Y	1_2	OFMS
018	11.78	12	N	N	N	N	N/A	Y	FNT	N	1_2	SECC
019	33.77	38	N	N	N	Y	N/A	N	Hand	N	4A	YFMS
020	2.22	9	N	N	N	N	N/A	Y	FNT	N	1_2	SEOC
021	53.48	29	N	Y	N	Y	N/A	Y	WTY/Mech	Y	4A	SECC
022	61.07	14	N	N	Y	N	N/A	Y	WTY	N	1_2	SEOC
023	46.47	10	Y	N	N	Y	N/A	Y	Mech	N	1_2	OFMS
024	73.02	11	N	N	Y	N	N/A	Y	WTY	N	1_2	SECC
025	26.84	39	N	N	N	Y	N/A	N	Hand	N	4A	SECC
026	8.16	11	N	Y	N	Y	N/A	N	WTY/Mech	Y	1_2	YFMS
027	9.09	10	Y	N	N	Y	N/A	N	Mech	Y	1_2	OFSS
028	34.75	15	N	N	N	N	N/A	Y	FNT	N	1_2	SECC
029	28.13	6	Y	Y	N	Y	N/A	Y	WTY/Mech	Y	1_2	OFMS
030	16.66	18	Y	N	N	Y	N/A	Y	Mech	Y	4A	OFMS
031	20.16	18	Y	N	N	Y	N/A	Y	Mech	Y	1_2	OFMS
032	184.46	12	N	N	N	N	N/A	Y	FNT	N	1_2	UR
033	140.66	17	N	N	Y	Y	N/A	N	WTY/Mech	Y	1_2	UR
034	33.79	12	N	N	N	Y	N/A	Y	Mech	Y	1_2	YFMS
035	167.68	9	Y	N	N	Y	N/A	Y	Mech	Y	1_2	OFMS
035	0.00	9	Y	N	N	Y	N/A	Y	Mech	Y	1_2	OFMS
035	2.73	9	Y	N	N	Y	N/A	Y	Mech	Y	1_2	OFMS
036	4.44	24	N	N	N	Y	N/A	Y	Mech	Y	1_2	SECC
037	16.74	9	N	N	N	Y	N/A	Y	Mech	Y	1_2	SECC
038	24.06	18	Y	Y	N	N	N/A	Y	WTY	N	4A	OFMS
039	26.72	9	N	Y	N	N	N/A	Y	WTY	N	1_2	SECC
040	23.23	29	N	Y	N	N	N/A	Y	WTY	N	4A	SECC
041	13.11	22	N	N	N	N	N/A	Y	FNT	N	1_2	SEOC
042	2.09	15	Y	Y	N	N	N/A	Y	WTY	N	4A	OFMS
043	12.19	12	N	N	N	N	N/A	Y	FNT	N	1_2	SEOC
044	49.77	13	N	Y	N	N	N/A	Y	WTY	N	1_2	SECC
046	74.65	11	N	N	N	N	N/A	Y	FNT	N	4A	UR
047	7.59	11	N	N	N	N	N/A	Y	FNT	N	1_2	UR
048	21.21	10	Y	Y	N	Y	N/A	Y	WTY/Mech	Y	4A	OFMS
049	21.27	10	Y	Y	N	Y	N/A	N	WTY/Mech	Y	4A	OFMS
050	24.30	12	N	N	Y	Y	N/A	Y	WTY/Mech	Y	1_2	SEOC
051	3.06	12	N	N	Y	N	N/A	Y	WTY	N	4A	SECC
052	65.41	12	N	N	Y	N	N/A	Y	WTY	N	1_2	SECC
052	103.34	12	N	N	N	N	N/A	Y	FNT	N	1_2	SECC
053	13.12	15	Y	N	N	Y	N/A	Y	Mech	Y	1_2	OFMS
054	68.87	20	Y	N	N	N	N/A	N	FNT	N	1_2	SEOC
055	30.42	12	N	Y	N	N	N/A	N	WTY	N	1_2	SEOC

Unit #	Acres	Slope	LOS	HTH	Group Select	SPC	Aspen	FUB	Slash Treatment	Bio-mass	MAs	Structure
056	24.70	4	N	Y	N	N	N/A	N	WTY	N	1_2	SECC
057	20.16	7	N	N	N	N	N/A	Y	FNT	N	1_2	SEOC
058	64.10	27	N	N	Y	Y	N/A	N	WTY/Mech	Y	1_2	SECC
059	20.41	22	N	N	Y	N	N/A	Y	WTY	N	1_2	SECC
060	67.15	15	N	N	N	N	N/A	Y	FNT	N	1_2	UR
061	2.12	17	N	N	N	Y	N/A	Y	Mech	Y	4A	YFMS
062	38.80	17	N	N	N	Y	N/A	Y	Mech	Y	1_2	YFMS
064	25.86	10	N	N	N	Y	N/A	Y	Mech	Y	1_2	YFMS
065	16.71	12	Y	Y	N	Y	N/A	N	WTY/Mech	Y	4A	OFMS
066	1.16	12	Y	Y	N	Y	N/A	Y	WTY/Mech	Y	4A	OFMS
067	8.49	9	N	Y	N	N	N/A	Y	WTY	N	4A	SEOC
068	56.28	41	N	N	N	Y	N/A	Y	Hand	N	4A	YFMS
069	39.62	13	Y	N	N	Y	N/A	N	Mech	Y	1_2	OFSS
100	2.10	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
101	0.36	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
101	0.01	<35	N	N	N	N	Release	N	LS	N	UL 3A	N/A
102	2.33	<35	N	N	N	N	Cage	N	FNT	N	UL 3A	N/A
103	0.28	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
104	0.18	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
106	4.55	<35	N	N	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
107	0.46	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
108	0.93	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
108	2.09	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
109	0.63	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
109	0.50	<35	N	N	N	N	Release	N	LS	N	UL 3A	N/A
110	0.61	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
112	0.28	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
113	4.66	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
114	0.50	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
115	0.38	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
116	0.24	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
118	7.23	<35	N	N	N	N	Comm	Y	WTY/LS	N	RHCA	N/A
119	0.29	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
120	0.29	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
121	0.66	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
121	0.06	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
122	1.89	<35	N	N	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
122	1.25	<35	N	N	N	N	Comm	Y	WTY/LS	N	RHCA	N/A
123	2.14	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
124	0.54	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
124	0.15	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
125	0.42	<35	N	N	N	N	Comm	Y	WTY/LS	N	RHCA	N/A
126	0.46	<35	N	N	N	N	Comm	Y	WTY/LS	N	RHCA	N/A
127	0.63	<35	N	N	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
128	5.61	<35	N	N	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
129	0.48	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
130	0.02	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
130	0.86	<35	N	N	N	N	Release	Y	LS	N	UL 3A	N/A
131	12.03	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
132	0.62	<35	N	N	N	N	Release	Y	LS	N	UL 3A	N/A
133	0.09	<35	N	N	N	N	Cage	N	FNT	N	RHCA	N/A
133	0.77	<35	N	N	N	N	Cage	N	FNT	N	UL 3A	N/A

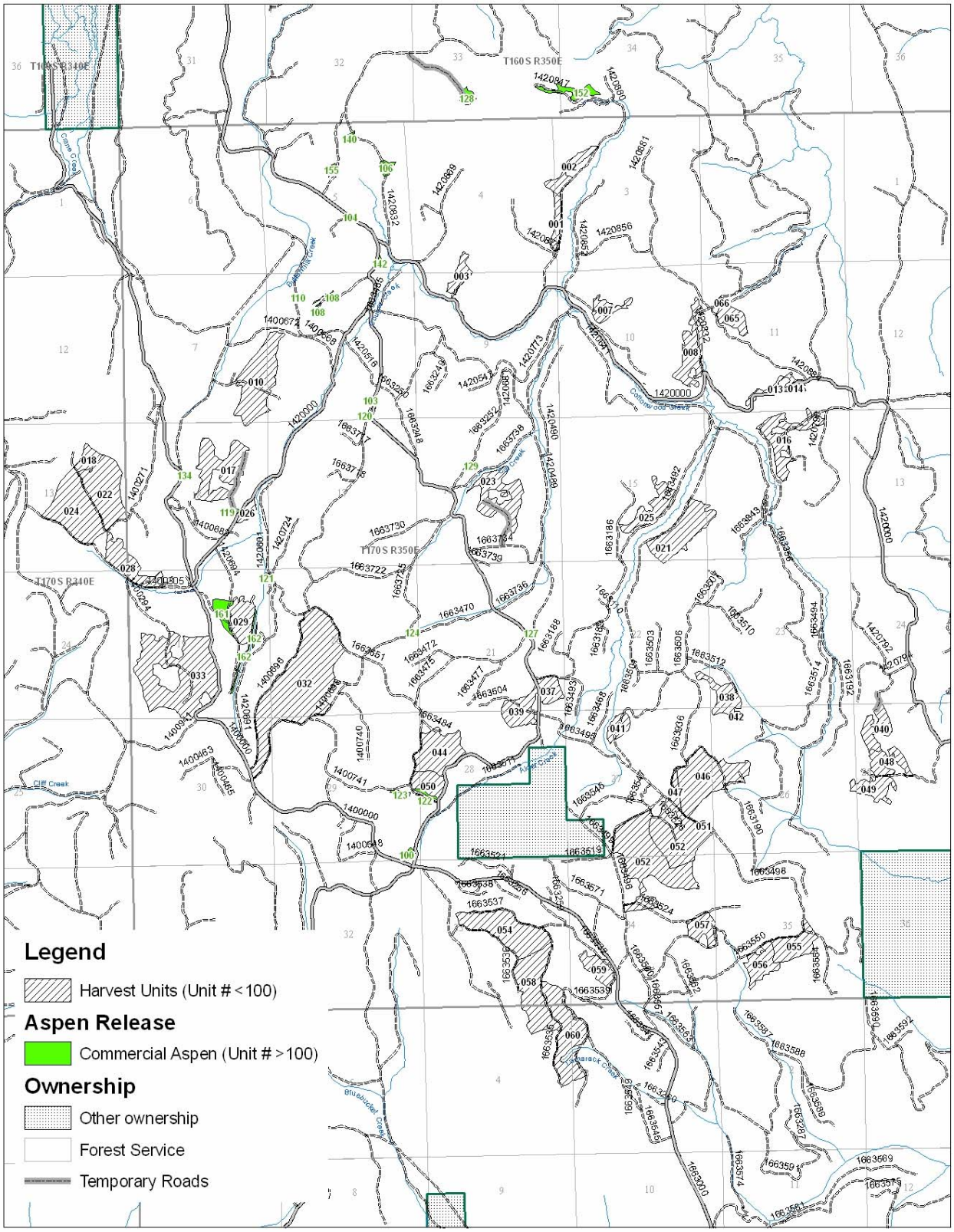
Unit #	Acres	Slope	LOS	HTH	Group Select	SPC	Aspen	FUB	Slash Treatment	Bio-mass	MAs	Structure
134	0.48	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
135	0.25	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
136	0.71	<35	N	N	N	N	Comm	Y	WTY/LS	N	RHCA	N/A
137	0.25	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
138	1.98	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
139	1.24	<35	N	N	N	N	Release	N	LS	N	UL 3A	N/A
140	2.12	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
141	0.37	<35	N	N	N	N	Comm	N	WTY/LS	N	RHCA	N/A
142	1.95	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
142	0.48	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
143	0.41	<35	N	N	N	N	Release	Y	LS	N	UL 3A	N/A
144	1.11	<35	N	N	N	N	Release	N	LS	N	UL 3A	N/A
145	3.60	<35	N	N	N	N	Release	N	LS	N	UL 3A	N/A
146	22.44	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
147	1.80	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
147	1.58	<35	N	N	N	N	Release	Y	LS	N	UL 3A	N/A
148	0.15	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
148	4.20	<35	N	N	N	N	Release	N	LS	N	UL 3A	N/A
149	0.42	<35	N	N	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
150	0.51	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
150	0.59	<35	N	N	N	N	Release	N	LS	N	UL 3A	N/A
151	0.35	<35	N	N	N	N	Release	Y	LS	N	UL 3A	N/A
152	11.07	<35	N	N	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
153	18.05	<35	N	N	N	N	Comm	Y	WTY/LS	N	RHCA	N/A
154	0.88	<35	N	N	N	N	Release	Y	LS	N	UL 3A	N/A
155	1.96	<35	N	N	N	N	Comm	N	WTY/Mech	Y	UL 3A	N/A
156	0.65	>35	N	N	N	N	Release	Y	LS	N	UL 3A	N/A
159	0.07	<35	N	N	N	N	Release	N	LS	N	RHCA	N/A
160	0.33	<35	N	N	N	N	Release	N	LS	N	UL 3A	N/A
161	11.46	<35	N	N	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A
162	3.91	<35	N	N	N	N	Comm	Y	WTY/Mech	Y	UL 3A	N/A

Abbreviations: LOS: Late and Old Structure, HTH: Commercial Thinning, SPC: Precommercial Thinning. Comm: Commercial harvest in an aspen stand. Release: Fall and leave encroaching conifers, FUB: Fuel Underburning, Slash Treatment: WTY: Whole Tree Yarding, LS: Lop and Scatter, Mech: Mechanical treatments, FNT: Fuels no treatment, Hand: Hand piles.

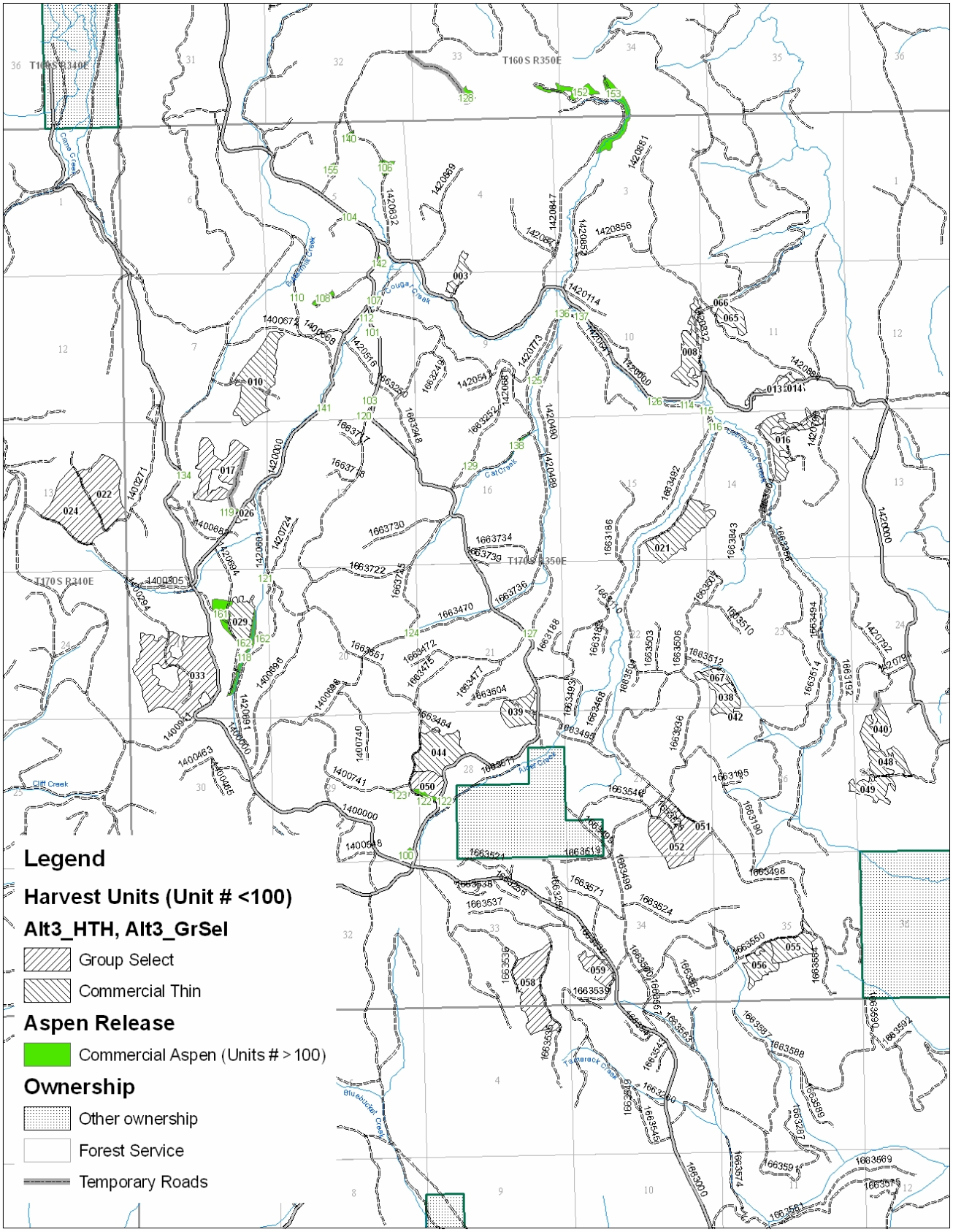
MAs: Management Areas: MA-1: General Forest, MA-2: Rangeland, MA-4A: Big Game Winter Range, UL: Upland, RHCA: Riparian Habitat Conservation Area.

Structure: SEOC: Stem Exclusion Open Canopy, OFMS: Old Forest Multi Strata, UR: Understory Reinitiation, OFSS: Old Forest Single Stratum, SECC: Stem Exclusion Closed Canopy, YFMS: Young Forest Multi Strata.

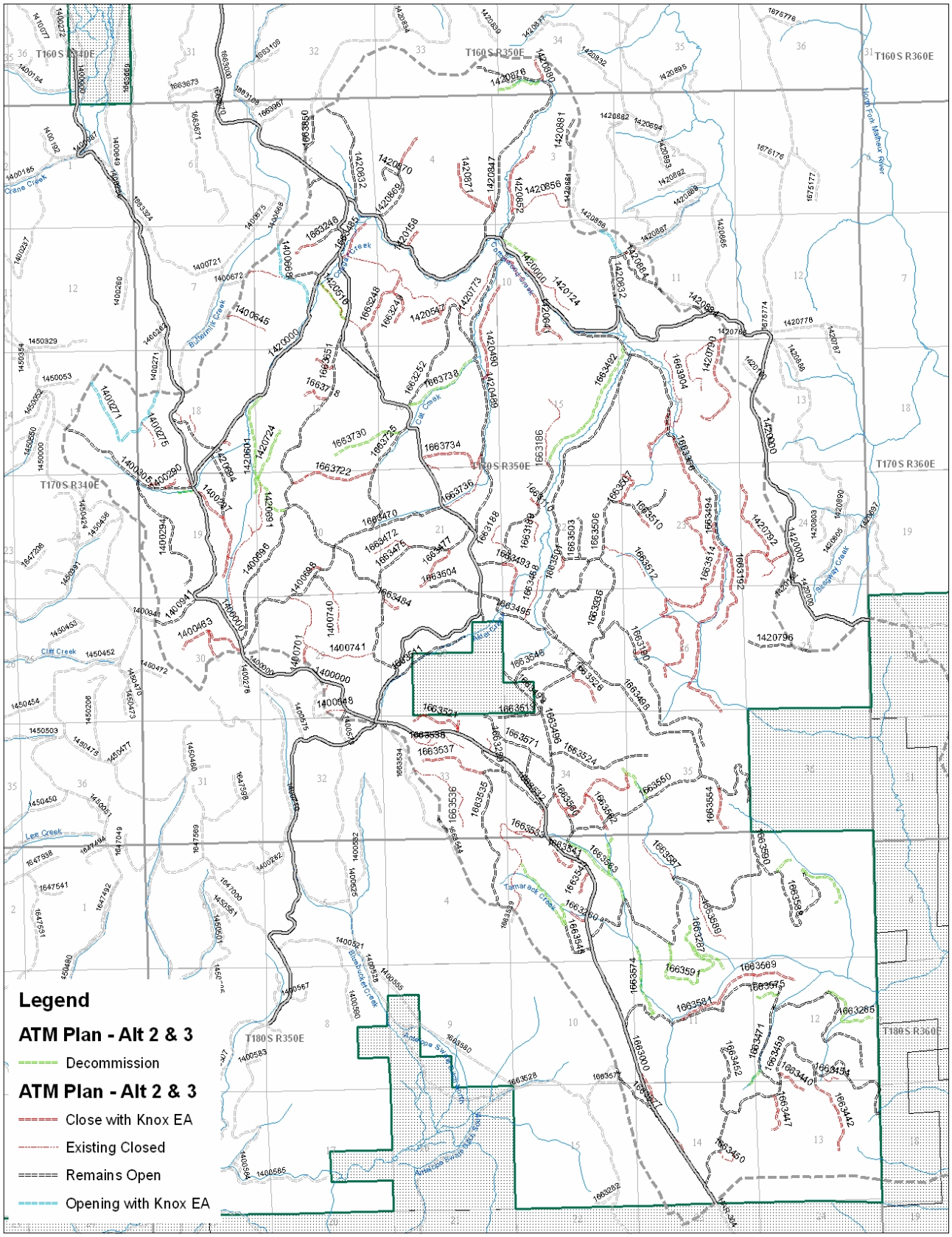
Appendix B – Project Maps



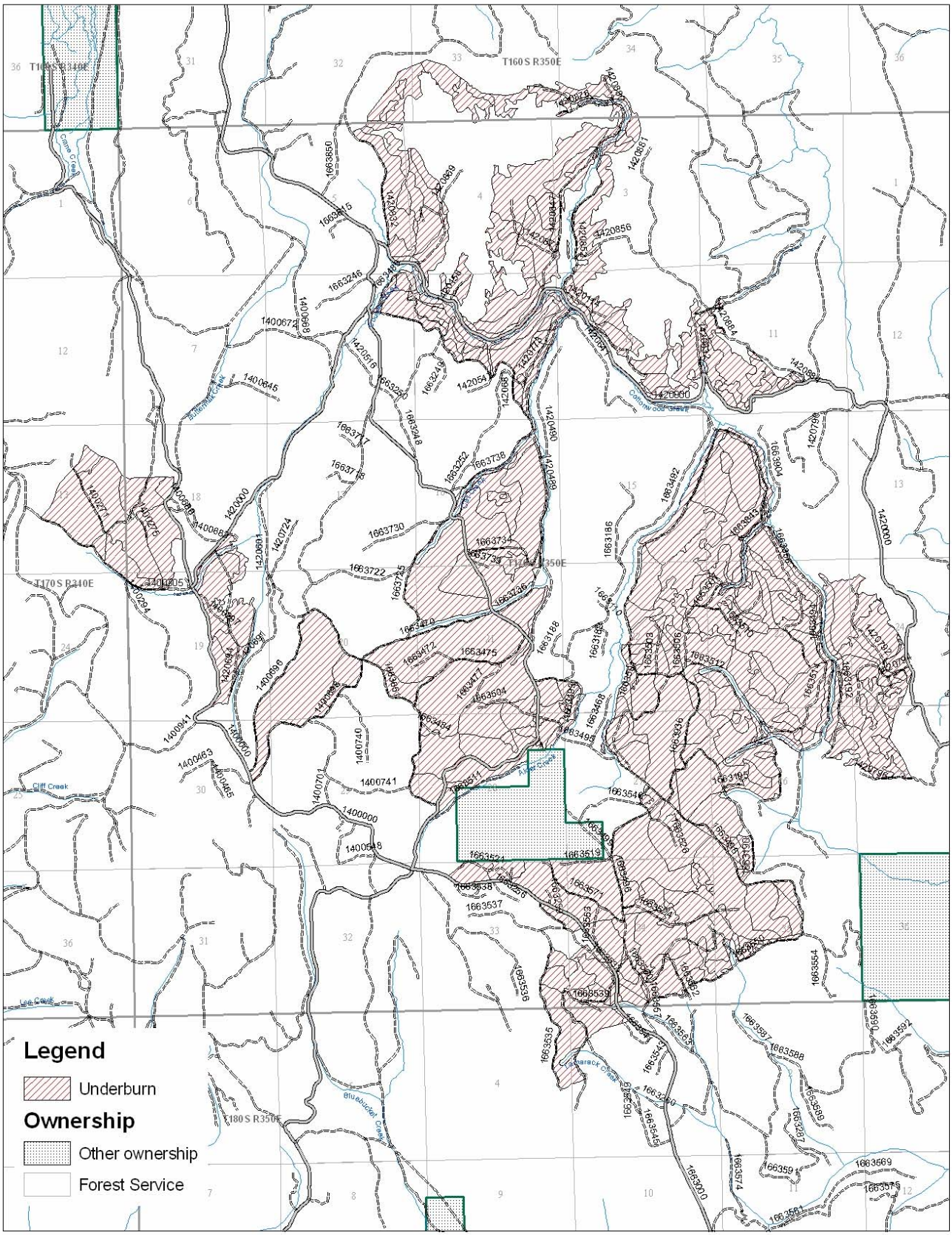
Alternative 2 Harvest Units.



Alternative 3 Harvest Units.



Alternatives 2 and 3 Active Travel Management Map.



Alternative 2 and 3 Prescribed Burning Map.

Appendix C - Cumulative Activities Considered

This appendix discloses actions considered in the cumulative effects sections of each resource in Chapter 3. In most cases, past and ongoing activities are incorporated into each resource's existing conditions because they help explain the current condition of the resource. Past and ongoing activities are also considered in cumulative effects in the context of how past or ongoing actions affect present conditions and how future actions increase, reduce, or do not change these conditions. This list includes all reasonably foreseeable projects expected to occur within each resources' defined scope of analysis (including all projects that overlap each resources cumulative impact area). This listing is consistent with the Council on Environmental Quality guidance letter of June 24, 2005.

Past Activities

Table C-1. Past Timber Sales (Tamarack Creek Subwatershed).

Year	Sale Name	Treatment **	Acres
1978	YOGURT	HPR	282
1983	COTTAM	HFR	1135
1983	GOTCHA	HCR	80
1983	GOTCHA	HFR	417
1983	OTT	HFR	425
1983	OTT	HTH	151
1983	SKAGWAY	HFR	213
1983	TERMITE	HTH	513
1984	GOTCHA	HCC	19
1984	OTT	HCR	24
1984	OTT	HFR	262
1984	OTT	HTH	94
1984	SKAGWAY	HFR	20
1985	COTTAM	HFR	56
1985	OTT	HCR	51
1986	LEFTOVER	HFR	216
1986	LEFTOVER	HPR	581
1986	RIM	HFR	975
1986	THREE_BEAR	HFR	441
1987	COUGAR	HFR	88
1987	LAZY	HFR	93
1987	LAZY	HPR	41
1987	LEFTOVER	HPR	544
1987	THREE_BEAR	HFR	87
1989	COUGAR	HFR	581
1989	COUGAR	HPR	63
1990	PIT	HOR	346
1991	BEARMILK	HOR	91
1991	PIT	HOR	540
1992	ALDER_ED	HPR	98
1996	PANTHER	HOR	17

** Harvest Treatment Definitions

- Commercial Thinning (HTH)
- Regeneration Harvest: even aged management; the stands naturally or artificially regenerated.
  - (HCC) - clearcut
  - (HCR) - seedtree
- Overstory Removal (HOR) - Harvest overstory removal.
- Final Removal (HFR) - final removal of mature overstory to release established immature crop tree that were not a result of a prescribed regeneration cut.
- Partial Removal (HPR)

Table C-2. Past Large Wildfires (Within Last 85 Years).

Year	*Fire Name	Acres	Description
N/A			

Additional small fires have occurred and been suppressed throughout the subwatershed and project area.

Table C-3. Outfitter Guides.

Year	Outfitter	Permit	Outfitter Type	Hunt Unit
N/A				

Table C-4. Noxious Weed Sites and Control.

Year	Activity	Inventoried Sites In Or Near the Knox Project Area	Weed Types	Total Acres of Inventoried Sites
2006 to Present	Annual Treatments	Yes	Canada Thistle Cheat Grass Scotch Thistle	1.4 acres 13.9 acres 3.5 acres

Table C-5. Other Past Activities.

Year	Activity	Description
Early 1800s until 1860	Creighton Wagon Trail	The wagon trail came from the Grande Ronde Valley to Fort Harney through the project area.
Early 1900s	Firewood Cutting	Firewood cutting throughout the project area. Firewood cutting access increased in the 1920s as the existing transportation system was established.
Early 1900s until present	Historic livestock grazing.	The entire Tamarack Creek Subwatershed was grazed by sheep, cattle and horses predating the establishment of the Malheur National Forest. The first documented use was in the 1890s. This use was continued until the 1950s, when grazing allotments where established on the Forest.
1907-1930s	Administrative Sites	Ott Ranger Station was abandoned in the 1930s
1900s until present	Summer Recreation	Within the Tamarack Creek Subwatershed the probability of recreation use was low prior to 1929. Historic recreation use in the Project Area includes hunting, camping, mushroom picking, huckleberry picking, shed antler hunting, Christmas tree cutting, and sight-seeing. In recent years recreational use of ATVs has become prevalent.
1900s until present	Fall Recreation (Hunting and Camping	Big game hunting for deer, elk, bear, and cougar. The Knox Project includes the Beulah Hunting Unit. See the 2008 Oregon Big Game

		Hunting Synopsis for tag numbers for each hunt.
1920s until present	Forest Service road building	First road building was for access for fire fighting. Developing transportation system provided access to miners, loggers, and cattle and sheep ranchers.
1920s until present	Use and maintenance of National Forest Roads	Use and maintenance of approximately 86.3 miles of open roads on National Forest System lands in the Tamarack Creek Subwatershed. Road maintenance includes cleaning of culverts, blading of existing roads, brushing of right of ways.
1970s until present	Winter Recreation Snowmobiling	Forest Road 14 is a groomed snowmobile route with approximately 5 miles of groomed route within the project area and 1420 is an ungroomed route with approximately 3 miles within the project area.
1950s until present	Fire Suppression	Fire suppression activities and rehabilitation.
1990s until present	Road Closures	Road closures in the Phoenix Timber Sale Analysis are ongoing, closures include gates and berms.
Early 1990s	Building check dams in Cottonwood Creek	Rock check dams installed on Cottonwood Creek.

Present or Ongoing Activities (2008)

Table C-6. Present Activities.

Present Activity	Description
Firewood cutting	Same as in past
Livestock grazing	Currently, portions of 4 grazing allotments fall within the Tamarack Creek Subwatershed: Ott Allotment – 430 cow-calf pairs from June 1st to September 30th (2,287 animal unit months: AUMs). Includes 7,252 acres of National Forest lands and 6,654 acres of privately owned land, includes 18,523 acres within the Knox Project Area. Antelope Allotment – 215 cow-calf pairs from June 10th to September 25th (1,013 animal unit months: AUMs Includes 4,187 acres of National Forest lands and 48 acres of privately owned land, includes 48 acres within the Knox Project Area. Bluebucket Allotment – 380 cow-calf pairs from June 1st to September 30th (2,022 AUMs). Includes 5,327 acres of National Forest lands and 176 acres of privately owned lands, includes 176 acres within the Knox Project Area. Spring Creek Allotment – 600 cow-calf pairs or 40 cow-calf pairs and 2,800 ewe-lamb pairs from June 10th to October 25th (3,619 AUM cattle or 2,559 AUM sheep) Includes 4,966 acres of National Forest lands and 1,040 acres of privately owned land, includes 1,040 acres within the Knox Project Area.
Summer, Fall, and Winter Recreation	Same as in past
Use and maintenance of National Forest Roads	Same as in past
Fire Suppression	Same as in past

Foreseeable Activities

Table C-7. Foreseeable Activities.

Year	Approved	Foreseeable Activity	Description
Annual	Yes	Firewood cutting	Same as in the past
Annual	Yes	Grazing	Same as ongoing
Annual	Yes	Summer, Fall, and Winter Recreation	Same as in past
Annual	Yes	Use and maintenance of National Forest Roads	Same as in past
Annual	Yes	Fire Suppression	Same as in the past

Appendix D – Aquatic Biological Evaluation

for

Threatened, Endangered, and Sensitive (TES) Aquatic Species

Prairie City Ranger District

Malheur National Forest

Knox Hazardous Fuels/Forest Health Project

Project Location

A. HUC 4: **Upper Malheur River** (17050116)
B. HUC 5: **Upper North Fork Malheur River** (1705011611) and **Otis Creek** (1705011606)
C. HUC 6: **Crane Creek** (170501161103) and **Tamarack Creek** (170501160601)

Prepared and Reviewed By:

/S/ Scott Cotter Date 8-20-2008

Scott Cotter, District Fisheries Biologist

I. Introduction

This Biological Evaluation (BE) satisfies requirements of Forest Service Manual 2672.4 requiring the Forest Service to review all its planned, funded, executed or permitted programs and activities for possible effects on proposed, endangered, threatened or sensitive species. The BE process is intended to review the Knox Hazardous Fuels / Forest Health Project in sufficient detail to determine effects of alternatives on species in this evaluation and ensure proposed management actions would not:

- Likely jeopardize the continued existence, or cause adverse modification of habitat, for a species that is proposed (P) or listed as endangered (E) or threatened (T) by the USDI Fish and Wildlife Service or NOAA National Marine Fisheries Service; or
- Contribute to the loss of viability for species listed as sensitive (S) by USDA Forest Service, Region 6, or any native or desired, non-native species; nor cause any species to move toward federal listing (FSM 2672.4).

The following sources were used during the prefield review phase to determine the presence or absence of aquatic TES species in the Knox Project Area:

1. Malheur N.F. GIS database
2. Regional Forester's (R6) sensitive animal list (2004, updated 07/2004)
3. ODFW stream survey and fish survey reports
4. Forest Service stream survey reports, Prairie City Ranger District, Prairie City, OR
5. Oregon Natural Heritage Program (ORNHP) database
6. Natural Heritage Conservation database (Biosource)

II. Summary

Table D-1 - Threatened, Endangered and Sensitive (TES) Species Considered in this Analysis of the Knox Hazardous Fuels/Forest Health Project and The Effects Determination for the No Action and Action Alternatives.

Aquatic Species	Status	Occurrence	Alt. 1 No Action	Alternative 2 Proposed Action
Columbia River Bull Trout *Salvelinus confluentus*	T, MIS	HN, N	NE	NE
Columbia River Bull Trout Designated Critical Habitat	D	HN	NE	NE
Mid-Columbia River Steelhead *Oncorhynchus mykiss*	T, MIS	HN, N	NE	NE
Mid-Columbia Steelhead Designated Critical Habitat	D	HN	NE	NE
Chinook Salmon EFH[1]	MS	HN	NAE	NAE
Interior Redband Trout *Oncorhynchus mykiss*	S, MIS	HD, D	MIIH	MIIH
Westslope Cutthroat Trout *Oncorhynchus clarki lewisi*	S, MIS	HN, N	NI	NI
Mid-Columbia River Spring Chinook *Oncorhynchus tshawytscha*	S	HN, N	NI	NI
Columbia Spotted Frog *Rana luteiventris*	S, C	HD, S	MIIH	MIIH
Malheur Mottled Sculpin *Cottus bairdi ssp.*	S	HN, N	NI	NI

[1]Chinook salmon waters are designated Essential Fish Habitat by the Magnuson-Stevens Act.

Status

E	Federally Endangered
T	Federally Threatened
S	Sensitive species from Regional Forester's list
C	Candidate species under Endangered Species Act
MIS	Management Indicator Species
P	Proposed Critical Habitat
D	Designated Critical Habitat
MS	Magnuson-Stevens Act designated Essential Fish Habitat

Occurrence

HD	Habitat Documented or suspected within the project area or near enough to be impacted by project activities
HN	Habitat Not within the project area or affected by its activities
H	Historical Occurrence
D	Species Documented in general vicinity of project activities
S	Species Suspected in general vicinity of project activities
N	Species Not documented and not suspected in general vicinity of project activities

Effects Determinations

Threatened and Endangered Species

NE	No Effect
NLAA	May Effect, Not Likely to Adversely Affect
LAA	May Effect, Likely to Adversely Affect
BE	Beneficial Effect

Sensitive Species

NI	No Impact
MIIH	May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
WIFV	Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
BI	Beneficial Impact

Designated Critical Habitat

NE	No Effect
LAA	May Effect, Likely to Adversely Affect
NLAA	May Effect, Not Likely to Adversely Affect

Chinook Salmon Essential Fish Habitat

NAE	No Adverse Effect
AE	Adverse Effect

III. Project Description

See Chapter 1 of the Knox Hazardous Fuels / Forest Health Project Environmental Assessment (EA) for a complete description of the project area and Chapter 2 for a description of the proposed action, design criteria and mitigation. See Appendix C of the EA for a list of past, ongoing and reasonably foreseeable future projects; all activities on this list have been considered in the cumulative effects analysis for each species in this BE.

IV. Existing Condition of Aquatic Habitat

Aquatic Habitat

Legacy Conditions and Upland Influence

For over 100 years the Tamarack Creek Subwatershed has been subjected to a variety of land-use practices. Practices have included past silviculture treatments, fire suppression, road construction, and livestock grazing on public and private land. These activities have reduced aquatic TES species habitat quality and complexity of streams within the analysis area.

Historically, wildfires within the subwatershed would have had a higher frequency of occurrence, but fires would generally have been of lower intensity than under a fire-suppression strategy. Sediment inputs would probably have been more frequent due to this fire pattern but would have been short-lived as vegetation returned quickly to the burned areas. Wildfire suppression over the past 75 to 100 years has altered natural disturbance regimes that contribute to watershed structure and function. Fire exclusion has caused the build-up of fuels, over-stocking of trees, and has created a situation where the possibility exists for an uncharacteristic wildfire. With a probable historic fire-return interval of 12 years, as many as seven fire events in the may have been eliminated from this ecosystem in the past century.

Data on earlier harvests is incomplete; however nearly all stands within the planning area have received some form of active management in the past 50 years. Past logging within RHCAs reduced canopy cover in some areas, resulting in less shade over streams. These harvest activities likely reduced the amount of LWD in perennial streams within the analysis area. The amount of LWD and coarse wood available for delivery from intermittent drainages during storm events was also likely reduced.

Evidence suggests that fires and disturbance in general can pose greater threats to fishes when their habitats become fragmented and otherwise altered by human activities (Dunham et al. 2003). Other human influences can interact with fire and when taken cumulatively can negatively affect aquatic TES species (e.g. habitat loss, degradation, fragmentation, nonnative species invasions) (Dunham et al. 2003).

Roads can account for most of the sediment problems in a watershed because they are a link between sediment source areas (cut slopes, etc.) and stream channels. They can directly affect the channel morphology of streams by accelerating erosion and sediment delivery and by increasing the magnitude of peak flow (Furniss et al. 1991). Wemple (1994) focused on the interaction of forested roads with stream networks in western Oregon and found that nearly 60% of the road network drained into streams and gullies, and are therefore, hydrologically integrated with the stream network. However, the Knox Project Area has less steep slopes and less precipitation than the western Cascades, and so much less than 60% of the roads drain into streams and gullies. From a qualitative standpoint, the following assumptions can be used as general indicators of sediment delivery risk associated with roads: 1) the higher the road density the higher the potential for sediment yield increases due to the larger acreage of exposed surfaces, 2) the more drainage ways that are crossed the higher probability that direct sediment introduction would occur, and 3) the greater the distance, or higher on the slope, that the road is from the drainage network, the less probability for delivered sediment to occur (erosion may occur but is less likely to be routed to the stream). Road drainage structure, function, and spacing are keys to minimizing the amount of surface flow, which directly affects surface

erosion. The spacing of drain or ditch relief structures depends on the road gradient, road surface and ditch soil types, runoff characteristics, and the effects of concentrated runoff on slopes below the road. Forest Service Handbook and other manuals provide guidelines for drainage structure spacing. Drainage structures should be close together on silt-sand soils with little to no binder on steep slopes and farther apart on gravel road surfaces with moderate binder and little to no fines on flat or minimum grades.

Surface erosion is highly dependant on soils, road surfacing and condition, road grade, traffic volumes, and the effectiveness and spacing of drainage structures. The greatest surface erosion problems occur in highly erodible terrain, particularly landscapes underlain by granitic soils, soils of the Clarno formation, and certain highly fractured or weathered rock types. Granitic soils, soils of the Clarno formation, and highly fractured or weathered rock types do not occur in the Knox Project Area. Studies have found that sediment delivery to stream systems is highest in the initial years after road construction, although raw ditch-lines and road surfaces with little binder can remain chronic sources of sediment. Native surface roads (mostly Maintenance Level 1 and 2 roads) are generally greater chronic sediment sources than surfaced, higher standard roads. Approximately 95% of on-Forest RHCA roads in the Tamarack Creek Subwatershed and approximately 94% of on-Forest RHCA roads in the Knox Project Area are native surface roads. Native surface roads are more likely to contribute fine sediment to streams that can adversely affect aquatic habitat compared to roads with other surface types. Most native surface roads, if used other than during dry or frozen conditions cannot tolerate much traffic without rutting causing other resource problems. Adverse affects to aquatic TES species are more likely to occur where native surface roads are located adjacent to Category 1 streams (Table D-2).

In the interior Northwest, stronghold populations of salmonids are associated with higher-elevation forested lands and the proportion declines with increasing road densities (Quigley et al. 1996). The higher the road density, the lower the proportion of subwatersheds that support strong populations of key salmonids. Specifically, Quigley et al. (1996) shows a strong correlation with road densities of 2 miles/mile^2 or higher and reduction of strong populations of salmonids. Further reductions of strong salmonid populations were identified at densities of 3 miles/mile^2 and 4 miles/mile^2 or greater. Roads in the project area that occur within 100 feet of streams or cross streams commonly impact fish and fish habitat more than roads located in uplands (Table D-2).

Table D-2: Existing Road/Stream Interaction Information.

	Knox Planning Area (Public & Private)[1]				
	Total Road Miles	**Road Miles within 100 ft. of Cat. 1-4 Channels**	**Stream Crossings on Roads (Cat. 1 or 2)**	**Stream Crossings on Roads (Cat. 4)**	**Total Road Density - Open and Closed (Mi/ Mi^2)**
Knox Planning Area	141.7	10.9	11	29	3.7

1 Note: Rounding road miles during calculations may result in minor (0.1) mile discrepancies. This information was derived from the Malheur National Forest GIS.

Total road densities would remain at or below 3.4 miles/mile^2 in the Tamarack Creek Sub-watershed and miles within 100 feet of Category 1-4 channels would remain high (Table 2). There are slightly over 10.9 miles of roads that likely impact streams due to proximity (100 feet

or less). These conditions continue to reduce availability of subsurface cool water storage and have led to streams that are disconnected from their floodplains.

Beaver

Historic beaver sign has been found along portions of the Alder Creek the project area and it is possible that beaver utilize the lower portions of other streams within the analysis area where conditions are suitable. Beaver play a crucial role in the maintenance of stream channels and associated RHCAs. Beaver dams trap sediment, reduce water velocity, and can redistribute water as hypothetic flow. The net effect of beaver dams may be to lower water temperatures by increasing bank storage, which leads to increased base flow levels.

The quality of fish habitat is affected by conditions within the stream channel and riparian areas along the channel. This section presents information on instream conditions. Stream surveys have been completed on four streams within the analysis area; however, recent surveys exist only on Cottonwood, Cat, and Alder Creeks (Table D-3).

Table D-3. Stream Habitat Surveys Conducted in the Knox Project Analysis Area.

Stream	Survey Year	*Agency	RHCA Category	Reach No.'s In the Analysis Area	Surveyed Length (mi.)
Cottonwood Creek	1966	OSGC	1	-	~6.0
Cougar Creek	1966	OSGC	1	-	~3.5
Cat Creek	1966	OSGC	1	-	~1.0
Alder Creek	1966	OSGC	1	-	~3.0
Cottonwood Creek	1989/1997	USFS	1	7	~5.0
Cougar Creek	1989	USFS	1	1	~0.4
Cat Creek	1989/1997	USFS	1	1	~1.0
Alder Creek	1989/1997	USFS	1	2	~1.8

*OSGC=Oregon State Game Commission prior to becoming Oregon Department of Fish and Wildlife

Cottonwood Creek

Many small logjams were noted in Cottonwood Creek during the 1996 survey. It was noted they do not provide obstacles to fish movement (OSGC). At the MNF boundary the valley floor averages approximately 15 yards wide bordered by steep 30 to 45 degree slopes. Mature forest provides dense shade. The stream channel is 10 to 25 feet wide with a moderate gradient. Notes describe the relatively poor quality of pool habitat. Pools are described as averaging 3 to 6 feet wide with a maximum depth never exceeding 1.4 feet. Photos from the 1997 stream survey show numerous large wood pieces providing fish cover and acting to create scour pools. Notes also mention large boulders creating fish habitat.

Cougar Creek

The 1966 survey described Cougar Creek as lacking quality pool habitat and as being an important spawning and rearing stream for small rainbow (OSGC). Speckled dace were collected in the first ¾ of a mile of stream.

Cat Creek

Valley floor is described as 80 yards wide at mouth, narrowing to 20 to 50 feet. Mature forest shades the valley, grass is common and cattle use described as heavy in the 1966 survey (OSGC). Numerous beaver ponds were described in the 1966 survey as averaging 20' by 10' by 3' with very low flows. Aspen were described as common. The 1989 stream survey describes remnant beaver dams and four exclosures.

Alder Creek

The valley floor is 100 yards wide at the mouth and narrows to approximately 30 yards. Canyon walls are moderately steep and covered with mature ponderosa, lodgepole and fir forest. Cattle use was described as moderate to heavy and the stream channel averages 3 feet wide. Throughout portions Alder Creek water is intermittent with never a stretch longer than 500 yards. A field visit in November 2006 found the middle portion of Alder Creek to contain decadent aspen stands and remnant beaver dams. Towards the upper portion of the survey gradient increases slightly, the valley floor narrows and downed logs become common in and around the stream bed.

INFISH RMOs and Forest Plan Amendment 29 DFCs

Important aquatic habitat elements as defined by INFISH and/or Forest Plan Amendment 29 include: 1) pool frequency, 2) water temperature/stream shading, 3) large woody debris, 4) bank stability, 5) width to depth ratio, and 6) embeddedness. These habitat elements are important in maintaining aquatic habitat function and health. Stream survey information was analyzed to compare existing habitat conditions to Forest Plan RMOs/DFCs for aquatic habitat (Table D-4).

Table D-4. Fish Habitat Summary Data for Category 1 Streams in the Knox Project Analysis Area.

Stream Name	Pools/ Mile	Pieces LWD/Mile[4]
Cottonwood Creek[5]	7[2]	37
Cougar Creek[5]	*	17
Cat Creek[6]	*	*
Alder Creek[6]	75[1]	5
INFISH RMO	96[1] 56[2]	20
Amend 29 DFC	75-132[1] 38-66[2]	80-120[3]

Notes: 1) channels of <10 feet in width, 2) channels of >10 to 20 feet in width, 3) mixed conifer ecosystem, 4) Stream survey protocol in 1989 included not only large woody material within the bankfull channel, but also leaning live trees that have the potential to fall into the stream; in 1997 protocol stated not to count leaning logs or trees and also that the tree bole or root swell of live or dead trees must interact with the streamflow at bankfull conditions, 5) 1989, 6) 1997, *Inadequate sample size data suspect.

Pool Frequency

Pool frequency is a gage of aquatic habitat diversity, and is an indicator of the degree to which streams are capable of supporting a varied and complex community of fish species. Pools are important for providing rearing habitat for juvenile fish and cool-water refuge areas for adult fish during periods of low flow and elevated temperatures. Pool spacing varies by channel morphology (Rosgen 1996). Deep pools also provide important habitat for adult Chinook salmon and steelhead trout.

Pool habitat can be reduced where management activities result in reductions of pool forming elements (e.g. LWD), changes in bedload (e.g. large increases in fine sediment), or changes in channel morphology (e.g. widening or straightening).

Stream surveys indicate that the INFISH RMO for pool frequency is not being met in Cottonwood Creek or Alder Creek; however Forest Plan DFC is being met in Alder Creek. Accurate data is not available for Cougar or Cat Creeks. (Table D-4).

Water Temperature/Stream Shading

Water temperature influences the metabolism, behavior, and health of fish and other aquatic organisms. Fish can survive at temperatures near extremes of suitable temperature ranges. However, growth is reduced at low temperatures because all metabolic processes are slowed. At the opposite extreme, growth is reduced at high temperatures because most or all energy from food must be used for maintenance needs. Fish are also more susceptible to diseases near the extremes of suitable temperature ranges.

The Forest Plan water temperature standard is for no measurable increase in maximum water temperature, and maximum water temperatures below 64°F within migration and rearing habitat and below 60°F within spawning habitats (INFISH RMO). In general, juvenile and Chinook salmon, redband trout, and juvenile steelhead will occupy water that is from 55 to 64°F. Upper lethal temperatures for redband trout range from about 80 to 85°F depending on acclimation temperature.

Large Woody Debris

LWD plays an important role in forested stream reaches. LWD aids in dissipating stream energy, trapping sediment and the formation of pools and associated aquatic habitat.

Quantity of LWD in streams can be altered by removal of streamside trees for timber production or salvage of instream pieces. Timber has been harvested from areas adjacent to streams in the analysis area. In extreme cases, large increases in peak flows and/or large increases in channel width can result in destabilization of instream pieces and subsequent transport downstream thus resulting in a decrease in LWD.

Riparian forests, especially individual trees that are within ½ to ¾ tree length of the stream channel, produce LWD that is recruited into a stream where it creates critical habitat features for aquatic species. The Malheur National Forest recognizes the role of LWD. Forest Plan Amendment 29 specifies a range in the number of pieces of LWD to be maintained for each mile of stream in certain ecotypes. In this analysis, the current condition of the riparian zones was rated with respect to near-term (10 to 20 years) LWD recruitment potential.

Stream surveys indicate that the INFISH RMO for large woody debris is being met in Cotton-wood Creek; however Forest Plan DFC for large woody debris is not being met. Stream surveys indicate that neither INFISH RMO nor Forest Plan DFC standards for large woody debris in Cougar Creek and Alder Creek are being met. Accurate data is not available for Cat Creek (Table D-4).

Embeddedness/Fine Sediment

Composition of the stream substrate is an important feature of aquatic habitat. Cobble and gravel substrates provide habitat for a diverse assemblage of benthic macroinvertebrates as well as eggs and early life stages of numerous fish species. Macroinvertebrates represent a substantial portion of the diet available to various fish species.

Filling of interstitial spaces (i.e. the gaps between rocks on the stream bottom) with fine sediment (particles < 2 mm in size) eliminates habitat for many macroinvertebrates. Fish eggs and early life stages can also be buried and smothered when interstitial spaces are embedded with fine sediment.

Embeddedness was not rated in at the time stream surveys were completed (1989) on Cotton-wood Creek, Cat Creek, or Alder Creek.

Embeddedness data is no longer collected during Region 6 stream surveys. Instead, stream substrate data is collected using pebble count procedures. Either methodology can be used to estimate the amount of fine sediment in streams. Adverse impacts to macroinvertebrates and fish can occur where fine sediment exceeds 20% of the surface area of the streambed or embeddedness exceeds 20%.

Fine sediment in streams is a normal component of salmonid habitat; however, major disruption of the system occurs when sediment levels substantially exceed natural levels. Deposition of fine sediment can eliminate habitat for aquatic insects; reduce density, biomass, and diversity of aquatic insects; reduce permeability of spawning gravels; and reduce emergence of fry from redds (Nelson et al. 1991). Studies have shown that an increase in 1-3mm size sand from 20% to 30% can decrease emergent survival of salmonid species from 65% down to 40% (Phillips et al. 1975). Fine sediments are known to impact fry emergence and survival, and fine sediment (<6.5mm in size) levels above 40% can effectively eliminate salmonid populations and many macroinvertebrate species (Everest and Harr 1982).

Increases in fine sediment can occur from both increases in transport of fine sediment from upland areas and from destabilized stream banks. Increases can result from both episodic sources such as wildfires or from chronic sources such a native surface roads. Episodic sources normally result in short-term increases that return to pre-disturbance levels through recovery processes. Chronic sources can result in long-term changes of stream channels and aquatic habitat. Numerous roads in the project area have been identified as potential sources of fine sediment based on field reviews and professional judgment.

Pebble counts were completed during the 1997 stream surveys on Cottonwood Creek and Alder Creek. Pebble counts determined that both Cottonwood Creek (~9% embedded) and Alder Creek (~13% embedded) met Forest Plan standards for cobble embeddedness. Wolman pebble counts were not conducted on Cat Creek or Cougar Creek.

Width-to-Depth Ratio

The Forest Plan DFC/RMO for width-to-depth ratio is based on wetted width and depth. A large wetted width-to-depth ratio indicates wide shallow stream channel morphology. Wide shallow streams are prone to increases in stream temperatures due to their high surface area to volume ratio. Shallow streams also provide little habitat for fish, due to the lack of water depth.

Width to depth ratios can be increased by increases in peak flows, direct bank alteration, or increases in sediment or a combination of these factors. Conversely, reductions in these factors can lead to reductions in width to depth ratios.

Bank Stability

The Forest Plan DFC for stream bank stability is for 90% of the banks to be stable. Channel types differ in their sensitivity to management activities due to differences in bank erosion

potential and the influence of streamside vegetation on bank stability. Data available from the 1993 stream surveys was not adequate to type streams based on Rosgen stream classification; therefore channel typing was not done on any of the streams within the analysis area.

V. Environmental Baseline of Species Considered in this Evaluation: Effects Calls and Rationale by Species and Alternative

On January 31, 2008, Regional Forester Linda Goodman released an updated Sensitive Species List which includes federally listed, federally proposed and sensitive species lists. In the cover letter for the updated species list the Regional Forester states that projects initiated prior to January 31, 2008 may use the updated sensitive species list or the list that was in effect when the project was initiated. The Responsible Official for the project has the authority to decide which list to use. "Initiated" means that a signed and dated document such as a project initiation letter (PIL), scoping letter, or Federal Register Notice for the project exists. The PIL was signed on February 14, 2007. Consequently, the 2004 Regional Forester Sensitive Species list in effect at that time was used for field reconnaissance and the Aquatic BE.

Management Indicator Species, Threatened, Endangered and Sensitive Species

Management Indicator Species (MIS) are species of vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities. Through the MIS concept, the total number of species found within a project area is reduced to a subset of species that collectively represent habitats, species, and associated management concerns. The MIS are used to assess the maintenance of populations (the ability of a population to sustain itself naturally) and biological diversity (which includes genetic diversity, species diversity, and habitat diversity), and to assess effects on species in public demand. Forest Plan Standard 61 (p. IV-32) lists species and gives direction to provide for habitat requirements of MIS species. Aquatic MIS in the project area for the Knox Project include rainbow/redband trout.

Threatened and endangered species are listed under the ESA; whereas, sensitive species are identified by the Forest Service Regional Forester. An endangered species is an animal or plant species that is in danger of extinction throughout all or a significant portion of its range. A threatened species is an animal or plant species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. A sensitive species is an animal or plant species for which species viability is a concern either a) because of current or predicted downward trend in population numbers or density, or b) because of current or predicted downward trends in habitat capability that would reduce a species' existing distribution. Forest Plan Standard 62 (p. IV-32) gives direction to meet all legal and biological requirements for the conservation of threatened and endangered plants and animals. Standard 62 states, "Assess all proposed projects that involve habitat changes or disturbance and have the potential to alter the habitat of threatened, endangered or sensitive plant and animal species." When threatened or endangered species or habitats are present, follow the required biological assessment process, according to the requirements of the ESA (Public Law 93-205). Forest Plan Standard 64 further states, "Meet all consultation requirements with the US Fish and Wildlife Service and state agencies." Effects to aquatic threatened, endangered, and sensitive species are analyzed in the Knox Project Aquatic Biological Evaluation.

One sensitive (TES) salmonid species and one sensitive amphibian species are found in the analysis area:

- Inland Columbia River Basin Redband trout are considered the native, resident form of rainbow trout and they are on the State of Oregon and Region 6 sensitive species list.
- Columbia spotted frogs are also on the State of Oregon and Region 6 Sensitive Species List and are a Candidate for Federal listing under the ESA.

Rainbow/Redband Trout

Redband trout are considered the native, resident form of rainbow trout and they are a Sensitive species on the Region 6 Sensitive Animal List and Oregon's ESA. Redband trout was considered a candidate species for listing under the federal ESA until March 20, 2000 when the decision was made not to list redband trout. In the Cottonwood Creek drainage, the redband species is considered to be Columbia River redband trout. Redband trout within upper Cottonwood Creek may be considered a distinct breeding population due to habitat isolation caused by dam construction (WPN 2004a).

See the Management Plan for a complete discussion of redband trout life history and habitat requirements within the Malheur River Basin. General limiting factors throughout the Malheur River Basin are best described in Hanson et al. (1990) and include nonpoint source pollution, riparian zone conditions, altered streamflow patterns, and unscreened diversions (WPN 2004a). A brief life history is presented here. Most redband trout reach spawning age at three or four years of age, but have been noted to sexually mature as early as age two and as late as age six. Riffle and pool tailouts with well aerated gravels relatively free of sediment are ideal spawning habitats. Redband trout require varying types of habitat throughout the year. Redband trout tend to seek out deep pools during summer months where temperatures may be somewhat cooler. During fall and winter months, redband trout require deep pools with extensive amounts of cover to overwinter (WPN 2004a). Redband trout feed on a variety of types of food items including plankton and aquatic invertebrates, often depending on what's available in their surrounding habitat (WPN 2004a).

Portions of Cottonwood Creek within the analysis area were chemically treated with rotenone on August 27, 1966 (OSGC 1966). According to the Oregon Department of Fish and Wildlife (ODFW), the treatment project on Cottonwood Creek in the mid-1960s centered on Cottonwood Creek Reservoir. The reservoir and a section of the creek upstream from the reservoir were treated with rotenone, in an attempt to eradicate all non-game fish including bridgelip suckers. Hatchery rainbow trout were restocked into the reservoir and may have moved upstream into Cottonwood Creek during high flow years. Observations over the last 17 years by ODFW staff indicate that the reservoir has been dry more years than not (Perkins pers. com. 2007).

Distribution

Information on species occurrence (i.e., presence/absence) was obtained from the MNF GIS, a field visit by the project fisheries biologist on November 6, 2006, first hand information from the ODFW and the Management Plan.

Cottonwood Creek

Redband trout inhabit Cottonwood Creek from below the Forest Service boundary upstream to approximately the mouth of Cougar Creek (approximately 16.5 miles upstream from

Cottonwood Creek Reservoir (OSGC 1966). Much of Cottonwood Creek goes subsurface during summer months and redband trout may take refuge in deeper pools or up tributaries where cool water refugia exist. Redband trout and minnows were observed in scour pools below culverts on Cottonwood Creek (near the mouth of Cougar Creek) and other isolated pools during a field visit in November 2006. They apparently are able to survive in these isolated pools throughout the dry season. Cottonwood Creek was chemically treated on August 27, 1966 to eliminate bridgelip suckers above Cottonwood Creek Dam. This treatment started approximately 16.0 miles upstream from the Cottonwood Creek Reservoir dam.

Cougar Creek

In November 2006, redband trout were observed in Cougar Creek upstream of the culvert crossing on Forest Service road (FSR) 1420. This culvert is passable to adult and juvenile redband trout. A survey completed in 1966 (OSGC) indicates that redband trout were observed in Cougar Creek upstream approximately 3.5 miles from the mouth.

Cat Creek

During a November 2006 survey, redband trout were observed in Cat Creek both upstream and downstream of FSR 489 culvert. A series of dysfunctional log weirs on mainstem Cat Creek upstream from FSR 489 culvert are currently providing hiding cover for adult redband trout. These log weirs do not appear to be barriers to adult migration. During a 1966 survey, redband trout were found in mainstem Cat Creek approximately one mile upstream from the confluence with Cottonwood Creek (OSGC). The eastern tributary to Cat Creek does not contain fish, however caddis fly larvae were observed in perennial portions of this tributary by stream survey crews in 1997. Approximately 1/3 mile upstream from FSR 489 crossing on the eastern tributary is a heavily utilized spring with severe head cuts in several places.

Alder Creek

Just upstream from where FSR 496 crosses Alder Creek, fine gravels have settled out, indicating this culvert is probably undersized. Woody debris has also piled up at the culvert entrance. Redband trout were observed throughout perennial sections of Alder Creek all the way up to just below Billy Pond. A November 2006 field trip found that just upstream from FSR 495 crossing (just below Alder Spring) water trickles from the base of a 13 foot high dam and a spillway exists to accommodate higher flows. A 1966 survey found redband trout up to approximately 1.25 miles from the mouth of Alder Creek (OSGC).

Columbia Spotted Frog

Spotted frogs are highly aquatic and are rarely found far from permanent water. They are usually found along the grassy margins of low gradient streams, lakes, ponds, springs, and marshes.

During winter, spotted frogs burrow into banks adjacent to streams, ponds, and springs. Breeding occurs in the spring varying with elevation. In the Columbia basin of Washington, breeding occurs from March to April in lower elevations, and from May to June in the higher elevations. Breeding habitat is usually found in shallow water in ponds or other quiet waters along streams. Breeding may also occur in flooded areas adjacent to streams and ponds. Adults may disperse overland in the spring and summer after breeding.

Condition and Trend of Population

This species occurs in extreme southeastern Alaska, southwestern Yukon, northern British Columbia, and western Alberta south through Washington east of the Cascades, eastern Oregon, Idaho, and western Montana to Nevada (disjunct, Mary's, Reese, and Owyhee river systems), southwestern Idaho (disjunct), Utah (disjunct, Wasatch Mountains and west desert), and western and north-central (disjunct) Wyoming. Disjunct populations occur on isolated mountains and in arid-land springs. In Oregon, Columbia spotted frogs are widely distributed east of the Cascade Mountains.

USFWS lists livestock grazing and introduction of nonnative fish (salmonids and bass) as threats to the Great Basin population of Columbia spotted frogs (66 FR 1295).

The Columbia spotted frog (*Rana luteiventris*) is on the Regional Forester's Sensitive Species List and is a candidate for Federal listing under the ESA. The spotted frog is considered present in all subbasins on the Malheur National Forest. It is assumed this species is widely distributed in the Upper Malheur Subbasin. Limited habitat surveys have been conducted specifically for spotted frogs; however, habitat probably exists along low gradient perennial streams. Fish surveys record incidental sightings of frogs but most do not differentiate species.

VI. Direct, Indirect and Cumulative Effects

Alternative 1 – No Action

Temperature/Stream Shading

With no vegetative treatments, haul activities or prescribed burning in riparian areas, there would be no short term effect on water temperature. Riparian areas within this planning area are not large enough to act as fire breaks for higher intensity wildfires. Because fuels would remain untreated under this alternative, all streams in the Analysis Area with existing conifer or hardwood shading would be at risk for losing shade and incurring increasing summer water temperatures in the future due to an increasing risk, over time, of an uncharacteristic wildfire. Increased width to depth (W/D) ratios from sediment pulses following such a wildfire could raise stream temperatures by increasing the surface area exposed to solar radiation. Additionally, the immediate water temperature increase resulting from a high intensity fire as it burns through a riparian area (over the stream) can lead to direct mortality of fish and spotted frogs.

Ongoing road maintenance activities located within RHCAs would not reduce existing stream canopy cover so as to adversely affect streamside shading or water temperature. Considering the risk of an uncharacteristic wildfire under the No Action Alternative, there is the slight potential for adverse direct and indirect water temperature affects to aquatic TES species over the long term.

Sediment/Embeddedness

The activities with the highest potential for affecting sediment input to streams are related to road maintenance, or a lack thereof. Road related impacts most likely to contribute high sediment inputs would be plugged culverts leading to washed out road fills, undersized culverts at stream crossings leading to high water velocities and subsequent erosion at culvert outlets, or sediment channeled on road surfaces and routed through road-side ditches and cross-drain culverts to streams. Under this alternative, there would be no road management activities other than routine

road maintenance. This can be considered a no effect, or no change from the existing condition, in the short term, however, at existing funding levels road maintenance is not expected to keep up with all needs. This alternative would not do anything to reduce impacts of the existing road system. Therefore it would be expected that sedimentation from existing open and closed roads would increase over time, unless other projects are implemented to address these impacts.

The quality of fish habitat could be reduced because fuels would remain untreated under this alternative. A high intensity, stand replacement wildfire could result in a scale and severity of effects that is uncharacteristic of this habitat type. Such a wildfire may transport fine ash, remove soil cover, kill bank-stabilizing plant roots, and potentially increase water run-off rates. The quality of fish habitat would decline until vegetation along burned portions of streams recovered (an estimated 5-10 years). Indirectly, given the risk of a high intensity, stand replacement wildfire under the No Action Alternative, a higher erosion potential exists for a certain period following such an event. Intense storm events (greater than a 6 year event) immediately following a wildfire that burned in steep terrain and had large areas of high severity burn may result in concentrated run-off, resulting in more sediment transport directly into fish bearing streams and potentially resulting in increased width-to-depth ratios. This could result in short term adverse affects and a recovery of the stream ecosystem from the effects of fire that is slower, more sporadic, and potentially incomplete, in cases where natural stream processes are already impaired (see below).

As noted by Dunham et al. (2003), the effects of wildfires depend on a variety of factors including their timing, location, area, extent, and intensity. Other factors include the characteristics of the ecosystems and the species affected along with other indirect physical and ecological linkages. While such events can cause short term negative effects, such as those listed below, over long time periods the resulting habitat conditions may be more productive then in areas where natural disturbance has been suppressed (Dunham et al. 2003). Wildfires can have a number of detrimental effects to stream channels such as decreasing stream channel stability, increasing discharge and affecting discharge variability, altering coarse woody debris delivery and storage, increasing nutrient availability, increasing sediment delivery and transport, increasing solar radiation and altering water temperature regimes (Dunham et al. 2003). In cases where natural stream processes are already impaired the recovery of the stream ecosystem from the effects of severe wildfire is likely to be slower, more sporadic, and potentially incomplete (Minshall 2003).

In summary, these future impacts could reach a magnitude of " May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species" for redband trout and Columbia spotted frogs. The short term water temperature increase due to a high intensity fire burning through the riparian area could lead to direct mortality of fish or spotted frogs in the stream(s) at that time. These impacts would not cover a large enough area to result in a WIFV determination for redband trout or Columbia spotted frog (see Table 1 definitions).

Alternative 2 – Proposed Action

Temperature/Stream Shading

Timber harvest units, landings, and all temporary roads would be located outside of RHCAs under Alternative 2. Restricting these activities to areas outside of RHCAs would prevent

adverse impacts to existing stream shading. Hand thinning, prescribed burning, limited pile burning and aspen release is planned for some units within RHCAs. No thinning would occur within 25 feet of perennial streams or within bankfull channel or lower benches, and trees would not be directionally felled into the no cut zone and removed. Additionally, hand piles in RHCAs will be located at least 50 feet away from live and intermittent stream channels and not in riparian vegetation (See Watershed Design Elements). Proposed actions to improve stand conditions by pre-commercial thinning would remove vegetation only from the outer portions of fish-bearing and intermittent RHCAs, consequently there are not expected to be any measurable effects on stream temperature.

Enhancement of approximately 95 acres of aspen stands within both uplands and RHCAs under this alternative would include felling conifers to reduce shading of and competition with young aspen and protecting regeneration from big game and cattle browsing by installing fencing or placement of the fallen material. Generally conifers would be felled where they interfere with the growth of existing aspen or where they block light from reaching aspen sprouts. Conifers may be preferentially felled across streams under the guidance of a hydrologist or other designated specialist. Felled trees may be used for fencing. Residual slash (limbs and tops) from felled trees would be lopped and scattered. Existing large wood debris would be left in place and protected from burning by piling slash away from the debris or by designating ignition locations during prescribed burning. Some aspen stands would be fenced to protect regeneration. Felling of conifers within RHCA aspen stands is not likely to result in measurable increases in stream temperature to fish bearing streams because the aspen overstory would remain intact and the number of conifer to be felled which could act to shade the stream would be minimal.

Prescribed fire activities would occur in RHCAs. Burning activities would mimic low intensity fires that are characteristic of natural burning patterns that tend to occur in riparian areas. This technique would result in a patchy distribution of burned and unburned areas in RHCAs based on the Malheur National Forest's experience with past prescribed burning activities in RHCAs using the same technique. Ignition for underburning would occur within some site specific segments of RHCAs to reduce fuels and to stimulate hardwood developments and would occur under strict burn prescriptions. In other burn blocks, fire from upslope burning units which is within prescription, would be allowed to back into RHCAs. Design elements include retention of at least 95% of stream shade and a goal of less than 5% actual exposed mineral soil within RHCAs. The prescribed burning would occur when moisture and climate conditions would minimize the potential for a high intensity burn. Although some mortality of overstory trees may occur, loss of shade which could affect stream temperature is not expected to occur. Burning in the ponderosa pine communities along fish bearing streams within the Planning Area is expected to be low intensity and rarely kill trees in this fire adapted community. Longer term beneficial effects could result from increased riparian vegetative vigor, as a result of these low intensity, mosaic burns in riparian areas. In a recent study, Beche et al. (2005) found that a fall prescribed fire within the riparian zone of a mixed-conifer forest in El Dorado County, California was patchy in terms of intensity, consumption, and severity. Additionally they found that although 49.4% of all tagged trees (>11.5 cm/4.5 in.) and snags were scorched by the prescribed fire, only 4.4% of all tagged trees were dead one year after the prescribed fire. In general the trees killed by the prescribed fire were small and located near areas of high litter accumulation (Beche et al. 2005).

Water for application (water withdrawals) would come from the following designated water sources: Buttermilk Pit and Crane Creek at FSR 1663. Water withdrawals would be in

accordance with the 2005 Malheur National Forest Road Maintenance Biological Assessment (BA) and NMFS guidance (with the exception that drafting would be permitted before sunrise and after sunset). Use of these procedures would ensure that water withdrawals do not result in a measurable increase in water temperatures.

Road decommissioning and closure actions would not have any immediate effect on shade. Removal of danger trees in RHCAs for closure/decommissioning activities is not anticipated. Conifers would be planted in decommissioned road segments as part of the decommissioning process. Over the long-term (50 to 70 years) shading will increase as planted conifers become established and grow to a size that where they provide shading.

Sediment/Embeddedness

Commercial harvest units, landings, and temporary roads would not be located in RHCAs under Alternative 2. Restricting these activities to areas outside of RHCAs would minimize the potential for sediment delivery to fish bearing streams. There would be soil disturbance associated with commercial thinning and other proposed activities, primarily as a result of tractor skidding, and some subsoiling of skid trails and landings. The risk of sediment from these activities reaching streams providing fish habitat is negligible, due to the likelihood that sediment will remain within unit boundaries as described in the Soils Report. The Soils Report goes on to state that sediment normally is deposited less than 15 feet down slope from skid trails as the water is slowed by ground cover and percolates into the soil. This is true even on slopes up to 45%. In most cases sediment generated from these activities, which has the potential to move off-site during rare large storm events, would be captured in the RHCA buffer.

There is also the potential for generating sediment from non-commercial thinning operations, burning hand piles, and felling trees across streams or close to streams within RHCAs. The risk of sediment from these activities reaching fish habitat is negligible because they do not involve heavy equipment and design elements have been developed to reduce the risk of sediment delivery to streams (See Chapter 2 of EA - Design Elements: Soils, Hydrology, and Fisheries). The felling of conifers less than 21 inches has the potential to generate some sediment and turbidity when felled across perennial streams. Additionally, when bankfull flows occur there is likely to be small amounts of fine sediment generated by erosive action of the high water around or under the felled tree. If felled outside of the instream work window, felling trees into streams has the potential to kill or injure young fish that have not yet emerged from stream gravels. To reduce the risk to redband trout and spotted frogs, all conifers that are preferentially felled into fish bearing streams will be felled under the guidance of a hydrologist or fishery biologist and instream work window will apply.

While high intensity prescribed fire has the potential to result in exposed soil, which in turn poses a potential for sediment transport off-site, the design elements for the proposed prescribed burning in this project would minimize that risk. Burn plan prescriptions would include parameters for weather and fuel moisture conditions, percent duff removal, percent mineral soils exposed, and others, which will set the sideboards to keep fire intensity to a level that would not result in soil loss. The ignition and limited use of fire within RHCAs described above would result in a low risk of generating sediment along perennial streams. Fire lines would not be permitted within RHCAs, thus reducing the risk of sediment being channeled to intermittent or perennial stream channels. Beche et al. (2005) conducted intense post-prescribed fire monitoring (e.g. pebble counts, longitudinal profiles, cross-sections) and observed little to no change in

stream sediment composition 1 year post-fire. Similarly, they observed little to no change in stream channel morphology and no substantial change in erosion or deposition in the surveyed reaches (Beche et al. 2005). The prescribed burning would be expected to burn across Category 4 RHCAs, since these would be dry during the burning operations. However, as mentioned in the Soils Report, because burning would take place so as to avoid decreasing ground cover below Forest Plan standards; the potential for erosion from these areas would not be significant. The potential for some sediment movement in some of these intermittent channels which could reach fish habitat is low, except under rare, intense storm events.

Temporary Road Construction

Approximately 1.56 miles of temporary road are proposed to be constructed. Temporary roads are not part of the Forest road system, and they would be returned to their existing state after use. Personal observations by the soil scientist indicate that sediment generated from temporary road construction and use would be deposited within 50 feet of the road edge (R. McNeil pers. com). All temporary roads are located entirely outside of RHCAs. Because of the location and design elements for these roads, it is not expected that any sediment generated from the construction, use, or "decommissioning" of these roads, would reach fish bearing streams.

Haul Road Use

There will be an opportunity to perform road maintenance on up to approximately 63 miles of Forest roads commensurate with commercial uses associated with project activities. The type of road maintenance activities which may occur on roads used for commercial haul could include:

- Blading and shaping of road surface and ditches
- Blade and shape existing drain dips, grade sags, waterbars and cross ditches
- Constructing one or two waterbars/cross ditches
- Spot rocking in wet areas of road, including some existing drain dips and grade sags
- Minor brushing for road width
- Falling and removal of danger trees from the road prism
- Minor realigning of road junctions
- Repair damaged culverts
- Seeding roadbed after closing/decommissioning a road
- Removing excess materials from roadway
- Removing debris that has sloughed into the roadway
- Removal and replacement of culverts with same size or larger up to 36” in diameter

Because the maintenance work accomplishments will be commensurate with use, the amount actually accomplished will vary depending on existing road conditions, season of use and other factors. When road maintenance work is accomplished, commensurate with use, it would help to ensure that haul roads are kept in an appropriate condition so as to avoid deterioration of conditions and reduce erosion and sediment output from haul roads.

The Malheur National Forest has a policy (with direction from INFISH RF-2) to regulate traffic during wet periods to minimize erosion and sediment delivery. This includes log haul, as well as, any other vehicle traffic. Mitigation measures such as dust abatement (mainly for safety

reasons), hauling on dry or frozen ground, and ceasing haul activities during muddy conditions are highly effective at minimizing sediment input to streams.

Because haul roads would receive pre/during and post haul maintenance, commensurate with use, the magnitude of haul road use on sedimentation is insignificant, and therefore would result in a neutral effect.

Road Maintenance

Roads used within the sale area would receive road maintenance at a level commensurate with use. Road maintenance includes several activities that potentially result in sedimentation from the road prism to the ditch line, or the adjacent slope. Typical road maintenance activities could include: blade and shape road including existing drainage dips, grade sags, and waterbars, repair damaged culverts, place rock in some existing drainage dips and grade sags, place rock in wet areas of road, brushing, remove hazard trees, and dust abatement.

Project design elements and protective measures from the 2005 Malheur National Forest Road Maintenance BA would be followed for the replacement, removal, or installation of ditch-relief culverts.

The longer term effects of road maintenance, commensurate with use, are to maintain or improve existing road conditions. Road maintenance, commensurate with use, may decrease chronic sedimentation in some locations. Improving drainage, removing ruts and rills from the driving surface, and adding less erosive surfacing material would reduce detachment and transport of sediment. This is especially important for roads within RHCAs. Because road maintenance activities would be commensurate with use, it is possible that if winter logging occurs, little to no road maintenance may be necessary and therefore would not occur. Alternatively, if operations occur in the summer, road maintenance, commensurate with use, may occur on all or nearly all of the roads.

Road Reconstruction

The following work is classified as maintenance under the definition listed in the Federal Register but will be listed as reconstruction in any contracts that are signed:

- Widening roadbed to meet standard width
- Constructing new drain dips and grade sags
- Major brushing
- Removing large amounts of excess material
- Rocking roadbed and/or drain dips and grade sags
- Removal and replacement of culverts with the same size or larger culverts greater than 36” in diameter
- Major realignment

Blading and reshaping road surfaces, damaged ditch-relief culverts, applying rocking, constructing new drain dips and waterbars and constructing new outlet ditches would all reduce erosion. Machinery would be kept on the road prism.

Road Closure/Decommissioning Activities

About 38 miles of roads are proposed to be closed or decommissioned within the subwatershed. Closed roads are those roads on which motorized traffic has been excluded by regulation, barricade blockage, or by obscuring the entrance. A closed road is still an operating facility on which motorized traffic has been removed (year-long or seasonal) and remains on the Forest Road Transportation System. Closed roads will be left in a stable condition and maintained. Drainage structures will be self-maintaining after closure. Closure of these roads poses a negligible risk of sedimentation to fish bearing streams because dry land "filtration" lies between the closure sites and any streams, and because the amount of land disturbed during berm or gate construction is too small and too flat to produce significant sediment. However, since these roads are being kept as part of the Forest road system, the benefits of the closures would likely not be "permanent."

Total road density after planned decommissioning would decrease to about 3.40 mi/mi^2 which would result in long-term beneficial impacts to redband trout. The effects of road decommissioning are beneficial effects for water quality and fish habitat, starting about two years after the decommissioning. The improved infiltration and ground cover conditions of the decommissioned roads will help restore natural watershed function, including reduced sediment yield from the road prism.

Cross ditches would be constructed to maintain drainage and reduce the potential for surface erosion. These measures would be implemented during decommissioning to "hydrologically disconnect" the road from streams, to reduce sediment entering streams and affecting fish habitat.

Additional soil stabilization measures that may be used include:

- Scarification or sub-soiling to increase infiltration and facilitate vegetative recovery.
- Seeding with native grass to stabilize soils.
- Planting conifers on decommissioned road segments located in RHCAs where conditions will support establishment and growth.

Road decommissioning activities may result in increases in fine sediment, especially where RHCA road segments are decommissioned. About 1.5 miles of road would be decommissioned within Category 1 RHCAs.

There is a short-term risk of generating sediment during and shortly after decommissioning activities which could reach streams, and could affect fish and fish habitat in those streams. This risk is primarily associated with the scarification, or subsoiling which may be needed on some road segments to discourage vehicle use and improve infiltration. Design criteria include culvert removal guidelines, as well as standard contract clauses, which incorporate BMPs. The proposed design criteria and application of BMPs would reduce the probability and magnitude of this short-term risk.

Due to the proximity of the work to some stream channels, there is a low level of risk of affecting juvenile redband trout rearing habitat.

After about 2 years, the effects of road decommissioning are beneficial effects for water quality and fish habitat. The improved infiltration and ground cover conditions of the decommissioned

roads will help restore natural watershed function, including reduced sediment yield from the road prism.

Road Closure/Decommissioning Activities

Road closure/decommissioning activities are proposed. About 0.7 miles of road would be closed including <0.1 mile in a Category 4 RHCA. Closed roads are those roads on which motorized traffic has been excluded by regulation, barricade blockage, or by obscuring the entrance. A closed road is still an operating facility on which motorized traffic has been removed (year-long or seasonal) and remains on the Forest Road Transportation System. Roads would be closed using gates, signs or berms. Closed roads will be left in a stable condition and maintained.

Road decommissioning results in the removal of a road from the permanent transportation system of the Forest. The impacts of the road on the environment are eliminated or reduced to an acceptable level; the goal is to leave the road in a "hydrologically disconnected" state and convert the former roadway to other resource use. The National Forest Management Act (NFMA) requires "re-establishing vegetative cover" on decommissioned roads within 10 years {16 USC 1608(b)}. To accomplish this, techniques such as posting and installing barriers and barricades, installing drainage structures (e.g., drain dips, waterbars), ripping/subsoiling and seeding, and converting the road to a trail, can be used.

Proposed decommissioning activities would consist of removal of one culvert on FSR 2620156, ripping/subsoiling and seeding herbaceous vegetation, spreading woody debris and slash over the former roadbed, and installing drainage structures to discourage unauthorized motorized vehicle use and ensure proper drainage occurs over time.

Road closure/decommissioning activities would not include removal of trees that could function as LWD in stream channels and therefore reductions in existing pool habitat will not occur. About 1.5 miles of road would be decommissioned within RHCAs. Conifers would be planted in decommissioned road segments in RHCAs as part of the decommissioning process. Over the long-term (70 to 100 years) LWD would increase as planted conifers become established, grow to a size that they would function as LWD, and therefore increase pool habitat in the future.

Chemical Contaminations/Nutrients

The Forest Service would require the purchaser to adhere to all requirements within the timber sale contract related to oil spills and hazardous substances. Refueling and fuel storage sites would be located at least 150 feet away from live streams. Other chemicals used may include saw gas and oil, and fuels used to ignite fires. All have the potential to adversely affect aquatic TES species, if they were to enter nearby stream systems. Handling procedures and spill plans would minimize the risk of potential effects. In the event of the need for fire suppression actions, no chemicals or retardant would be used within 300 feet of water or wetlands. There is minimal risk of an accidental spill from logging equipment, vehicles used to transport crews, equipment, ignition materials, or fire suppression activities in the event of an escaped prescribed burn.

Beche et al. (2005) found that ash deposition from the prescribed fire appeared to have a minimal impact on stream water chemistry with increases in some water chemistry parameters (SO4-, total P, CA2+, and Mg2+). It should be noted that their study area had low to moderate hillslopes and so accelerated erosion and ash delivery would not be expected. It might be expected that these same water chemistry parameters would also increase with the proposed prescribed burning in this alternative, at least temporarily.

Dust abatement procedures would adhere to the Road Maintenance Specification in the Dust Abatement plan. Only water would be used for dust abatement, as needed, during periods of heavier vehicle use associated with commercial timber harvest activities and/or rock haul activities. Water for application would come from the following designated water sources: Buttermilk Pit and Crane Creek at FSR 1663.

Because handling procedures, refueling restrictions and spill plans would be in place and there is a low probability of a fuel spill when lighting in RHCAs, there is a neutral effect of the project to streams from chemical or nutrient contamination. No change to baseline levels of nutrients or chemical contaminants are expected.

Large Woody Debris (LWD)

Felling of danger trees for human safety along haul routes in RHCAs has the potential to reduce the supply of LWD to stream channels and therefore pool habitat. Under INFISH, trees may be felled in RHCAs when they pose a safety risk (INFISH Standard RA-2). All trees felled in RHCAs for safety reasons would be kept on site in accordance with INFISH Standard RA-2 to meet woody debris objectives. Proposed road maintenance and haul activities would not likely result in a reduction of LWD to Category 1, 2, or 4 stream channels because in most cases, trees that can only safely be felled across the road, often have a lean away from the stream channel and would be less likely to fall into stream channels where they could function in the formation of pools and/or contribute coarse particulate organic matter directly to the stream.

Prescribed fire activities would occur in RHCAs. Burning activities would mimic low intensity fires that are characteristic of natural burning patterns in riparian areas. This technique would result in a patchy distribution of burned and unburned areas in RHCAs. Using these techniques, mortality of understory trees may occur in burned patches but few overstory trees would be killed. Fire intensities would not be high enough to consume trees or downed wood large enough to function as LWD (> 20" dbh) in stream channels therefore burning activities would not result in a reduction of pool habitat. Consumption of coarse wood near stream channels greater than 4"dbh would be minimized. Beche et al. (2005) found that prescribed fire did not change the amount or movement of LWD in their study reach relative to unburned streams. They did note, however, that in other less intensely studied reaches snags fell into the stream channel.

There may be an increase of downed wood in the riparian areas contributing to stream function as conifers are cut and left. There is a neutral or slightly positive effect to LWD and its recruitment from the project because instream wood will not be physically removed from RHCAs where it has the potential to fall into live streams, snags may fall into streams as a result of prescribed fire activities, and as a result of aspen treatments LWD may be felled into the stream under this alternative. Some roadside danger trees may be felled into stream channels, ephemeral draws or floodplains, and the reduction in stocking densities following burning activities may increase the vigor of larger trees in the overstory.

Alternative 3 – Alternative Action

Temperature/Stream Shading

All landings and all temporary roads would be located outside of RHCAs under Alternative 3. Restricting these activities to areas outside of RHCAs would prevent adverse impacts to existing stream shading. Hand thinning, prescribed burning, limited pile burning and aspen release is

planned for some units within RHCAs. Potential effects would be the same as those described for Alternative 2. Water withdrawals and road decommissioning would also occur under Alternative 3 and potential effects would be the same as described under Alternative 2.

Enhancement of approximately 60 acres of aspen both upland and within RHCAs would occur under this alternative and would include felling conifers to reduce shading of and competition with young aspen and protecting regeneration from big game and cattle browsing by installing fencing or placement of the fallen material. Felling of conifers within RHCA aspen stands would not result in increases in stream temperature to fish bearing streams because the aspen overstory would remain intact and the number of conifer to be felled which could act to shade the stream are minimal. Under Alternative 3, commercial conifer removal would occur in 35 RHCA acres (4% of RHCAs in the subwatershed). Felled trees adjacent to or contributing to stream function would not be removed. Trees that are removed would be surplus to the needs and function of the riparian area. Stream shading should not be affected because the aspen overstory will remain intact and the number of conifer to be felled and/or removed that contribute to stream shading are minimal. The re-introduction of fire should also increase aspen sprouting and will accelerate habitat for beaver.

Sediment/Embeddedness

All landings and all temporary roads would be located outside of RHCAs under Alternative 3. Restricting these ground disturbing activities to areas outside of RHCAs, along with erosion control BMPs for skidding, roads, and temporary roads, would prevent additional increases in existing levels of fine sediment from these activities. INFISH RHCA buffer widths were designed to trap fine sediment that may be generated from upslope activities such as timber harvest. All temporary roads would be decommissioned after use. Decommissioning would eliminate future use of the road with the objective of restoring hydrological function. This will include subsoiling and seeding as necessary. As described in the Soils Report, road closure would have no effect on soil and road decommissioning would partially restore the productivity of a tiny amount of land. Effects from constructing 1.14 miles of temporary road, haul road use, road maintenance, road closure, road decommissioning, prescribed fire would be similar to those described under Alternative 2.

There will be an opportunity to perform road maintenance on up to approximately 48 miles of Forest roads commensurate with commercial uses associated with project activities. As with Alternative 2, because the maintenance work accomplishments will be commensurate with use, the amount actually accomplished will vary depending on existing road conditions, season of use and other factors. When road maintenance work is accomplished, commensurate with use, it would help to ensure that haul roads are kept in an appropriate condition so as to avoid deterioration of conditions and reduce erosion and sediment output from haul roads.

Because haul roads would receive pre/during and post haul maintenance, commensurate with use, the magnitude of haul road use on sedimentation is insignificant, and therefore would result in a neutral effect.

As with Alternative 2, total road density after planned decommissioning would decrease to about 3.40 mi/mi^2 which would result in long-term beneficial impacts to redband trout. The effects of road decommissioning are beneficial effects for water quality and fish habitat, starting about two years after the decommissioning. The improved infiltration and ground cover conditions of the

decommissioned roads will help restore natural watershed function, including reduced sediment yield from the road prism.

Cross ditches would be constructed to maintain drainage and reduce the potential for surface erosion. These measures would be implemented during decommissioning to "hydrologically disconnect" the road from streams, to reduce sediment entering streams and affecting fish habitat.

Additional soil stabilization measures that may be used include:

- Scarification or sub-soiling to increase infiltration and facilitate vegetative recovery.
- Seeding with native grass to stabilize soils.
- Planting conifers on decommissioned road segments located in RHCAs where conditions will support establishment and growth.

Road decommissioning activities may result in increases in fine sediment, especially where RHCA road segments are decommissioned.

There is a short-term risk of generating sediment during and shortly after decommissioning activities which could reach streams, and could affect fish and fish habitat in those streams. This risk is primarily associated with the scarification, or subsoiling which may be needed on some road segments to discourage vehicle use and improve infiltration. Design criteria include culvert removal guidelines, as well as standard contract clauses, which incorporate BMPs. The proposed design criteria and application of BMPs would reduce the probability and magnitude of this short-term risk.

Due to the proximity of the work to some stream channels, there is a low level of risk of affecting juvenile redband trout rearing habitat.

After about 2 years, the effects of road decommissioning are beneficial effects for water quality and fish habitat. The improved infiltration and ground cover conditions of the decommissioned roads will help restore natural watershed function, including reduced sediment yield from the road prism.

In summary, the risk of sediment from Alternatives 2 or 3 reaching streams providing fish habitat is negligible, due to the likelihood that sediment will remain within unit boundaries or would be deposited within 15 feet of skid trails, the fact that all temporary roads would be located outside of RHCAs, and the likelihood that sediment generated from temporary road construction and use would be deposited within 50 feet of the road edge. In most cases sediment generated from proposed activities, which has the potential to move off-site during rare large storm events, would be captured in the RHCA buffer. The overall effect of the proposed action to the baseline conditions of sediment is that the negligible effects over the short or long term would be insignificant to measurably increase the baseline levels of sediment in spawning or rearing habitat of redband trout.

The effects determination for Alternatives 2 and 3 is “May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species” for redband trout and spotted frogs with beneficial long-term impacts to redband trout (see Table 1).

Cumulative Effects

Cumulative Effects under All Alternatives

All of the activities in the EA, Appendix C (past activities, past wildfires, present activities, and foreseeable activities) and the current project proposal have been considered for their cumulative effects on aquatic habitat and associated aquatic species. The following discussion focuses on the past, ongoing and foreseeable future activities that may contribute positive or negative effects. The analysis area for aquatic species and the cumulative effects boundary are the same as used for aquatic habitat.

Past actions include logging, roads, fuel treatments, fire suppression, grazing, firewood cutting, and Off Road Vehicles. The effects of these past actions are described in the "Existing Condition" section above. Ongoing actions, such as grazing, firewood cutting, and ORV use, would continue to compact a negligible amount of soil, at about the same rate as in the past. This compaction would be counter-balanced by recovery from similar impacts in the past, so the level of detrimental impacts from these ongoing and foreseeable actions would remain at about current levels. Road building, grazing, and lack of disturbance from beaver and low intensity, high frequency fires have all had negative effects on the stream and riparian systems in the Tamarack Creek Subwatershed. These conditions have led to streams that are disconnected from their floodplains and a reduction of subsurface cool water storage.

This project will not result in measurable increases in stream temperature or fine sediment to fish bearing streams, and there will be no removal of trees that contribute to the function and health of the streams. This project attempts to begin restoration of stream function by releasing aspen and re-introducing fire to the ecosystem. There are not likely to be adverse cumulative effects from implementation of this project.

If a wildfire occurs, the hazard of erosion would greatly increase on severely burned areas due to inadequate ground cover and possibly hydrophobic soil. In addition nutrients and organic matter would be lost and redband trout or spotted frogs may die after exposure to high water temperatures as a result of wildfire passing over the stream(s).

Appendix C has been reviewed and lists no foreseeable future actions, except continuation of ongoing actions.

Alternatives 2 and 3

These cumulative effects are in addition to those discussed under Alternative 1. As described in the Fire/Fuels Specialist Report, Alternatives 2 and 3 would break up the continuity of hazardous fuels across the project area, thereby reducing the increased potential for uncharacteristic, crown fire behavior across the project area.

Under the proposed action, commercial/precommercial thinning, log and rock haul, prescribed burning, and road maintenance may result in negligible increases in fine sediment; however it is unlikely that these increases would result in cumulative adverse effects when combined with other past, ongoing, or future actions.

Short-term increases in fine sediment from prescribed burning are unlikely to result in measurable increases in fine sediment in stream channels. Timber harvest units, landings, and all temporary roads would be located outside of RHCAs under Alternative 2. Restricting these

activities to areas outside of RHCAs would prevent adverse impacts to existing stream shading and reduce the chance of sediment input to streams.

Of the activities proposed under Alternatives 2, only prescribed burning, pile burning, limited pre-commercial thinning, and certain road maintenance and haul activities could affect sediment input to fish bearing streams. Under Alternative 3 there is a slight risk of generating sediment from commercial conifer removal in 35 RHCA acres. However, this risk is minimal because felled trees adjacent to or contributing to stream function would not be removed and trees that are removed would be surplus to the needs and function of the riparian area. Additionally, commercial and precommercial thinning within 10 feet of the intermittent stream channels or within 25 feet of the live stream channels would be avoided where there is a potential for adverse effects. All other activities would occur outside of RHCAs, and associated buffering should be sufficient to trap any mobilized soil resulting from external ground disturbance. Prescribed burning, as described in the direct and indirect effects section, could creep down to streams and remove soil cover and although ground cover would decrease, especially during fall burns, effects from prescribed burning would be minor. Burning would take place so as to avoid decreasing ground cover below Forest Plan standards, so erosion would not be significant (see Soils Resources Report). As a result, the cumulative increase in sediment would likely be brief and not measurable. Consequently no cumulative effects on Cottonwood Creek, Alder Creek, Cat Creek or Cougar Creek are expected to develop from the proposed activities following common run-off events.

General Water Drafting Guidance for Road Maintenance and Non-Emergency Fire Use for Watersheds with Anadromous Fish in the Blue Mountain Tri-Forest Area

Within the Blue Mountain Tri-Forest area (Malheur National Forest, Umatilla National Forest, and Wallowa Whitman National Forest), water drafting regularly occurs to accomplish road maintenance activities as well as control fires. Because of the wide distribution of Endangered Species Act (ESA) listed anadromous salmonids within the Tri-Forest area, and frequency of drafting water for Federal activities, there is potential for water drafting activities interfering with ESA listed anadromous salmonids. This is particularly true in northeast Oregon where streams used for water are small and support ESA-listed anadromous salmonids.

Water drafting for road maintenance activities can happen at any time of the year, though the largest water withdrawals typically occur in spring. Water is used to soften soil for road shaping, grading, and rocking. These activities usually involve tanker trucks ranging from 500 gallons to 3500 gallons which fill their tanks from local surface water sources and distribute water on roads as they drive. Most tankers used for this application are equipped with power take off (PTO) pumps which are powered by the vehicles engine. PTO pumps for these types of tankers typically range from about 150 gallons per minute (gpm) (approximately 0.3 cubic feet per second (cfs)) to about 550 gpm (approximately 1.2 cfs) and are often not capable of varying pump rates. Because these types of pumps are capable of removing large volumes of water at high rates, and streams available for water drafting are often small, it is important to avoid or minimize the potential to harm or harass ESA listed anadromous salmonids.

Water drafting for prescribed fire use can vary from use of small pumps (less than 40 gpm/ 0.1 cfs) for direct use with hoses to larger pumps as described above for filling tanks or water tenders.

Regardless of pump rate, physical damage to redds, spawning adults, or juveniles can occur from incorrect placement of water drafting equipment. Proper equipment handling and placement in sensitive areas is important to reduce the likelihood of direct harm of ESA listed anadromous salmonids.

This document provides guidance for water drafting activities mainly associated with road maintenance and non-emergency fire suppression activities in the Blue Mountain Tri-Forest area (Umatilla, Malheur, and Wallowa Whitman National Forests). The goal is to create an understandable and workable protocol that will allow water drafting to occur while avoiding or minimizing risks to Endangered Species Act (ESA) listed fish.

The following guidance is intended to minimize or avoid adverse effects to listed fish in the Blue Mountain Tri-Forest area when engaging in water drafting activities. As with any activity, site specific or project specific information may require more stringent or relaxed criteria to avoid adverse effects. In addition, compliance with these criteria may not minimize adverse effects to avoid take of listed fish in all cases, and therefore does not preclude the need for consultation. Projects will be reviewed on a case by case basis to ensure that guidance is reasonable, prudent, and adequately avoids or minimizes adverse effects to listed species.

Any intake used for drafting water will be screened according to NOAA Fisheries Juvenile Fish Screen Criteria for Pump Intakes for salmonid fry (see Appendix B).

Non-stream water (i.e. ponds) sources will be used prior to the use of stream sources whenever feasible. When non-stream sources are unavailable, streams with the greatest flow will be used whenever feasible.

Water withdrawal will not reduce stream flow by more than 1/10th. In order to accomplish the lowest reduction of flow from marginal water sources (sources in which water drafting will reduce flows by more than 5%), the lowest drafting rate on pumps that have adjustable draft rates, and the smallest volume tender appropriate for the project will be used. Whenever feasible, marginal water sources will be avoided.

During drafting, streams will be monitored for reduced flows. If a flow concern is identified, operators will reduce pumping rates to ensure that flow reduction is not more than 1/10th of the existing stream flow is being removed or discontinue drafting.

If marginal water sources are used, withdrawal from single marginal sites will be limited to 18,000 gallons per day.

No more than one high-volume pump per site will be used, except sites in which the use of multiple pumps will not measurably decrease stream flows.

To avoid disturbing fish that may be spawning, no drafting will occur from any pools which contain adult salmonids.

Operators will avoid direct effects to redds or pre-emergence alevins by placing the intake hose in the deepest part of a drafting pool (where redds are unlikely to be present) and will avoid placing equipment on areas that redds are known or suspected to be. Operators will also ensure that tailout areas of pools that are known or suspected to have redds will not be dewatered.

Blading, shaping, aggregate placement, and dust control should be performed in spring and early summer when flows are high, to take advantage of available road soil moisture content to minimize the need for water drafting. Exceptions during the low-flow period will be limited to roads receiving heavy summer through fall traffic creating hazardous road surface conditions that require maintenance for human safety reasons. Essential maintenance during low-flow conditions will be deferred, when possible, until fall precipitation reduces the need for water drafting. Spring and fall blading and shaping will minimize demands for water usage, will minimize dust production, and will reduce sediment generated from surface erosion.

USFWS and District Fishery Biologist/Hydrologist may periodically review drafting activities to ensure that these measures are adequate for the protection of listed fish.

NMFS Juvenile Fish Screen Criteria for Pump Intakes

Developed by: National Marine Fisheries Service, Environmental & Technical Services Division Portland, Oregon, May 9, 1996

The following criteria serve as an addendum to current National Marine Fisheries Service gravity intake juvenile fish screen criteria. These criteria apply to new pump intake screens and existing inadequate pump intake screens, as determined by fisheries agencies with project jurisdiction.

Definitions used in pump intake screen criteria

Pump intake screens are defined as screening devices attached directly to a pressurized diversion intake pipe. Effective screen area is calculated by subtracting screen area occluded by structural members from the total screen area. Screen mesh opening is the narrowest opening in screen mesh. Approach velocity is the calculated velocity component perpendicular to the screen face. Sweeping velocity is the flow velocity component parallel to the screen face with the pump turned off.

Active pump intake screens are equipped with a cleaning system with proven cleaning capability, and are cleaned as frequently as necessary to keep the screens clean. Passive pump intake screens have no cleaning system and should only be used when the debris load is expected to be low, and if a small screen (less than 1 CFS pump) is over-sized to eliminate debris impingement, and where sufficient sweeping velocity exists to eliminate debris build-up on the screen surface, and if the maximum diverted flow is less than .01% of the total minimum streamflow, or the intake is deep in a reservoir, away from the shoreline.

Pump Intake Screen Flow Criteria

The minimum effective screen area in square feet for an active pump intake screen is calculated by dividing the maximum flow rate in cubic feet per second (CFS) by an approach velocity of 0.4 feet per second (FPS). The minimum effective screen area in square feet for a passive pump intake screen is calculated by dividing the maximum flow rate in CFS by an approach velocity of 0.2 FPS. Certain site conditions may allow for a waiver of the 0.2 FPS approach velocity criteria and allow a passive screen to be installed using 0.4 FPS as design criteria. These cases will be considered on a site-by-site basis by the fisheries agencies.

If fry-sized salmonids (i.e. less than 60 millimeter fork length) are not ever present at the site and larger juvenile salmonids are present (as determined by agency biologists), approach velocity shall not exceed 0.8 FPS for active pump intake screens, or 0.4 FPS for passive pump intake

screens. The allowable flow should be distributed to achieve uniform approach velocity (plus or minus 10%) over the entire screen area. Additional screen area or flow baffling may be required to account for designs with non-uniform approach velocity.

Pump Intake Screen Mesh Material

Screen mesh openings shall not exceed 3/32 inch (2.38 mm) for woven wire or perforated plate screens, or 0.0689 inch (1.75 mm) for profile wire screens, with a minimum 27% open area. If fry-sized salmonids are never present at the site (by determination of agency biologists) screen mesh openings shall not exceed 1/4 inch (6.35 mm) for woven wire, perforated plate screens, or profile wire screens, with a minimum of 40% open area.

Screen mesh material and support structure shall work in tandem to be sufficiently durable to withstand the rigors of the installation site. No gaps greater than 3/32 inch shall exist in any type screen mesh or at points of mesh attachment. Special mesh materials that inhibit aquatic growth may be required at some sites.

Pump Intake Screen Location

When possible, pump intake screens shall be placed in locations with sufficient sweeping velocity to sweep away debris removed from the screen face. Pump intake screens shall be submerged to a depth of at least one screen radius below the minimum water surface, with a minimum of one screen radius clearance between screen surfaces and adjacent natural or constructed features. A clear escape route should exist for fish that approach the intake volitionally or otherwise. For example, if a pump intake is located off of the river (such as in an intake lagoon), a conventional open channel screen should be considered, placed in the channel or at the edge of the river. Intakes in reservoirs should be as deep as practical, to reduce the numbers of juvenile salmonids that approach the intake. Adverse alterations to riverine habitat shall be minimized.

Pump Intake Screen Protection

Pump intake screens shall be protected from heavy debris, icing and other conditions that may compromise screen integrity. Protection can be provided by using log booms, trash racks or mechanisms for removing the intake from the river during adverse conditions. An inspection and maintenance plan for the pump intake screen is required, to ensure that the screen is operating as designed per these criteria.

Appendix E – Knox Road List

Road #	Miles	Existing Condition	Remain Open	Remain Closed	Proposed Closures	Proposed Decom.	Reasons for Closures and Decommissioning	Re-Opening of Closed Roads	Reasons for Re-Opening a Closed Road
1400000	1.90	Open	1.90						
1400000	0.52	Open	0.52						
1400000	0.67	Open	0.67						
1400000	0.10	Open	0.10						
1400271	1.09	Open					Previously Closed under Phoenix EA, but wasn't changed in INFRA Database	1.09	Fire, Admin., Public Access
1400275	0.23	Open		0.23			Previously Closed under Phoenix EA, but wasn't changed in INFRA Database		
1400283	0.09	Closed		0.09					
1400290	0.14	Open			0.14		Watershed and Sedimentation		
1400292	0.09	Open			0.09		Watershed and Sedimentation		
1400294	1.12	Open	1.12						
1400296	0.15	Open				0.15	Sedimentation		
1400297	0.32	Open			0.32		Big Game Security		
1400305	1.23	Open	1.23						
1400463	0.63	Open			0.63		Big Game Security and DOG		
1400465	0.23	Open			0.23		Big Game Security and DOG		
1400548	0.24	Closed		0.24					
1400573	0.10	Open	0.10						
1400645	0.34	Open		0.34			Big Game Security Previously Closed under Phoenix EA, but wasn't changed in the INFRA Database		
1400668	0.64	Open					Previously Closed under Phoenix EA, but wasn't changed in INFRA Database	0.64	Fire, Admin., Public Access
1400672	0.30	Open		0.30			Big Game Security Previously Closed under Phoenix EA, but wasn't changed in INFRA Database		
1400682	0.48	Open	0.48						
1400685	0.18	Closed		0.18					
1400688	0.12	Closed		0.12					
1400696	1.26	Open	1.26						

1400698	1.32	Open	1.32						
1400701	0.14	Open			0.14		Big Game Security		
1400702	0.11	Open			0.11		Big Game Security		
1400740	0.37	Closed		0.37					
1400740	0.19	Open	0.19						
1400741	1.13	Closed		1.13					
1400941	0.43	Open	0.43						
1420000	2.53	Open	2.53						
1420000	0.08	Open	0.08						
1420000	4.18	Open	4.18						
1420000	0.53	Open	0.53						
1420114	0.34	Open				0.34	Sedimentation and Redband Trout		
1420124	0.57	Closed		0.57					
1420157	0.28	Open	0.28						
1420158	0.16	Open			0.16		Sedimentation		
1420489	2.49	Open	2.49						
1420490	0.83	Open			0.83		Watershed and Wildlife		
1420516	0.44	Closed				0.44	Sedimentation and Redband Trout		
1420547	0.20	Open			0.20		Big Game Security and DOG		
1420601	1.15	Open				1.15	Big Game DOG/ Cultural Resources		
1420641	1.01	Open			1.01		Sedimentation		
1420681	0.33	Open	0.33						
1420691	1.26	Closed		1.26					
1420694	0.53	Open			0.53		Sedimentation and Cultural Resource		
1420694	0.53	Open	0.53						
1420723	0.08	Open			0.08		Cultural Resource		
1420724	0.45	Open				0.45	Sedimentation and Redband Trout		
1420758	0.06	Closed		0.06					
1420770	0.07	Closed		0.07					
1420773	1.90	Closed		1.90					
1420788	0.76	Open		0.76			Big Game Security Previously Closed under Phoenix EA, but wasn't changed in INFRA Database		
1420790	0.86	Open			0.86		Big Game Security		
1420792	0.70	Open			0.70		Big Game Security		
1420793	0.19	Closed		0.19					
1420794	0.65	Open			0.65		Big Game Security		
1420796	0.46	Open	0.46						
1420832	0.64	Open	0.64						
1420832	0.90	Open	0.90						
1420837	0.15	Open				0.15	Sedimentation		
1420847	2.15	Open	2.15						
1420852	0.64	Open			0.64		Big Game Security, Trout/Cultural Resources		

1420852	0.24	Open	0.24						
1420856	0.59	Open		0.59			Big Game Security Previously Closed under Phoenix EA, but wasn't changed in INFRA Database		
1420856	0.27	Open					Big Game Security Previously Closed under Phoenix EA, but wasn't changed in INFRA Database	0.27	Fire, Admin., Public Access
1420869	0.26	Open			0.26		Sedimentation and Road Surface Safety		
1420869	0.53	Open	0.53						
1420870	0.25	Open	0.25						
1420871	0.55	Open			0.55		Sedimentation and Cultural Resource		
1420873	0.11	Open			0.11		Big Game Security		
1420876	0.39	Open				0.39	Sedimentation and Redband Trout		
1420880	0.18	Open			0.18		Big Game Security		
1420881	0.25	Open	0.25						
1420884	0.62	Open	0.62						
1420887	0.11	Open		0.11			Sedimentation Previously Closed under Phoenix EA, but wasn't changed in INFRA Database		
1663000	1.96	Open	1.96						
1663000	3.27	Open	3.27						
1663000	6.08	Open	6.08						
1663107	0.31	Open				0.31	Redband Trout		
1663110	0.11	Open			0.11		Big Game Security		
1663186	0.65	Closed		0.65					
1663188	0.26	Closed		0.26					
1663189	0.26	Closed		0.26					
1663190	1.70	Open	1.70						
1663192	0.77	Open			0.77		Sedimentation and Redband Trout		
1663195	0.20	Open			0.20		Big Game Security		
1663246	0.20	Open			0.20		Big Game Security Cultural Resource		
1663246	0.23	Open	0.23						
1663248	0.58	Open			0.58		Big Game Security		
1663248	0.43	Open	0.43						
1663249	0.33	Open			0.33		Big Game Security		
1663250	0.16	Closed		0.16					
1663252	1.03	Open	1.03						
1663256	0.23	Closed		0.23					
1663259	0.11	Closed		0.11					
1663260	0.16	Open			0.16		Sedimentation and Redband Trout		
1663262	0.17	Open			0.17		Big Game Security		
1663285	0.62	Open				0.62	Sedimentation and		

							Redband Trout		
1663287	0.21	Open				0.21	Big Game Security		
1663356	1.18	Open			1.18		Big Game Security		
1663440	0.27	Open			0.27		Big Game Security		
1663442	0.63	Open			0.63		Big Game Security		
1663442	0.12	Open	0.12						
1663447	0.34	Open			0.34		Big Game Security		
1663450	0.26	Closed		0.26					
1663452	0.67	Open	0.67						
1663454	0.18	Closed		0.18					
1663459	3.02	Open	3.02						
1663468	0.39	Closed		0.39					
1663470	0.98	Open	0.98						
1663471	0.76	Open	0.76						
1663472	0.33	Closed		0.33					
1663473	0.17	Open				0.17	Sedimentation		
1663475	1.04	Open	1.04						
1663477	0.41	Open			0.41		Sedimentation and Big Game Security		
1663484	0.16	Open			0.16		Big Game Security		
1663485	0.38	Open			0.38		Sedimentation and Big Game Security		
1663492	1.18	Open				1.18	Sedimentation and Redband Trout		
1663492	1.34	Open	1.34						
1663493	0.36	Open			0.36		Sedimentation and Big Game Security		
1663494	1.63	Open			1.63		Sedimentation and Big Game Security		
1663494	1.94	Open	1.94						
1663495	0.80	Open	0.80						
1663496	0.02	Open	0.02						
1663496	1.39	Open	1.39						
1663496	0.58	Open	0.58						
1663496	3.37	Open	3.37						
1663498	1.44	Open	1.44						
1663498	1.12	Open	1.12						
1663499 Pvt.	0.20	Open	0.20						
1663499	0.15	Open	0.15						
1663499	0.10	Open	0.10						
1663501	0.12	Open			0.12		Big Game Security		
1663502	0.10	Open	0.10						
1663503	0.35	Open	0.35						
1663504	0.46	Open	0.46						
1663506	1.17	Open	1.17						
1663507	0.33	Open			0.33		Big Game Security		
1663510	0.15	Open			0.15		Big Game Security		
1663511 Pvt.	0.07	Open	0.07						
1663511	0.35	Open	0.35						
1663511	0.24	Open	0.24						

1663511 Pvt.	0.08	Open	0.08						
1663512	0.47	Closed		0.47					
1663514	1.97	Open			1.97		Sedimentation and Redband Trout		
1663519	0.37	Open	0.37						
1663521	0.47	Open			0.47		Protection of Private Property		
1663523	0.07	Open			0.07		Protection of Private Property		
1663524	0.87	Open	0.87						
1663526	0.34	Open			0.34		Big Game Security		
1663532	0.48	Open	0.48						
1663533	0.17	Closed		0.17					
1663534	0.04	Open	0.04						
1663534	0.01	Open	0.01						
1663534	0.05	Open	0.05						
1663534	0.07	Open	0.07						
1663535	0.42	Open	0.42						
1663535	0.50	Open	0.50						
1663535	0.70	Open	0.70						
1663536	0.74	Closed		0.74					
1663537	0.57	Open			0.57		Big Game Security		
1663538	0.27	Closed		0.27					
1663539	0.09	Closed		0.09					
1663539	0.60	Closed		0.60					
1663539	0.70	Closed		0.70					
1663540	0.11	Closed		0.11					
1663541	0.29	Open			0.29		Big Game Security		
1663543	0.20	Open			0.20		Big Game Security		
1663545	0.65	Open				0.65	Sedimentation and Redband Trout		
1663545	0.39	Open	0.39						
1663546	0.57	Open	0.57						
1663547	0.16	Open	0.16						
1663549	0.22	Open				0.22	Sedimentation and Redband Trout		
1663550	0.94	Open	0.94						
1663552	0.30	Open				0.30	Sedimentation		
1663553	0.49	Open	0.49						
1663554	0.39	Open			0.39		Big Game Security		
1663557	0.42	Open	0.42						
1663558	0.10	Open			0.10		Big Game Security		
1663560	0.05	Open				0.05	Sedimentation and Redband Trout		
1663560	1.03	Open			1.03		Sedimentation and Redband Trout		
1663561	0.31	Open	0.31						
1663562	0.34	Open			0.34		Big Game Security		
1663562	0.03	Open	0.03						
1663563	0.69	Open				0.69	Sedimentation and		

							Redband Trout		
1663569	1.11	Open			1.11		Big Game Security		
1663571	0.53	Open	0.53						
1663573	0.05	Open	0.05						
1663573	0.03	Open	0.03						
1663574	0.63	Open				0.63	Sedimentation and Redband Trout		
1663575	0.21	Open				0.21	Big Game Security		
1663577	0.51	Open	0.51						
1663581	3.38	Open	3.38						
1663587	0.42	Closed		0.42					
1663588	0.53	Open				0.53	Sedimentation and Redband Trout		
1663588	4.17	Open	4.17						
1663589	0.51	Closed		0.51					
1663590	0.29	Open	0.29						
1663591	1.39	Open				1.39	Big Game Security		
1663592	0.18	Open				0.18	Sedimentation and Redband Trout		
1663651	3.60	Open	3.60						
1663717	0.19	Open			0.19		Big Game Security		
1663718	0.24	Open			0.24		Big Game Security		
1663722	0.73	Open			0.73		Big Game Security and Sedimentation		
1663725	1.01	Open	1.01						
1663730	0.59	Open				0.59	Sedimentation and Redband Trout		
1663734	0.65	Open			0.65		Big Game Security		
1663736	0.49	Closed		0.49					
1663738	0.69	Open				0.69	Big Game Security and Sedimentation		
1663738	0.02	Open	0.02						
1663739	0.12	Closed		0.12					
1663807	0.31	Open			0.31		Big Game Security		
1663815	0.01	Open	0.01						
1663815	0.14	Open	0.14						
1663843	0.44	Open			0.44		Big Game Security and Sedimentation		
1663850	0.31	Open	0.31						
1663904	0.88	Closed		0.88					
1663936	1.05	Open	1.05						
Total	**141.77**		**84.79**	**16.91**	**26.34**	**11.69**		**2.00**	

APPENDIX F – SUMMARY OF GLOBAL CLIMATE CHANGE PREVENTION ACT OF 1990.

7 U.S.C. §§ 6701-6710, November 28, 1990.

Overview

This Act authorizes and directs the Secretary of Agriculture to take steps towards researching climate change, including establishing: a Global Climate Change Program; a technical advisory committee; an Office of International Forestry; urban forestry demonstration projects; biomass energy demonstration projects. The Secretary is also directed to study the effects of global climate change on agriculture and forestry, and the interaction between forest greenhouse gas emissions and climate change.

Global Climate Change Program

The Act directs the Secretary of Agriculture (Secretary) to establish a Global Climate Change Program in order to have within the Department of Agriculture a focal point for coordinating all issues of climate change. The Secretary must designate a director, who shall: coordinate policy analysis, long range planning research, and response strategies relating to climate change issues; provide liaison with other federal agencies, through the Office of Science and Technology Policy, regarding issues of climate change; perform other enumerated duties. § 6701.

Agriculture and Forestry

The Act directs the Secretary to study: the effects of global climate change on agriculture and forestry; the emissions of methane, nitrous oxide, and hydrocarbons from tropical and temperate forests, and the manner in which they may affect, and will be affected by, global climate change. The Secretary must submit to Congress reports of the agriculture and forestry studies by November 1993 and November 1996, respectively. § 6702.

Technical Advisory Committee

The Secretary must establish a technical advisory committee to provide advice to the Secretary concerning the major study areas required under this chapter. § 6703.

Office of International Forestry

The Secretary, acting through the Chief of the Forest Service, must establish an Office of International Forestry within the Forest Service. The Chief is to appoint a Deputy Chief for International Forestry responsible for the international forestry activities of the Forest Service. § 6704.

Institutes of Tropical Forestry

The Secretary is authorized and directed to establish an Institute of Tropical Forestry in Puerto Rico and an Institute of Pacific Islands Forestry. The Institutes will conduct research on forest management and natural resources that must include: managing and developing tropical forests; the relationship between climate change and tropical forests; threatened and endangered species recreation and tourism; developing tropical forest resources on a sustainable yield basis;

techniques to monitor health and productivity of tropical forests; tropical forest regeneration and restoration; effects of tropical deforestation on biodiversity, global climate, wildlife, soils and water. § 6706.

Urban Forestry Demonstration Projects

The Secretary is authorized to undertake, through the Forest Service's Northeastern Area State and Private Forestry Program, a study and pilot implementation project to demonstrate the benefits of retaining and integrating forests in urban development. § 6707.

Biomass Energy Demonstration Projects

The Secretary may carry out projects that demonstrate the potential of short-rotation silvicultural methods to produce wood for electricity production and industrial energy needs. § 6708.

Interagency Cooperation to Maximize Biomass Growth

The Secretary may enter into an agreement with the Secretary of Defense to: conduct a study of reforestation and improved management of Department of Defense military installations and lands; develop a program to manage such forests and lands so as to maximize their potential for biomass growth and sequestering carbon dioxide. § 6709.

Appropriations Authorized

There are authorized to be appropriated sums necessary to carry out the Act for fiscal years 1991 through 1996. § 6710.