



United States
Department of
Agriculture

Forest
Service

April 2008



Draft Environmental Impact Statement

East Maury Fuels and Vegetation Management Project

**Lookout Mountain Ranger District
Ochoco National Forest**

Crook County, Oregon

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

East Maury Fuels and Vegetation Management Project

Draft Environmental Impact Statement

Crook County, Oregon

Lead Agency: USDA Forest Service
Responsible Official: Jeff Walter, Forest Supervisor
Ochoco National Forest
3160 NE Third Street
Prineville, OR 97754

For Information Contact: Barb Fontaine, Team Leader
Ochoco National Forest
3160 NE Third Street
Prineville, OR 97754
(541) 416-6500

Abstract: This Draft Environmental Impact Statement (DEIS) describes the effects of implementing fuel reduction and vegetation management strategies in the eastern portion of the Maury Mountains. The project area is located about 20 miles southeast of Prineville, Oregon, and encompasses nearly 24,329 acres. Proposed fuels and vegetation treatments reduce the risk of stand loss due to overly dense stand conditions, increase the resistance of forest stands to insects and diseases, and change the distribution of fire regimes.

This DEIS assesses the effects of three different alternatives: Alternative 1 No Action; Alternative 2 Proposed Action (preferred alternative); and Alternative 3. Alternative 1 is the no action alternative and would not treat any acres. Alternative 2 is the preferred alternative and would treat fuels and vegetation on approximately 14,000 acres through the use of harvest (6,857 acres), pre-commercial thinning (11,039 acres), and fuels management (11,400 acres) strategies. Alternative 3 would treat approximately 13,725 acres through the use of harvest (5,102 acres), pre-commercial thinning (10,833 acres) and fuels management (11,061 acres) strategies.

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision-making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and

contentions. *Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. *City of Angoon v. Hodel* (9th Circuit, 1986) and *Wisconsin Heritages, Inc. v. Harris*, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

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

SUMMARY

Introduction

The Forest Service has prepared this Draft Environmental Impact Statement (DEIS) in compliance with the National Environmental Policy Act and other relevant Federal and State laws and regulations. This DEIS analyzes a proposal to use commercial timber harvest, pre-commercial thinning, grapple piling, hand piling, and prescribed fire in the eastern half of the Maury Mountains for the treatment of fuels and vegetation management. This DEIS analyzes two additional alternatives (including the No Action Alternative); the significant issues associated with the proposal; and the direct, indirect, and cumulative effects of implementing any of the alternatives.

The East Maury Project Area is located on the Lookout Mountain Ranger District of the Ochoco National Forest, about 37 miles southeast of Prineville, Oregon. The project size is about 24,239 acres, and falls within Upper Crooked River, Camp Creek, and Crooked River above the North Fork watersheds. Elevations range from 6,086 feet to 4,200 feet above sea level. There is one tract of private land (about 40 acres) within the project area boundary.

Why is the action being proposed?

The purpose and need for this proposal was derived from evaluating the Ochoco National Forest Land and Resource Management Plan (Forest Plan) (USDA Forest Service, 1989), identifying desired future conditions, and comparing them to the existing conditions in the project area. The purposes of this proposal are to:

1. Move the seral and structural conditions of forest stands towards their historic ranges of variability, maintain and increase late and old structured stands; increasing the resistance of forest stands to insects and disease; and maintain and increase broadleaf and shrub communities;
2. Move the distribution of fire regimes towards their historic ranges of variability, increase the amount of low-intensity fire conditions, decrease the amount of high-intensity fire conditions and maintain low-intensity fire conditions where they already exist; and,
3. Provide wood products to contribute to the health of the local and regional economies (Forest Plan, pp. 4-31 to 4-32) consistent with Management Area and Forest-wide standards and guidelines and to provide opportunities for employment and income.

In 2000, the Ochoco National Forest conducted a watershed analysis of the Maury Mountains, which included an extensive look at forest fuels and vegetation conditions, the relationship between those conditions and changes in fire hazard, insect and disease dynamics, wildlife habitat, and riparian health. The watershed analysis documents that almost all of the plant communities in area have changed in the last 100 years and that many conditions are outside of the historic range of variability. Stands today are denser with more shade-tolerant species than they were historically. Large trees are susceptible to mortality related to competition stress with smaller, understory trees. Fire suppression has also allowed the amount of fuels to increase.

What action is proposed?

Alternative 2 in the East Maury Fuels and Vegetation Management Project DEIS was developed to respond to the purpose and need for the action. Alternative 2 includes commercial harvest, non-commercial thinning, and prescribed fire activities. Treatments focus on stands with the objectives of reducing stand densities, reducing surface and ladder fuels, and reducing the risk of stand loss due to high fuel loadings. This alternative also includes objectives to maintain existing desired fuel levels, increase forested stands' resilience to insects and disease, and to treat forested stands to move towards late and old structured stand conditions. Treatments would reduce the abundance of late seral species and increase the amount of early seral species such as ponderosa pine. In addition, vegetation management would occur within Riparian Habitat Conservation Areas to promote the growth and development of desired deciduous vegetation to enhance shading and riparian dependent species habitat. No trees over 21 inches in diameter would be harvested unless removal is necessary for safety or road construction needs.

Connected actions, such as new road construction, reconstruction, and temporary construction would be needed to access some areas proposed for commercial harvest. The locations of roads to be constructed reconstructed and decommissioned. Approximately 7 miles of new roads would be constructed to reach stands identified for treatment. New system roads would be closed after timber harvest and associated activities were completed. Approximately 2 miles of temporary roads would be built to access commercial harvested areas. The temporary roads would be decommissioned after use. Approximately 18 miles of existing roads would be reconstructed by doing spot rocking, erosion control measures, or brush clearing within the road prism to reduce resource impacts and improve safety. About 4.5 miles of roads in the project area have been identified as no longer needed and will be either closed or decommissioned.

What would it mean not to meet the need?

Forest Vegetation

Stands in the project area would continue growing and the amount of LOS would increase. However, much of the future LOS would tend towards mid- or late-seral species composition and multi-strata characteristics. The rate at which stands develop large tree character would be hampered by over-stocked conditions. On drier sites, such as the ponderosa pine and Douglas-fir plant association groups, stand stagnation may preclude the attainment of additional large trees. Existing large trees would continue to be susceptible to mortality from competition with understory trees and the accompanying increase in risk to loss due to insect, disease, and wildfire. Acres dominated by ponderosa pine and western larch (early-seral species) would steadily decrease.

Upland shrub communities would continue to decline in vigor and abundance. Juniper dominance and conifer cover would increase with a resulting decrease in grass and shrub cover. The proportion of juniper on ponderosa pine, Douglas-fir and grand fir sites would continue to increase. Mountain mahogany and other shrubs would continue to decline in abundance.

No treatments to maintain or increase riparian plant communities would occur. Specifically, some aspen stands would continue to decline as conifer encroachment continues.

Fuels

Stands that are currently in low fire intensity as a result of being thinned and burned in the 1980s and 1990s would not be maintained, and would transition into mixed fire intensity within the next 5 - 10 years. The amount of forested acres within the mixed and high-intensity fire regimes are expected to increase as fuel accumulates faster than it decomposes and the number of trees per acre in the understory increases. Limited vegetation management, aggressive wildfire suppression, and insect and disease mortality would continue the trend of fuel loadings accumulating in the form of dead and down trees, small diameter trees growing into the overstory, and dense crown conditions. These changes would increase the risk of landscape-scale crown fire, and associated severe effects to fish and wildlife habitat, soil productivity, late and old structured habitat, and air quality.

Fire in these stands could be intense, stand replacing events, which could result in the loss of late and old structure, wildlife habitat cover, and consumption of large woody material and structure in riparian areas.

Wood Products and Seasonal Jobs

There would be no jobs supported with commercial harvest activities. There would be no seasonal jobs supported with service contracts for noncommercial thinning and fuels treatments. There would be no economic benefit to the local or regional economies.

Are there other alternatives that would meet the need?

One other alternative was identified that would meet the need for the project.

Alternative 3 was developed to respond to the key issues discussed in Chapter 1, while also meeting the stated purpose and need. This alternative focuses activities in stands with the objective to reduce stand densities, reduce hazardous fuels, reduce the risk of stand loss due to high fuel loadings, and reduce impacts associated with new road construction. Objectives also include maintaining desired fuel levels where they exist, increasing forested stands' resiliency to insects and disease, and moving towards late and old structured stand conditions. This alternative was developed in response to public comments received concerning the impacts of roads and the amount of new road construction proposed. The amount of new and temporary road construction proposed is reduced to 0.4 mile as opposed to 9 miles proposed in Alternative 2. This alternative focuses on using existing roads whether open or closed and includes reconstruction. As a result of reduced road access, harvest would occur on approximately 1,750 fewer acres than alternative 2. In addition, the amount of pre-commercial thinning, fuel treatments, and aspen stand treatments would also be reduced.

What are the effects of the alternatives?

Forest Vegetation

Historic Range of Variability, Late and Old Structure and Stand Vigor

Under all alternatives, stands would move toward HRV but at different rates. Under all alternatives, the amount of LOS would increase over time. Activities in each of the action alternatives would remove understory trees to reduce stand density, to maintain existing large trees, and to enhance the development of additional large trees. Harvest and noncommercial thinning

would encourage the development of large structure at an accelerated rate. No live trees 21 inches in diameter or larger would be cut, except those trees considered hazardous to the logging/hauling operation, would be cut. Activities would generally move stands from multi-strata conditions to or towards single-strata conditions. The abundance of early-seral species would be maintained and enhanced in the long-term; however, late-seral species would continue to be present in stands where they exist prior to treatment. In addition, reducing stocking density would increase tree vigor and reduce insect and disease hazard.

Alternative 2 would result in the greatest increase in LOS over time. The projections indicate that Alternative 2 would result in an 18 percent increase in LOS in 20 years. Alternative 3 is projected to result in a 16 percent increase in LOS in 20 years. These projections do not include any future management such as continued underburning, thinning, or other stand-tending activities that may occur in the future. Thus, the predicted amounts of multi-strata LOS tend to increase with time as succession and stand growth continue without future management activities other than continued fire suppression.

The proposed activities (commercial harvest and pre-commercial thinning) included in each of the action alternatives are designed to reduce tree density and improve growth and vigor of the residual trees and reduce susceptibility to insects and disease. These activities would more quickly restore historic seral/structural stage conditions and improve growing conditions for larger trees than either no action or prescribed fire alone. The abundance of early-seral species would be maintained and enhanced in the long term; however, late-seral species would continue to be present in stands where they exist prior to treatment.

Broadleaf and Shrub Communities

Harvest and noncommercial thinning in and around aspen stands would improve aspen vigor and allow aspen stands to expand. Some larger conifers will be felled and left on site to augment low down wood levels in Wiley and Double Cabin creeks. Immediately after treatment the aspen sites would have reduced cover until the aspen and other broadleaf shrubs can respond. Response time and amount will vary by current aspen condition, post treatment fencing and intensity of treatment, but generally would be apparent within three years.

Noncommercial thinning would be done on approximately 981 acres (including aspen treatments) within RHCAs. Precommercial thinning younger thickets in the vicinity of larger trees would promote the survival of existing large trees and allow development of additional large trees. Thinning prescriptions would be modified to maintain existing shade over the stream channel except where the objective is aspen improvement.

Fire would be used to encourage the growth of riparian vegetation in RHCAs by reducing conifer encroachment. Fuel management activities would also be used to reduce the risk of high-intensity fire in RHCAs by reducing fuels.

Upland Grass and Shrub Communities

Proposed treatments in the uplands would open the canopy and allow increased grass and shrub development. Better overall forage conditions would encourage more dispersed grazing and browsing with potentially less pressure in riparian areas. Furthermore, the removal of slash and thinning of thickets will allow more access for livestock into the uplands and potentially lower grazing pressure in riparian areas.

Juniper cutting would occur on 3,327 acres on sites identified with dry ponderosa pine or juniper potential natural vegetation and would result in approximately 2,003 acres returned to grass and shrub dominance. The remaining acres would have reduced stocking of ponderosa pine or large juniper. In addition, some merchantable juniper may be removed within units with prescribed harvest and would be cut or girdled in pre-commercial thinning units. Junipers larger than 21 inches in diameter or with old growth indicators would remain.

Prescribed fire treatments would reduce stocking of seedling and sapling junipers. As a result of decreased stand density shrub and grass cover would increase from recruitment of new plants and growth of existing plants.

It is anticipated that the proposed treatments in this project would also rejuvenate mountain mahogany. Survival of mountain mahogany seedlings would increase in treated stands in response to reduced conifer cover and exposed mineral soil. Other types of shrubs would increase from more vigorous sprouting and from recruitment of new seedlings.

Fuels

Alternative 2 would use commercial harvest, pre-commercial thinning, and prescribed fire to move 6,859 acres from mixed and high fire intensity to low fire intensity. Alternative 2 would use pre-commercial thinning and prescribed fire to maintain 3,330 acres of low fire intensity. Alternative 3 would use commercial harvest, pre-commercial thinning, and prescribed fire to move 5,661 acres from mixed and high fire intensity to low fire intensity. Alternative 3 would use pre-commercial thinning and prescribed fire to maintain 3,176 acres of low fire intensity. Alternative 3 proposes less crown density reduction than Alternative 2, and would move fewer acres from high risk to low risk.

Forest Wood Products and Seasonal Jobs

Alternative 2 supports the highest levels of jobs in total due to the most acreage treated and volume produced. Alternative 2 would result in approximately 20.5 million board feet in commercial timber products. Alternative 2 is estimated to support approximately 243 jobs associated with commercial timber harvest and 43 seasonal jobs associated with noncommercial thinning and fuel treatments. Alternative 3 is estimated to support 178 jobs and 55 seasonal jobs associated with noncommercial thinning and fuel treatments. Alternative 3 would result in approximately 15.3 million board feet in commercial timber products.

What factors would be used in making the decision between alternatives?

The Responsible Official for this proposal is the Forest Supervisor of the Ochoco National Forest. The Responsible Official will decide whether to:

1. Select the proposed action;
2. Select an action alternative that has been considered in detail;
3. Modify and an action alternative;
4. Select the no action alternative;

5. Identify what mitigation measures and monitoring will apply; *or*
6. Amend the Forest Plan.

The Responsible Official will decide whether to conduct commercial harvest, precommercial thinning, aspen treatments, and fuels reduction activities in the East Maury area. The decision will be determined by how well each alternative provides the best mix of prospective results in regard to the purpose and need, the significant issues, and public comments.

What monitoring is necessary?

Implementation monitoring is necessary to assure the selected alternative and mitigation measures are implemented as designed and achieve the desired results. Monitoring that is necessary includes:

1. Post-project surveys and monitoring of noxious weed infestations, including mineral sources, would be conducted to evaluate the effects of the project on noxious weeds and to continue eradication treatments. Post-project surveys would identify new noxious weed infestations while they are small.
2. Temperature monitoring would continue on selected stream reaches such as Shotgun, Drake, and Wiley Creeks. Pre and post-activity temperature and shade monitoring would be done below aspen treatments in the Wiley Creek drainage. Aspen plantings would be surveyed until establishment.
3. Occupancy and reproduction in mapped raptor territories would be monitored during and after project implementation.
4. Snag levels would be surveyed in selected areas during project preparation and after implementation.

Which alternative is preferred?

Based on the purpose and need, Alternative 2 is the preferred alternative. The proposed action includes approximately 6,857 acres of commercial harvest, 11,039 acres of pre-commercial thinning, and 11,400 acres of fuel treatment. Commercial harvest includes tractor, skyline, and horse logging systems. Road construction activities include 9 new miles of road construction and reconstructing 18 mile of road on existing roadbed. Newly constructed roads and roads that are reopened for the project would be closed after harvest activities are complete. Two Forest Plan amendments are needed to implement this alternative.

Alternative 3 is the environmental preferred alternative. Alternative 3 has fewer roads and proposes less harvest and fuel treatments. There would be less sedimentation and soil disturbance under this alternative.

Table of Contents

Summary	i
Introduction	i
Why is the action being proposed?	i
What action is proposed?	ii
What would it mean not to meet the need?	ii
Are there other alternatives that would meet the need?	iii
What are the effects of the alternatives?	iii
What factors would be used in making the decision between alternatives?	v
What monitoring is necessary?	vi
Which alternative is preferred?	vi
Chapter 1 – Purpose and Need	1
Document Structure	1
Background	1
Purpose and Need for Action	2
Forest Vegetation	2
Fuels	5
Forest wood products and seasonal jobs	6
Proposed Action	7
Connected Actions	7
Roads	7
Soap Material Source	7
Forest Plan Direction	8
Eastside Screens	9
Inland Native Fish Strategy	9
Scope of Project and Decision Framework	9
Public Involvement	10
Issues	11
Significant Issues	11
Analysis Issues	12
Issues Not Addressed in Detail	13
Chapter 2 – Alternatives, Including the proposed action	15
Introduction	15
Alternatives Considered but Eliminated from Detailed Study	15
Alternatives Considered in Detail	15
Alternative 1 (No Action)	15
Alternative 2 (Proposed Action)	16
Alternative 3	20
Design Elements Common to All Alternatives	23
Air Quality/Private Land Interface	23
Cultural Resources	23
Sensitive Plants	24
Noxious Weeds	25
RHCAs	26
Soils and Geology	28
Water Quality/Fisheries	28

Table of Contents

Wildlife.....	29
Range/Minerals	30
Recreation.....	30
Visual/Scenic Resources	31
Roads.....	31
Monitoring.....	31
Comparison of Alternatives.....	32
Chapter 3 Affected Environment and Environmental Consequences.....	39
Past, Present, and Reasonably Foreseeable Future Actions	39
Resource Conditions Relative to the Purpose and Need	40
Late and Old Structure (LOS)	40
LOS Connectivity.....	52
Forest Health	55
Upland Grass and Shrub Communities	61
Riparian Plant Communities	63
Fuels	67
Potential Fire Behavior and Probability.....	74
Forest Wood Products and Jobs	77
Water Quality	82
Water Yield	83
Temperature and 303(d) List.....	90
Sediment and Turbidity.....	95
Geology	104
Dormant Landslide Terrain	104
Soap Material Source	107
Soils	108
Aquatic Species and Habitat.....	115
Riparian Habitat Conservation Areas.....	115
Aquatic Species.....	127
Sensitive, Threatened and Endangered Plant Species	138
Non-native Invasive Plants (Noxious Weeds).....	146
Wildlife.....	152
Goshawk.....	153
Other Raptors	161
Pileated Woodpecker.....	164
Primary Cavity Excavators, Snag and Down Log Habitat.....	168
Big Game.....	173
Migratory and Focal Bird Species.....	179
Sensitive, Threatened and Endangered Wildlife Species.....	183
Heritage Resources and Plants of Cultural Value	189
Visual Quality.....	196
Recreation.....	197
Civil Rights and Environmental Justice	199
Short-term Uses and Long-term Productivity	199
Unavoidable Adverse Effects.....	200
Irreversible and Irretrievable Commitments of Resources.....	201

Table of Contents

Cumulative Effects	202
Other Required Disclosures.....	202
National Historic Preservation Act	202
US Fish and Wildlife Service and NOAA Fisheries	203
Clean Air Act	204
Clean Water Act.....	204
National Forest Management Act	204
Chapter 4 Consultation and Coordination.....	217
Preparers and Contributors	217
Interdisciplinary Team Members	217
Distribution of the Environmental Impact Statement.....	220
References.....	221
Index	236

Appendices

- Appendix A - Description of Actions
- Appendix B - Proposed Treatment by Unit
- Appendix C - Biological Assessment and Biological Evaluation
- Appendix D - Unit-By-Unit Analysis of Soil Conditions
- Appendix E - East Maury Project Maps
- Appendix F - Water Quality Best Management Practices

List of Figures

Figure 3-1 Stocking Levels for Ponderosa Pine in the Grand fir/pinegrass PA.....	56
Figure 3-2 Change in Condition Class by Alternative.....	73
Figure 3-3 Equivalent Harvest Area Alternative 1	84
Figure 3-4 Equivalent Harvest Area for Alternative 2 from 2007-2015.....	87
Figure 3-5 Equivalent Harvest Area for Alternative 3 from 2007-2015	88
Figure 3-6 Direct Sediment Potential.....	98
Figure 3-7 RER Cumulative Sediment Delivery	102

List of Tables

Table 2-1 Alternative 2 Proposed Activities	17
Table 2-2 Alternative 2 Proposed New System and Temporary Roads.....	19
Table 2-3 Alternative 3 Proposed New System and Temporary Roads.....	21
Table 2-4 Alternative 3 Proposed Activities	22
Table 2-5 Proposed Activities	32
Table 2-6 Comparison of Alternatives	33
Table 2-7 Comparison of Alternatives by Forest Plan Management Area	38
Table 3-1 Plant Association Groups in the East Maury Project Area.....	41
Table 3-2 Viable Ecosystem Seral/Structural Matrix.....	41
Table 3-3 Acres by Harvest and Precommercial Thinning by Decade	42
Table 3-4 Dry Grand Fir Plant Association Group	44

Table of Contents

Table 3-5 Douglas-fir Plant Association Group	44
Table 3-6 Ponderosa Pine Plant Association Group.....	45
Table 3-7 Juniper Plant Association Group	45
Table 3-8 Existing Distribution of LOS Compared to Historic Range of Variability	46
Table 3-9 Alternatives Comparison of Treatments within LOS	49
Table 3-10 Comparison and Projection of LOS by Alternative (from pixel data).....	51
Table 3-11 Acres of Treatment in Connectivity Corridors by Alternative	54
Table 3-12 Comparisons of Alternatives to Stand Condition and Risk.....	57
Table 3-13 Area Affected By Insects or Disease.....	57
Table 3-14 High Risk Stages by Plant Association Group	59
Table 3-15 Bark Beetle Activity and Proposed Treatment	60
Table 3-16 Dwarf Mistletoe Treated by Alternative.....	60
Table 3-17 East Maury Fire Regimes	67
Table 3-18 Characteristics of Condition Classes for Fire Regime I, Dry forest	68
Table 3-19 Burn Severity Classification	69
Table 3-20 Tree Mortality from Wildfire in Condition class 1 (Unit 40)	70
Table 3-21 Tree Mortality from Wildfire in Condition Class 2 (Unit 26)	71
Table 3-22 Acres of Fuel Reduction Activities	71
Table 3-23 Comparison of Alternatives	73
Table 3-24 Changes in Fine Fuel Moisture by Alternative	74
Table 3-25 Comparison of Alternatives by changes in Flame Length	75
Table 3-26 Central Oregon Population Growth	77
Table 3-27 Projected Annual Employment and Income	81
Table 3-28 Partial Harvest Snow Water Equivalent Increases	85
Table 3-29 Equivalent Harvest Area 2007-2015	89
Table 3-30 7-day Average of Daily Maximum Stream Temperatures (°F)	91
Table 3-31 Alternative 2 Tractor Units within 200 Feet of Streams	98
Table 3-32 Alternative 3 Tractor Units within 200 Feet of Streams	100
Table 3-33 Open Road Densities within 400 Ft. of Streams.....	102
Table 3-34 Miles of Road on Dormant Landslide Terrain.....	105
Table 3-35 New, Closed, Reconstructed, and Temporary Roads on Dormant Landslide Terrain	106
Table 3-36 Soil Disturbing Activities by Alternative.....	113
Table 3-37 Interim Objectives for Pool Frequency in INFISH	117
Table 3-38 Interim Objectives for LWD in INFISH.....	118
Table 3-39 Comparison of activities within RHCAs by alternative.....	120
Table 3-40 Harvest within RHCAs in Alternatives 2 and 3 by Stream	121
Table 3-41 Noncommercial Thinning and Fuels Treatments in RHCAs.....	122
Table 3-42 Non-native Invasive Plant Populations in East Maury Project Units.....	148
Table 3-43 Noxious Weed Risk by Alternative.....	150
Table 3-44 Goshawk Reproductive History in the East Maury Project Area.....	154
Table 3-45 Alternative 2 Treatments within Goshawk Post Fledging Areas	156
Table 3-46 Alternative 3 Treatments within Goshawk Post Fledging Areas	159
Table 3-47 White-Headed Woodpecker Primary Nesting Habitat (in acres)	170
Table 3-48 East Maury Existing Cover, Road Density, and HEI Values	174
Table 3-49 Effects to Big Game Habitat from Alternative 1	175

Table of Contents

Table 3-50 Effects to Big Game Habitat from Alternative 2 176
Table 3-51 Big Game Habitat Alternative 3 177
Table 3-52 Blue Mountains Subprovince Priority Habitats and Focal Species 179
Table 3-53 Comparison of Existing Focal Species Habitat to HRV 179
Table 3-54 Alternative 2 Focal Species Habitat Projections..... 181
Table 3-55 Alternative 3 Focal Species Habitat Projections..... 182
Table 3-56 Cumulative Habitat Projections for Migratory and Focal Birds 182
Table 3-57 Proposed Treatment Areas That Overlap Heritage Sites 193
Table 3-58 Example of PM 2.5 Smoke Production by East Maury..... 201
Table 3-59 Applicable Forest Plan Direction 208

CHAPTER 1 – PURPOSE AND NEED

Document Structure

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

Chapter 1. Purpose and Need for Action: The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2. Alternatives, including the Proposed Action: This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.

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

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

Index: The index provides page numbers by document topic.

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

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

Background

A Watershed Analysis for the entire Maury Mountains was completed in 2000 (Ochoco National Forest 2001). The Watershed Analysis included an extensive look at forest fuels and vegetation conditions, the relationships between those conditions and changes in fire hazard, insect and disease dynamics, wildlife habitat, and riparian health. Vegetation patterns and occurrence within the analysis area are different now than what existed historically. Changes to the health, structure, composition, distribution, and function of forest stands have altered the natural processes that maintain a viable ecosystem. This has affected vegetative resiliency, wildlife habitat diversity and amount, water quality, visual quality, fuel loadings, and fire behavior. The Watershed Analysis found that the entire Maury Mountains area was deficient in seral structural stages that contain large trees, and recommended treatments that would lead to the

rapid development of large trees and speed the development of deficient seral structural stages (pp. 157-158). The Watershed Analysis also recommended using prescribed fire to control seedling and sapling density under large trees; regenerate grass, forb, and shrub layers; and reduce fuel loadings to allow for the re-introduction of fire as a disturbance factor (pp. 159-160).

According to the Forest Service Road Management Policy (2001), all National Environmental Policy Act decisions signed after January 12, 2002, which involve certain changes in the transportation system, must be informed by a roads analysis. A project-level roads analysis was completed for the East Maury Fuels and Vegetation Management project area. The roads analysis supports the need for an increased transportation system for accessing portions of the project area and identifies roads that are no longer needed.

Project Location

The East Maury Fuels and Vegetation Management Project Area lies in the eastern portion of the Maury Mountains of central Oregon. The Maury Mountains are located about 37 miles southeast of Prineville, Oregon. As shown on **Map 2 East Maury Vicinity Map**, the project area is about 24,239 acres contained within Crooked River watershed and in the Pine, Drake, Indian, Lower Camp, and Maury Creek sub watersheds. The project area lies within:

- Township 17 South, Range 20 East, sections 20-29, 30-36;
- Township 17 South, Range 21 East, sections 27-34;
- Township 18 South, Range 20 East, sections 1-6, 8-12; and
- Township 18 South, Range 21 East, sections 3-10.

Elevations range from 6,086 feet above sea level at Tower Point Lookout to 4,200 feet where Wildcat Creek crosses the Forest boundary. There is one tract of private land (about 40 acres) within the project area boundary.

Purpose and Need for Action

The purpose and need is derived from evaluating current planning direction identified in Forest Plan Management Area goals and objectives and Forest-wide standards and guidelines which identify desired future conditions and comparing them against current conditions in the environment. This includes the desire to reduce stand densities and fuel loadings and reduce conditions favorable to insect and disease attack and wildfire damage. In addition, the Maury Mountains Watershed Analysis and the East Maury Roads Analysis identified vegetation and road current conditions, desired conditions, and opportunities to move towards desired future conditions. Because of the emphasis in reducing the risk of stand loss due to overly dense stands coupled with the increased risk of stand replacement fire events, two areas have been identified as needing corrective measures; vegetation and fuels. An additional purpose and need is to provide wood products and opportunities for jobs as a byproduct of vegetation management in accordance with forest-wide standards and guidelines and management area goals and objectives in the Forest Plan. The following describes in more detail the elements needing change.

Forest Vegetation

There is a need for moving the seral and structural conditions of forest stands towards their historic ranges of variability, maintaining and increasing late and old structured

stands; increasing the resistance of forest stands to insects and disease; and maintaining and increasing broadleaf and shrub communities.

- Move seral structural conditions toward the historic range of variability.
- Restore historic amount of stands dominated by large trees.
- Reduce excess stocking in stands dominated by trees less than 21 inches in diameter at breast height (dbh) to promote growth and development of large trees.
- Reduce the levels of mortality of large diameter trees within late and old structured stands.
- Reduce insect and disease susceptibility and mortality in forested stands.
- Maintain and restore upland shrub communities.

Manage stocking near streams, springs and meadows to increase the number of large trees and broadleaf tree and shrub communities to promote long-term shading and channel stability.

The Forest Plan (p. 4-12) identifies a goal of maintaining forest health for present and future uses. The Forest Plan (p. 4-3) also has a goal to “maintain or enhance ecosystem functions to provide long-term productivity of forest resources and biological communities.” The objective associated with this goal is to provide for all seral stages of plant associations, with a distribution that is ecologically sound. The Ochoco National Forest Viable Ecosystems Management Guide (Simpson et al. 1994) is a tool for analyzing each seral/structural stage for the plant associations found on the Ochoco National Forest. Managing an ecosystem within its range of natural (or historic) variability (HRV)¹ is a scientifically defensible way to maintain diverse, resilient, productive, and healthy systems (Swanson et al. 1994).

Restoration of historic stand conditions and late and old structure

According to the Maury Mountains Watershed Analysis, forested stands that occurred historically were more resilient to insects, disease, and wildfire on a landscape basis. Stands on drier sites tended to develop in clumps or groups of same age trees creating a mosaic of different age classes and canopy layers. The dominant disturbance factor was frequent, low-intensity fire that curtailed the survival of the majority of seedlings and saplings. Currently, more of the project area is covered by dense stands of smaller trees than was present historically. Stands dominated by large trees are fewer than were present historically. Species composition of forest stands has shifted from early seral (fire-resistant ponderosa pine and western larch) to late seral (grand fir and Douglas-fir). Upland slopes once covered by shrub and grass communities have converted to western juniper.

Dense stands need to have the smaller diameter trees removed to reduce competition between trees and to increase the vigor of the existing large diameter trees. This will move these stages towards the development of deficient stages dominated by large trees. The historic amount of

¹ Historic Range of Variability (HRV) is a method to understand the dynamic nature of ecosystems; the processes that sustain change in the ecosystem; the current state of ecosystem in relationship to the past; and the possible ranges of conditions that are feasible to maintain. It is a useful tool for determining a range of desired future conditions for establishing the limits of acceptable change. Best available science and local management expertise are used to determine the historic range of variability.

The area dominated by large trees is estimated to have ranged from 10,500 acres to 19,600 acres (amounts do not include western juniper plant associations). At present, there are approximately 800 acres dominated by late and old structure. Treatment of existing acres dominated by large trees is needed to reduce competition among trees to increase the health and vigor of remaining trees, changing multi-canopied (multi-strata) stands to single canopied (single-strata) stands. This would lead to maintaining these stands longer into the future. Treatment in ponderosa pine communities with in-growth of fir would reduce the amount of shade-tolerant species and move stands towards early-seral species conditions.

Forest Health

A major factor of the overall health of the forest is the vigor of the trees. If the majority of the trees in a given area have densities that result in stagnated stands, they become vulnerable to insects and disease. Competition from intermediate and suppressed trees in ponderosa pine stands reduces growth of dominant and codominant trees (Cochran 1993). This is important given the existing low amount of large trees and the time and growth needed to develop large structure.



Photo 1-1 Thinning needed to reduce density near large trees

Upland Shrub

Increasing stand density has resulted in decline of grass and shrub cover. In addition, over the last 100 years, juniper has expanded significantly and new stands of western juniper (*Juniperus occidentalis*) have developed in areas that were historically mountain big sagebrush (*Artemisia tridentata*) and grass dominated (Maury Mountains Watershed Analysis, p. 61). The Forest Plan (p. 4-5)

describes a desired condition for biological diversity and indicates that species dominance may change as a result of juniper thinning or removal. Juniper has also moved into stands on ponderosa pine, Douglas-fir, and grand fir sites and competes for site resources. Reducing the amount of juniper on some sites is needed to maintain or increase the vigor of grass, forb, and shrub communities where they existed historically.

The HRV for grass and shrub-dominated communities on sites identified as western juniper woodland, western juniper steppe and dry ponderosa pine in the project area is between 2,084 and 3,315 acres. Currently small scattered openings totaling 554 acres within these plant association groups are shrub dominated. Increased juniper cover decreases grass and shrub cover which in turn increases the area of exposed soil and potential erosion (Gedney et al 1999). Reduced grass and shrub cover also reduces forage and hiding cover for some wildlife species.

Other shrub species are also in decline in the project area including mountain-mahogany (*Cercocarpus ledifolia*), serviceberry (*Amelanchier florida*), cherry (*Prunus* sp.), currant (*Ribes* sp.), rose (*Rosa* sp.), and snowberry (*Symphoricarpos albus*) occur in the project area and favor open stands with low canopy cover. These shrubs decline under dense conifer shade. Thinning

conifer stands and reducing canopy cover would reduce competition for light, moisture, and growing space. Grasses and shrubs would respond with increased vigor and growth, and prevent future decline in abundance, disturbance, and extent.

Riparian Plant Communities

There is a need to reduce conifer encroachment in and near aspen and broadleaf shrubs to increase their vigor and increase the area dominated by these species. The Forest Plan (p. 4-32) identifies a desired future condition where hardwoods such as cottonwood, aspen, alder, and willow will be more common along streams, meadows, and wet areas. Aspen and broadleaf shrubs are currently declining. In the Maury Mountains, black cottonwood, quaking aspen, willow, birch, and shrub communities dominated by red-osier dogwood, chokecherry, or hawthorn only occur as remnant stands (WA, p. 71). Increasing stand density and forest expansion (especially western juniper encroachment) have reduced nonforest vegetation.

Aspen grows in self-perpetuating clones in areas of locally high moisture such as meadows, seeps, and adjacent to streams. Aspen occurs throughout the project area. Today, most clones are in poor health and are receding in area; some consist of only one to three trees. The reasons for aspen decline include conifer encroachment and increasing density; over browsing by livestock, deer, and elk; and loss of habitat where the water table has dropped due to stream down-cutting. It is important to take action to re-invigorate aspen by reducing conifer encroachment.

Broadleaf shrubs within the project area typically include alder (*Alnus*), willow (*Salix*), birch (*Betula*), dogwood (*Cornus*), cherry (*Prunus*), elderberry (*Sambucus*), and currant (*Ribes*) species. Existing occurrence and density of these shrubs are less than historic conditions. Along many streams, lowered water tables due to channel downcutting, increased density of upland conifer cover, grazing by livestock and big game, and competition from conifer development is reducing the potential for these shrubs to develop and grow. It is important to take action to reduce conifer cover and competition to encourage the expansion of broadleaf shrubs.

Fuels

There is a need for moving the distribution of fire regimes towards their historic ranges of variability, increasing the amount of low-intensity fire conditions, decreasing the amount of high-intensity fire conditions and a need to maintain low-intensity fire conditions where they already exist.

- Move the distribution of fire regimes towards the historic range of variability.
- Decrease the area with conditions susceptible to high-intensity fire.
- Increase the area meeting conditions for low-intensity fire.
- Maintain existing areas with low-intensity fire conditions.

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

Historically, the dominant disturbance factor in the project area was frequent, low-intensity fire with an average return interval of less than 25 years. This was typical of low-elevation, semi-arid ponderosa pine-dominated forests of the American west (Barrett et al 1997). Historically, over a 10-year period, the expected total acres burned in the Maury Mountains would be about 28,600 acres (Maury Mountains Watershed Analysis, p. 76).

The frequent return interval of fire kept forest stands open and eliminated the majority of seedlings and saplings, thus resulting in low levels of surface fuels. In the absence of frequent, low-intensity fires, forest stands in the project area have developed multi-canopy conditions, stocking levels have increased, ladder fuels have increased, surface fuels have increased, and the abundance of fire-intolerant species (such as fir) has increased. These changes from historic conditions have left forested stands susceptible to high-intensity wildfire, with an increased potential for the unwanted loss of trees, water quality, soil productivity, wildlife habitat, and other forest resources. High-intensity wildfires caused by these conditions also limit the suppression options available to firefighters, decreasing the safety, efficiency, and economy of fire suppression.

The East Maury project area currently has 15,192 acres of forest stands that have been determined to be susceptible to high-intensity wildfire because they have missed one or more fire cycles. It is important to take action now to reduce surface fuels, ladder fuels, and stand density with thinning and prescribed fire. Reducing fuels would also reduce the risk of high-intensity wildfire in these forest stands.

There is a need to increase the amount of acres within the low-intensity fire regimes by reducing the surface and standing fuel loadings in fire adapted plant associations such as ponderosa pine

There is also a need to maintain low-intensity fire conditions where they already exist. About 5,875 acres in the East Maury project area currently are in a low-intensity fire condition. Without treatment, surface fuels accumulate, multiple canopy layers develop, fire-intolerant species become more abundant, and the potential for high-intensity fires increases.



Photo 1-2 Small diameter ladder fuels

Forest wood products and seasonal jobs

There is a need for providing wood products to contribute to the health of the local and regional economies (Forest Plan, pp. 4-31 to 4-32) consistent with Management Area and Forest-wide standards and guidelines and to provide opportunities for employment and income.

The Multiple-Use Sustained Yield Act as amended by the NFMA directs the Forest Service to develop and administer the renewable surface resources of the National Forests for multiple use and sustained yield of products and services. Through the implementation of the Ochoco Forest Plan, management area allocations have objectives of providing wood products for local and regional economies while meeting other resource objectives. These management area allocations within the project area are General Forest (16,457 acres) and General Forest Winter Range (1,742 acres) and constitute approximately 18,199 acres of the 24,239 acre project area. In addition, other management area allocations, when meeting applicable standards and guidelines, can also produce wood products as a secondary output to meeting other objectives such as wildlife or scenic resources. Seasonal jobs associated with timber harvest would be supported through the sale of merchantable material consistent with General Forest and General Forest Winter Range goals and objectives. Noncommercial vegetation management needs can also produce the need for service contracts which produce seasonal jobs in the service contract sector.

Proposed Action

The Lookout Mountain Ranger District is proposing to manage vegetation and reduce fuel loads through commercial timber harvest, pre-commercial thinning, juniper cutting, and prescribed burn activities to meet the purpose and need. The proposed action includes approximately 6,852 acres of commercial harvest, 7,711 acres of pre-commercial thinning, 3,327 juniper thinning, and 11,375 acres of fuel treatment. Commercial harvest includes tractor, skyline, and horse logging systems. Road construction activities include 9 new miles of road construction and reconstructing 18 mile of road on existing roadbed. Newly constructed roads and roads that are reopened for the project would be closed after harvest activities are complete. The proposed action is described in detail in Chapter 2 (Alternative 2). A complete description of proposed activities is described in **Appendix A**. Unit specific prescriptions and road use are included in **Appendix B**.

Connected Actions

Roads

Implementation of the proposed action would require the construction of approximately 7 miles of new permanent roads and the construction of 2 miles of new temporary roads. Newly constructed permanent roads would be used to access treatment units and would be closed after timber harvest and post-harvest activities were completed. Temporary roads would be decommissioned at the completion of harvest within the unit. Approximately 18 miles of existing roads would be reconstructed to restore the road for transport of equipment and vehicles to perform the proposed treatment prescriptions. Decommissioning of existing roads within or accessing treatment units would be done on approximately 2.5 miles of roads. An additional 2 miles of currently open road will be closed. All roads identified for decommissioning access units proposed for treatments and are connected to the vegetative treatment actions.

Soap Material Source

As a connected action, the expansion of Soap Material Source is included in the proposed action. To meet the needs of the proposed road work and future needs for this area, the material source needs to be expanded by approximately 3 acres to the southeast. The area of the expansion

currently has a mixture of small western juniper, ponderosa pine and Douglas-fir. All vegetation would be removed from the expansion area.

Forest Plan Direction

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

There are 9 Forest Plan management areas in the project area. A management area is “composed of lands with similar capabilities or characteristics” (Forest Plan, p. 4-45). Each management area has specific goals, desired future conditions, and standards and guidelines. The location of these management areas is depicted on **Map 2. Forest Plan Management Areas**. The emphasis for each of the management areas is briefly described below.

MA-F6 Old Growth - Habitat will be provided for wildlife species dependent upon old-growth stands (Forest Plan, p. 4-58). The project area contains an estimated 627 acres of allocated old growth.

MA-F12 Eagle Roosting Area – provide winter roosting habitat for migrating bald eagles from December through April. The project area includes approximately 42 acres of designated eagle roost area.

MA-F13 Developed Recreation - Provide safe, healthful, and aesthetic facilities for people to utilize while they are pursuing a variety of recreational experiences within a relatively natural outdoor setting (Forest Plan, p. 4-71). The project area includes 57 acres within the developed recreation management area in the Wiley Flat and Elkhorn campgrounds.

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

MA-F15 Riparian and RHCA - RHCAs include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems. RHCAs encompass the MA-F15 management area and are overlaid on other management areas. RHCAs are shown on the **Map 3. Stream Class – Riparian Habitat Conservation Areas**. There are an estimated 2,114 acres within RHCAs.

MA-F20 Winter Range - Manage for big game winter range habitat (Forest Plan, p. 4-82). The project area includes an estimated 3,773 acres of winter range.

MA-F21 General Forest Winter Range - Manage for timber production with management activities designed and implemented to recognize big game habitat needs (Forest Plan, p. 4-84). The project area includes an estimated 1,749 acres within this management area.

MA-F22 General Forest - Produce timber and forage while meeting the Forest-wide standards and guidelines for all resources. In ponderosa pine stands, management will emphasize

production of high value (quality) timber (Forest Plan, p. 4-86). There are an estimated 16,458 acres of general forest within the project area.

MA-F26 Visual Management Corridors - Maintain the natural-appearing character of the Forest along major travel routes, where management activities are usually not evident or are visually subordinate to the surrounding landscape (Forest Plan, p. 4-95). The project area includes approximately 1,491 acres in visual management corridors along Road 16.

Eastside Screens

The *Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales* amended the Forest Plan in 1995. The direction only applies to the design and preparation of timber sales on eastside Forests and is often referred to as “Regional Forester’s Forest Plan Amendment #2” or as the “Eastside Screens.” The Eastside Screens contain guidelines for management of timber sales in LOS relative to the HRV (ecosystem screen), wildlife corridors, snags, coarse woody debris, and goshawk management. All other pre-commercial vegetative management treatments are exempt from the Eastside Screens. The Regional Forester encouraged the consideration of Forest Plan amendments in cases where the proposed treatments would move landscape conditions towards HRV and provide single story late and old structure in the drier ponderosa pine and larch stands.

Inland Native Fish Strategy

The riparian management guidelines of the Forest Plan were amended by the Inland Native Fish Strategy (1995). On June 11, 2003, the Regional Forester issued supplemental guidance for implementing Eastside Screens. INFISH was intended to be interim direction to protect habitat and populations of resident native fish and to provide for options for management. The INFISH delineated RHCAs where riparian-dependent resources receive primary emphasis. These RHCAs include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems. These areas will be managed to maintain or restore water quality, stream channel integrity, channel processes, sediment regimes, in stream flows, diversity and productivity of plant communities in riparian zones, and riparian and aquatic habitats to foster unique genetic fish stocks that evolved within the specific region. RHCAs run through and are overlaid on other allocations.

Scope of Project and Decision Framework

The scope of the project and the decision to be made are limited to: commercial harvest; non-commercial treatments; fuels reduction treatments; road management actions; Soap Material Source expansion; aspen treatments associated with treatment units; and monitoring within the project area. Chapter 2 details the designs of these actions. The project is limited to National Forest System lands within the project area.

The Responsible Official for this proposal is the Forest Supervisor of the Ochoco National Forest. The Draft EIS will have a 45-day public comment period. The Responsible Official will decide whether to:

- Select the proposed action, or
- Select an action alternative that has been considered in detail, or
- Modify an action alternative, or
- Select the no-action alternative, or

- Identify what mitigation measures and monitoring will apply, and
- Amend the Forest Plan.

The decision will be determined by comparing how each factor of the project purpose and need is met by each of the alternatives and the manner in which each alternative responds to the key issues. The alternative which provides the best mix of prospective results in regard to the purpose and need, the issues, types and levels of effects and public comments, will be selected for implementation. Specific questions the Responsible Official will consider when evaluating alternatives include:

1. Would the density and species composition of forested stands be modified towards a balance of seral/structural stages as described by the HRV?
2. Would the overall amount of Late and Old Structure (LOS) be maintained? Would the amount of single strata LOS be increased? Would the activities reduce the competition stress and likely mortality of large trees? Would the activities lead to the future development of large trees?
3. Would the selected activities reduce stand densities and improve health and vigor? Would the potential for epidemic outbreaks of insects and disease be reduced? Would a mosaic of stand conditions be maintained within the project area?
4. Would the selected activities maintain and increase diversity of riparian plant communities? Would the amounts of aspen and broadleaf shrubs increase?
5. Would the selected activities restore grass, forb, and shrub communities on upland shrub sites? Would the amount of juniper encroachment be reduced?
6. Would stand densities, species composition, and structure be reduced to decrease the susceptibility to stand replacement (high intensity) wildfire? Would the amount of fuel loading be reduced? Would the number of acres that support non-lethal (low intensity) fire be increased?
7. How well have public comments been considered during the analysis process? Have comments provided any new information relevant to the proposed activities that has not been considered?

Public Involvement

The Notice of Intent was published in the Federal Register on August 15, 2005. A revised NOI was published in the Federal Register on October 19, 2007. The Notice of Intent asked for public comment on the proposal from August 15, 2005 to October 1, 2005. In addition, as part of the public involvement process, the agency met with the Crook County Natural Resources Planning Committee to discuss this project on June 21, 2005 and October 4, 2005. The Forest Service mailed letters to potentially interested and affected individuals on August 4, 2005. The Forest Service also mailed letters to potentially affected Tribes on August 5, 2005.

As a result of these efforts, letters or e-mails were received from League of Wilderness Defenders-Blue Mountains Biodiversity Project, Oregon Natural Resources Council, Ochoco Lumber Company, Kastor Ranch, Shotgun Creek Ranch, Post Ranch, B. Sachau, Crook County Natural Resources Planning Committee, Oregon Department of Fish and Wildlife Service, U.S.

Fish and Wildlife Service, and the U.S. Environmental Protection Agency. Copies of these comments are contained in the project file.

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

Issues

Issues are points of discussion, debate, or dispute about environmental effects that may occur as a result of the proposed action. Issues provide focus and influence alternative development, including development of mitigation measures to address potential environmental effects. Issues are also used to display differing effects between the proposed action and the alternatives regarding a specific resource element. The Forest Service separated the issues into three groups: Key issues, Analysis issues and Issues not addresses in detail.

Key issues were used to develop Alternative 3. These are issues that cannot be resolved without some consideration of the trade-offs involved. Trade-offs can be more fully understood by developing alternatives and displaying the relative impacts of these alternatives.

Analysis Issues are other environmental components that were determined to be important and were considered during the analysis process. They are also used to develop design elements to address potential environmental effects.

Issues not addressed in detail are not considered during the analysis process. They were identified as those: (1) outside the scope of the proposed action; (2) already decided by law, regulation, Forest Plan, or other higher level decision; (3) irrelevant to the decision to be made; or (4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) regulations explain this delineation in Sec. 1501.7, "...identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)...".

Significant Issues

The Forest Service identified two key issues that were used in the development of an alternative to the proposed action.

Issue 1: New road construction can cause adverse effects to water quality by increasing sediment, altering stream discharge, and altering thermal processes. The Relative Erosion Rate model will be used to show differences in sediment production by alternatives. The Equivalent Harvest Area model will be used to describe changes in flow. Changes to water temperature will also be described in the environmental consequences discussion for temperature and 303(d) listed streams.

Issue 2: New road construction causes adverse effects to wildlife by fragmenting habitat. The Habitat Effectiveness Index model uses open road density, in part, to describe effects to big game habitat. The amount of open road density, by alternative, will be described in the environmental consequences discussion for elk.

Analysis Issues

Noxious weed arose as an issue because the proposed action would remove vegetation and disturb soil, creating conditions conducive to the spread of weeds. Design elements have been included to reduce the risk of weed infestation. Effects are discussed in Chapter 3.

Comments related to wildlife included concerns about habitat for goshawks, pileated woodpeckers, bats, Canada lynx, pine martin, California wolverine, great grey owl, pygmy nuthatch, bald eagle, cavity-nesting birds, and neotropical migratory birds. The underlying reasons for proposed treatments in the East Maury Fuels and Vegetation Management is maintenance and restoration of historic seral and structural stages and that by doing this, habitat potential for the full suite of native wildlife species would be maintained. In Chapter 3 the effects of each of the alternatives on a variety of wildlife habitats such as pileated woodpecker feeding habitat, goshawk post-fledging areas, elk satisfactory cover in winter range, connective corridors (Eastside Screens), and special habitats such as aspen and cottonwood stands are displayed. The differences between alternatives are measured by the activities within and changes to various types of habitat.

One comment suggested developing potential habitat for sage grouse within the project area. Actions included in both the Proposed Action and Alternative 3 would increase sage grouse habitat.

One comment received supported variable density thinning using methods described in *Matthew Hunter's Management of Young Forests* (Hunter, 2001) that would allow young forests to develop into more complex and resilient forests. All of the action alternatives include variable density thinning within the stocking capabilities of these sites. Most suggestions in "Management of Young Forests" are described for and better adapted to forests in the Cascade Mountains and farther west.

One commenter would prefer less use of ground-based logging systems. Alternative 3 is designed to harvest fewer acres and consequently would result in less ground-based logging. The effects of ground-based logging are described in Chapter 3.

Some comments suggested that snags should be harvested, while others suggested that snags should be retained and additional snags should be created. The level of snags across the project area varies and some forest strata are snag deficient. Throughout the project area, estimated snag density is about 42 percent of the maximum potential population. The Eastside Screens indicates that snags should be maintained at 100 percent of potential population levels. Because the amount of snags is less than 100 percent of potential population levels, none of the alternatives include harvesting snags with the exception of snags that pose a safety hazard.

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

Some comments suggested removal of diseased trees greater than 21 inches in diameter instead of the proposed girdling in Alternatives 2 and 3. Other comments suggested that mistletoe problems be addressed by restoring overall forest health and fire regimes. The Purpose and Need describes needed changes to forest health and fire regimes at the landscape scale and Alternatives

2 and 3 include actions to improve forest health and restore fire regimes. The amount of LOS across the landscape is deficient (see the Purpose and Need for Action). The Eastside Screens requires that all live trees greater than 21 inches in diameter would not be commercially harvested, unless the amount of LOS is above the HRV.

A comment expressed concern about potential impacts to mountain mahogany and wanted existing mahogany protected. Mountain mahogany is a component of the upland shrub community that is addressed in the Purpose and Need. Both action alternatives propose treatments to maintain and augment mahogany in the project area. The current condition and expected changes to the abundance of this shrub is addressed in Chapter 3.

A comment stated that prescribed burning contributes to air pollution. Effects on air quality from proposed prescribed burning are addressed in Chapter 3.

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

Other comments related to roads suggested that additional roads should be closed to improve wildlife habitat effectiveness, water quality and reduce dust. All newly constructed roads in Alternatives 2 and 3 will be closed after use. Roads that are currently closed that will be used for this project, will be closed again at the completion of the project. In addition, some currently and open roads will be closed, and other roads will be decommissioned. The amount of road of closure and decommissioning varies by alternative. The alternative descriptions in Chapter 2 provide information on road work. Road densities and use are discussed in Chapter 3. Methods used to close roads are described in the **Appendix A** Description of Activities. Additional road closures not related to the proposed activities are outside the scope of the analysis.

Comments were received suggesting that the effects of all terrain or off-road vehicles (OHV) use needed to be considered and that targeted mitigation to reduce OHV use needed to be included in the EIS. Where appropriate, the effects of OHV use are discussed under the cumulative effects sections in Chapter 3. Targeted mitigation to reduce OHV use was not considered in detail in this EIS because it is outside the scope of this project. However, the Deschutes and Ochoco National Forests are developing a Travel Management project that will result in identifying roads, trails, and areas where motorized use, including OHVs, will be allowed.

Issues Not Addressed in Detail

Comments suggested that the project should establish conditions for effective winter range use by deer and elk. Additional comments related to leaving a percentage of existing shrubs untreated, leaving roadside screens and maintaining adequate cover areas. All of the alternatives were designed to meet Forest Plan standards for deer and elk. The effects of each of the alternatives on winter range are measured by the change in the Habitat Effectiveness Index for big game and are disclosed in Chapter 3. Improvement in shrub cover and vigor is part of the Purpose and Need for Action.

One commenter stated that the project area contained unroaded areas on the east and southeast sides and that the EIS should fully analyze any effects to roadless areas and values. The EIS does not analyze effects to roadless areas and values because there are no Forest Service inventoried roadless areas within the project area. The areas identified as “unroaded” by the commenter were delineated in such a way as to eliminate some existing roads. The project area has already been developed, includes several roads, and has a history of past timber management

activities. Roads in this area delineated as roadless by the commenter include: 1600-452, 1670-080, 1670-110, 1670-200, 1670-201, 1670-250, 1670-252, 1670-255, and several unclassified roads that are not numbered. Additional information is available in the Forest Vegetation Report for the East Mary Project.

Comments that were determined to be outside the scope of this project included statements such as reduce or remove livestock. Where appropriate, the effects of live stock grazing are discussed under the cumulative effects sections in Chapter 3.

Other comments suggested that the Purpose and Need for action should be redefined to include restoration and wildlife were also determined to be non-significant. The restoration of historic forest conditions identified in the Purpose and Need is assumed to support historic wildlife habitats. The effects of each of the alternatives on a variety of wildlife habitats are discussed in Chapter 3.

One commenter disagrees with post-fire logging. The project area is not currently a post-fire environment. The Purpose and Need for Action is defined to reduce risk of future fire uncharacteristically severe fires.

CHAPTER 2 – ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Introduction

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

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by the National Environmental Policy Act to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for an alternate method for achieving the purpose and need. The alternate method would include using non-commercial activities. This alternative was briefly considered then eliminated from detailed study. On the Lookout Mountain Ranger District, several previous environmental analyses considered a “no commercial harvest” alternative. A no commercial harvest alternatives would remove trees up to 9 inches in diameter and would not construct any new roads. Based on previous analyses, the “no commercial harvest” alternative would do little to increase the amount of LOS stands within the project area. This alternative would not accelerate the restoration of seral structural stages toward HRV because the level of treatment would not maintain a sufficient amount of open, single strata stands. Treated stands would return to dense, stagnated conditions sooner. This alternative also would do little to increase broadleaf trees and shrubs. This alternative would not produce forest wood products and the jobs associated with commercial harvest.

Alternatives Considered in Detail

The Forest Service developed three alternatives in detail, including the No Action and Proposed Action alternatives. Alternative 3 was developed directly in response to issues raised by the public concerning road construction.

Alternative 1 (No Action)

Alternative 1 is the No Action alternative. No vegetation or fuel management activities would be implemented to accomplish project goals. This alternative serves as a baseline for comparison of the effects of all of the alternatives.

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

There would be no stand density management treatments. Stands would continue to incur mortality and large diameter trees would continue to be at risk of loss due to competition among trees. LOS stands would remain multi-strata with dense stand conditions causing competition for resources among trees. Large diameter trees, such as ponderosa pine, would remain at a high risk of mortality. Riparian and upland grass and shrub communities would continue to decline.

There would be no fuels reduction treatments. Areas would continue to accumulate fuels with the potential for a wildfire causing unwanted damage to forested stands, wildlife habitat, soils, and water quality.

Alternative 2 (Proposed Action)

Alternative 2 is the proposed action. This alternative was developed to respond to the purpose and need. The proposed action includes approximately 7,058 acres of commercial harvest including aspen treatments on 207 acres. Noncommercial thinning would occur on 11,038 acres. Fuel reduction activities include approximately 7,927 acres, and 3,433 acres of grapple piling, and 15 acres of handpiling. Commercial harvest includes tractor, skyline and horse logging systems. Areas identified as tractor logging are areas where heavy equipment, such as logging tractors/skidder, will be used to remove a commercial product. **Table 2-1** is a summary of the Proposed Action. **Maps 7, 8 and 9** display the commercial harvest and road work, precommercial thinning, locations of aspen within treatment units, and fuels treatments for Alternative 2.

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

Stands selected for commercial and precommercial thinning have a large component of pole and small sized (less than 21 inches dbh) trees with dense stocking conditions. The objective of these treatments is to move stands towards late and old structural stage conditions in a more rapid timeframe than would occur with no treatment. Many of these smaller diameter trees are shade-tolerant species that have increased in numbers in the absence of fire and would not normally be found at these densities if fire suppression had not occurred over the last several decades. Many stands also contain large amounts of small diameter ponderosa pine under overstories of ponderosa pine and are a result of fire suppression. Reducing stocking of stands to recommended levels allows the remaining trees to increase growth rate and vigor. Trees in treated stands will be more resilient to insect and disease attack and better able to survive during adverse conditions such as drought.

Commercial harvest on slopes less than 35 percent would be implemented with ground-based harvest systems. Precommercial thinning would occur after the harvest in most units. Activity fuels will either be treated with prescribed fire, grapple piling, or hand piling. Where there are short, steep pitches in tractor logging units, these areas may be harvested by methods such as winch-lining. On steeper slopes, such as those over 35 percent, a skyline logging system would be employed for soil protection. Horse logging systems are also designated for areas with concerns about using ground-based systems.

Western junipers would be cut from some juniper woodland, juniper steppe and dry ponderosa pine sites to promote grass and shrub development. Juniper larger than 21 inches dbh or displaying old growth characteristics would not be cut.

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

Conifers would be removed commercially on 206 acres in and around aspen stands located in Riparian Habitat Conservation Areas (RHCA). Commercial harvest would be followed by pre-commercial thinning. Higher levels of slash would be maintained in these areas for protection of aspen sprouts. Aspen would be planted to augment existing low aspen counts or to restore aspen to sites where the aspen has died. Temporary fences or caging will be constructed to protect aspen sprouts. In addition, 1,009 acres within RHCAs will receive a combination of precommercial thinning, juniper cutting and prescribed fire without commercial harvest. Prescriptions would be modified to maintain shade (except for some aspen treatments) in perennial streams. Expected benefits to riparian habitats are more rapid development of large trees, stimulation of shrub establishment and growth, and generally improved ground vegetation.

Appendix A contains detailed descriptions of each activity. **Appendix B** contains a description of proposed treatments by unit for this alternative.

Table 2-1 Alternative 2 Proposed Activities

Proposed Activities	Area (acres)	Percent of Total Project Area (24,239 acres)
Total Treated Area	14,000	58%
Harvest – Total	6,857	28%
Sanitation	237	1%
Individual Tree Selection	5,285	22%
Commercial Thinning	1,125	5%
Aspen Treatment	210	1%
Noncommercial Thinning – Total	11,039	46%
Precommercial Thinning	7,711	32%
Juniper Thinning	3,327	14%
Fuel Treatment – Total	11,400	48%
Underburn (prescribed fire)	7,952	33%
Grapple Pile	3,433	14%
Hand Pile	15	<1%
Logging Systems	6,857	
Tractor	6,163	25%
Skyline	512	2%
Horse	182	<1%
Road Management (miles)		
Construction	9.3	
Reconstruction	18	
Decommissioning	2.5	
Estimated Volume from Commercial Harvest (million board feet)	20.5	

Note: Many of the acres in Table 2-1 are actually overlap acres. As an example, a commercial harvest unit may have pre-commercial thinning and grapple piling occurring within the same unit.

The proposed action includes road work. Approximately 7 miles of new roads would need to be constructed to reach stands identified for treatment. New system roads would be closed after timber harvest and associated activities were completed. Approximately 2 miles of temporary roads would need to be built to access commercial harvested areas. The temporary roads would be decommissioned after use. Approximately 18 miles of existing road would be reconstructed by doing spot rocking, erosion control measures, or brush clearing within the road prism to allow machinery movement, log haul, to reduce resource impacts and improve safety. Approximately 2 miles of roads currently accessing treatment areas would be closed after harvest and associated activities are completed (based on the East Maury Roads Analysis Report, 2007). An additional 2.5 miles of road would be decommissioned.

Proposed new and temporary roads proposed in Alternative 2 are described in **Table 2-2**. **Table 2-2** also displays which units are accessed and the amount of area accessed by each road. The criteria used to determine whether additional road access was needed included:

- reducing average skid distance to reduce soil disturbance or to reduce uphill skidding,
- location of existing access relative to stream channels and potential for sedimentation,
- changing from ground-based skidding to skyline yarding to reduce soil disturbance,
- road access to previously unmanaged stands.

Portions of the following roads would be reconstructed for use during harvest activities:

1600-000	1670-000-1	1680-011
1600-452	1670-000-2	1680-050
1600-475	1670-080	1690-000
1600-550	1670-110	1750-000-1
1600-551	1670-250	1750-000-2
1600-650	1670-120	

The following is a list of additional roads or portions of roads that would be closed after harvest and associated activities are complete:

1600-400	1680-050	1690-015
----------	----------	----------

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

1600-289	1670-000
1600-500	1670-015
1600-600	1670-254

As a connected action, the expansion of Soap Material Source is included in Alternative 2. To meet the needs of the proposed road work and future needs for this area, the material source needs to be expanded by approximately 3 acres to the southeast. The area of the expansion currently has a mixture of small western juniper, ponderosa pine and Douglas-fir. All vegetation would be removed from the expansion area.

Table 2-2 Alternative 2 Proposed New System and Temporary Roads

Road Number	Road Type	Miles	Units Accessed	Harvest Area (acres)	Stream Crossing	Comments
1600-17-264	New	0.1	264	10		Controls access around wetland
1600-289-071	New	0.4	76	28	StewartCr. Trib. 1 (Class IV)	Relocates road out of draw bottom.
1600-190-279	New	0.3	279	94		Replaces access to units cut off by removing culvert and crossing in Double Cabin Creek.
1600-400-222	New	0.1	222	26		Improves access.
1600-500-013	New	.9	13, 21	78		Access for skyline machinery.
1600-600-015	New	0.5	2, 3, 4, 5, 15, 18	431		Relocates road out of steep draw, reducing grade and improving drainage. Additional future access of 60 acres.
1600-640-002	Temporary	0.3	2	96		Provides access to lower slope.
1600-640-003	New	0.6	3, part of 4	90	Keeney Cr. Trib. 2 (Class IV)	Access for skyline machinery.
1600-475-061	New	0.2	half of 61	30		Access for skyline machinery.
1670-000	New	0.2		0		Maintains access after decommissioning poorly located section of Road 1670.
1670-215	New	0.1	202.3	25	Poison Cr. (Class IV)	Improves Class IV stream crossing.
1670-050-126	New	1.1	126	123		Access for skyline machinery.
1670-000-125b	Temporary	0.3	125	119		Improves access.
1670-000-232	New	0.3	232	56		Access for skyline machinery.
1670-250-087	Temporary	0.4	87	167		Improves access.
1670-250-124	Temporary	0.1	124	20		Improves access. Reduces skid distance and uphill skidding.
1670-254-068	New	0.6	68	58		Relocates road out of draw bottom.
1670-350-098	Temporary	0.3	98	35		Improves access.
1670-355-086a	Temporary	0.4	86	138		Improves access.
1680-032-016	Temporary	0.1	half of 16	42		Improves access.
1750-680-151	New	0.3	151.1	44		Relocates access out of draw bottom.
1750-000-189	New	0.1	189	11		Access for skyline machinery.
1750-000-186	New	0.2	186	29		Access for skyline machinery.
1750-000-192	New	0.2	192	11		
1750-000-185	New	0.4	185	23		Access for skyline machinery.
1750-680-107	New	0.6	half of 107	35		Mid slope road below Tower Point.
1760-011-164	Temporary	0.2	164.1	54		Relocates access out of draw bottom.

Soap Material Source currently does not have enough reserves available for the proposed road work identified for the East Maury project. Expanding the excavation limits to the southeast by 4 acres will meet the needs for the project and future needs. The Soap Material source is located on Road 1670-030 in Unit 166. An estimate of 77,000 cubic yards of mineral material reserves would be available with this expansion. The proposed expansion is to the south and east (300 feet by 400 feet, 2.7 acres) would increase the area to 4.1 acres. The topsoil averages 1 to 2 feet deep, with a potential stockpile of approximately 8,900 loose cubic yards if the whole area is cleared initially. A long term management plan has been developed for the source. The source should have reserves to meet needs during the next 10 years. Less than 1,000 cubic yards per year would be removed from this source.

Forest Plan Amendments Associated with Alternative 2

During the evaluation of the proposed action against current management direction, it was found that certain areas and treatments were not consistent with the Forest Plan, as amended. Two Forest Plan amendments would be needed to implement Alternative 2. These amendments are described below.

The Eastside Screens – Harvest in LOS

The East Maury project area contains about 1,322 acres of LOS distributed in stands ranging from 5 to 133 acres. The Proposed Action would treat 573 acres of LOS in order to accelerate the development of historic seral/structure stage conditions and improve the growing conditions for larger trees.

Treatments in LOS would be designed to maintain large trees by changing LOS from multi-strata to single strata conditions, although these stands would continue to have an uneven-aged (uneven-sized) structure. Treatments would reduce understory canopy layers, thus reducing competition stress in the older, larger overstory. The harvest prescription would retain the historic characteristics of groups of younger and older trees at the stand level by maintaining structural diversity and species diversity where it exists. At the landscape level, both treated and untreated LOS would provide a continuum of structural, density and successional conditions.

The Eastside Screens – Harvest in Connective Corridors

There are approximately 289 acres of connective corridors identified in the project area. About 83 acres would be treated with commercial harvest. Canopy closures in these stands would be reduced to below 50 percent but would still function as connective corridor habitat for species associated with more open conditions. Those species selecting for more dense conditions would be more affected by treatment

Alternative 3

Alternative 3 was developed to respond to key issues discussed in Chapter 1, while also meeting the stated purpose and need. This alternative focuses activities in stands with the objective to reduce stand densities, reduce hazardous fuels, reduce the risk of stand loss due to high fuel loadings, and reduce impacts associated with new road construction. Objectives also include maintaining desired fuel levels where they exist, increasing forested stands' resiliency to insects and disease, and moving towards late and old structured stand conditions.

This alternative was developed in response to public comments received concerning the impacts of roads and the amount of new road construction proposed. The amount of new and temporary

road construction proposed is reduced to 0.4 mile as opposed to 9 miles proposed in Alternative 2. This alternative focuses on using existing roads whether open or closed and includes reconstruction. As a result of reduced road access, harvest would occur on approximately 1,750 fewer acres than alternative 2. In addition, the amount of precommercial thinning, fuel treatments, and aspen stand treatments would also be reduced.

Approximately 0.2 miles of new roads would need to be constructed to reach stands identified for treatment. Newly constructed system roads would be closed after timber harvest and associated activities were completed. Approximately 0.2 miles of temporary roads would be constructed to access commercial harvest areas. The temporary roads would be decommissioned after use. Approximately 2 miles of existing road would be closed and an additional 0.8 miles of road would be decommissioned. Proposed new and temporary roads proposed in Alternative 2 are described in **Table 2-3**. **Table 2-3** also displays which units are accessed and the amount of area accessed by each road.

Table 2-3 Alternative 3 Proposed New System and Temporary Roads

Road Number	Road Type	Miles	Units Accessed	Harvest Area (acres)	Comments
1600-17-264	New	0.1	264	10	Controls access around wetland
1600-400-222	New	0.1	222	26	Improves access.
1670-250-124	Temporary	0.1	124	20	Improves access. Reduces skid distance and uphill skidding.
1680-032-016	Temporary	0.1	half of 16	42	Improves access.

Portions of the following roads will be reconstructed for use during harvest activities:

1600-000	1600-650	1680-050	1750-000-1
1600-475	1670-000-1	1680-011	1750-000-2
1600-550	1670-000-2	1690-000	
1600-551	1670-250		

Additional roads that will be closed after harvest activities are complete are 1600-400 and 1690-015.

Table 2-4 is a summary of the proposed activities in Alternative 3. **Appendix A** includes a description of the proposed treatments and **Appendix B** contains a table showing the prescriptions for each unit. **Maps 10, 11, and 12** display the proposed harvest, fuels treatments and road work for Alternative 3. Stands selected for commercial and pre-commercial vegetative and fuel treatments are the same as those described in Alternative 2.

Table 2-4 Alternative 3 Proposed Activities

Proposed Activities	Area (acres)	Percent of Total Project Area (24,239 acres)
Total Treated Area	13,725	57%
Harvest – Total	5,102	21%
Sanitation	237	1%
Individual Tree Selection	3,781	16%
Commercial Thinning	918	4%
Aspen Treatment	166	<1%
Noncommercial Thinning – Total	10,833	45%
Precommercial Thinning	7,501	32%
Juniper Thinning	3,332	14%
Fuel Treatment – Total	10,909	46%
Underburn	8,315	24%
Grapple Pile	2,579	11%
Hand Pile	15	<1%
Logging Systems	5,102	
Tractor	4,836	20%
Skyline	110	<1%
Horse	156	1%
Road Management (miles)		
Construction	.4	
Reconstruction	18	
Decommissioning	.8	
Estimated Volume from Commercial Harvest (million board feet)	15.3	

Note: Many of the acres in Table 2-4 are actually overlap acres. As an example, a commercial thinning unit may have pre-commercial thinning and grapple piling occurring within the same unit.

Forest Plan Amendments Associated with Alternative 3

During the evaluation of the proposed action against current management direction, it was found that certain areas and treatments were not consistent with the Forest Plan, as amended. Two Forest Plan amendments would be needed to implement Alternative 3. These amendments are described below.

The Eastside Screens – Harvest in LOS

Alternative 3 would treat 249 acres of LOS in order to accelerate the development of historic seral/structure stage conditions and improve the growing conditions for larger trees.

Treatments in LOS would be designed to maintain large trees by changing LOS from multi-strata to single strata conditions, although these stands would continue to have an uneven-aged (uneven-sized) structure. Treatments would reduce understory canopy layers, thus reducing competition stress in the older, larger overstory. The harvest prescription would retain the historic characteristics of groups of younger and older trees at the stand level by maintaining structural diversity and species diversity where it exists. At the landscape level, both treated and untreated LOS would provide a continuum of structural, density and successional conditions.

The Eastside Screens – Harvest in Connective Corridors

There are approximately 289 acres of connective corridors identified in the project area. About 72 acres would be treated with commercial harvest. Canopy closures in these stands would be reduced to below 50 percent but would still function as connective corridor habitat for species associated with more open conditions.

Design Elements Common to All Alternatives

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

Air Quality/Private Land Interface

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

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

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

Enclosures, exposed water lines, and other improvements would be protected during implementation.

Developments where there is no visible spring box would have the line flagged by a range tech or the hydrologist. The Meisner and Elkhorn water lines would be flagged by the hydrologist. Any crossings of water lines or the irrigation ditch would be coordinated with the Special Use permittees, the special use coordinator and the recreation specialist. Any damage to water lines or the irrigation ditch would be repaired.

If a crossing of the irrigation ditch is needed, a temporary culvert would be placed in the irrigation ditch if flows are maintained during operations. Otherwise the crossing should be hardened with the ditch being restored upon completion of logging in the unit.

Cultural Resources

Refer to Appendix B for specific units with cultural resource elements

If cultural/heritage resource sites are discovered or disturbed during implementation, efforts would be made to avoid any further disturbance. Site-specific mitigation would be determined and consultation with the Oregon State Historic Preservation Office would occur prior to resuming activities.

Road construction activities would be planned to avoid and protect known site locations and features. Any physical road closure barriers would be designed and placed to avoid and protect heritage sites and features through coordination with the archaeologist during implementation. Physical decommissioning activities would avoid and protect heritage sites (i.e. ripping would not be allowed on sites, drainage structures would be installed to prevent further erosion and meet heritage management objectives).

The layout and design for commercial harvest, non-commercial thinning, and fuels treatment activities and changes to roads will be developed to avoid and protect features, surface, and subsurface integrity of heritage sites in the identified units (**see Appendix B**). This will be done by:

- Noncommercial thinning would avoid adding fuels to site locations through unit layout and design; modification of the thinning prescription to remove fewer trees per acre; by reducing the diameter size to 3 to 4 inches with lop and scatter slash treatment; or removing thinning slash by hand away from heritage site locations. In some cases, thinning slash may be left untreated when future risk for hot surface fire is not increased from current conditions. Site-specific conditions would be considered for best treatment options.
- Fuels treatments would protect sensitive features such as wooden features and structure remains by avoidance. Fire crews would coordinate with archaeologist prior to burning for site locations and to ensure sites are avoided. In some cases, sites may be burned with the appropriate low burning temperatures and short exposure times. Preparation for burning may include pulling slash away from sensitive features, use of black line, or use of fire line construction away from site boundary. Selected site types and environmental settings would be protected through low-intensity, short-duration fire prescriptions which are often met under spring-like burning conditions. No fire line would be allowed on heritage sites.
- Staging areas and use of OHVs would not be allowed on sites.
- For grapple pile units with heritage sites to protect, burning conditions need to be such that fire would not spread into areas to be protected. Surface artifacts and environmental settings would be protected through burning prescriptions with low-intensity, short-duration fire prescriptions.

During implementation, activities would be coordinated with the archaeologist to ensure that heritages sites are adequately protected. This includes coordination with a variety of specialists including the sale administrator, logging systems specialist, silviculturist, marking crew foreman, and burn boss.

Sensitive Plants

Refer to Appendix B for specific units with sensitive plant elements

No slash piling or ground-based equipment would be used within 100 feet of areas identified as containing Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) populations or habitat. Exceptions would be reviewed by the botanist and hydrologist or fisheries biologist. Exceptions would include:

1. Pulling cable (winch lining) from an existing road in an RHCA;

2. Using existing roads as landings in RHCAs;
3. Constructing spur roads to access landings within units; or
4. Aspen treatments.

Implementation of activities including layout of new road construction near documented populations of sensitive plants would be coordinated with the botanist. Additional surveys of new road locations on scabland habitat would be done.

Avoid ground-disturbing activities, including piling of slash, on scablands to reduce impacts to unique scabland habitat (lithosol soils), and associated sensitive needlegrass (*Archnatherum hendersonii* and *A. wallowaensis*) habitat. Exceptions can occur on existing roads, or other areas that have been reviewed by the botanist. Scabland habitat is identified by the presence of rigid sagebrush (*Artemisia rigida*) or low sage (*A. arbuscula*).

Road construction on scablands will be limited to long-term collector, arterial and local roads. Temporary or short-term roads or trails will not be constructed across scablands unless there is no other feasible alternative. The area affected by construction of a temporary road will be completely erosion proofed through the use of crushed rock or other appropriate methods or other measures.

Provide a 50 foot infiltration buffer along the scabland/forest interface. The number of crossings, landings, and roads will be kept to a minimum.

If any new species or populations are found during project implementation, these species would be considered as described in the policy guidelines found in FSM 2670, regardless of the date of sale or other contract.

Noxious Weeds

Refer to Appendix B for specific units with noxious weed elements.

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

Re-use of landings infested with noxious weeds would not occur until reviewed by the weed coordinator. Where weeds persist, shade would be retained, and burning would be avoided within 100 feet of the infestation. Exceptions would be made through coordination with the weed coordinator.

Avoid or minimize disturbance within or adjacent to existing noxious weed infestations by avoiding the use of weed-infested areas for camps, staging areas. Exceptions may be made through coordination with the weed coordinator.

Water for prescribed fire control, watering roads, or other activities would be obtained from weed-free sites or by methods that reduce the risk of transferring weed seeds from infested areas near water sources. Fire engines and water tenders would avoid driving over noxious weed on the banks of water sources. Operators would use portable pumps to move water to engines and tenders.

Gravel and rock used on roads and landings would come from weed free material sources.

To reduce the potential for transport or spread of noxious weeds by road construction or logging equipment, the timber sale contract would require: (1) certification that equipment be

clean of all plant or soil material that may result in the establishment or spread of noxious weeds; and (2) notification of location where equipment was most recently used. The timber sale administrator would certify that equipment is clean of plant and soil material before the equipment enters the project area.

All equipment and vehicles to be used at the material site shall be cleaned and certified free of noxious weeds and their seeds prior to entrance onto the National Forest. The restriction shall include equipment and vehicles intended for off-road use as well as on road use, whether they are owned, leased, or borrowed by the permittee/contractor. Cleaning shall consist of the removal of all dirt, grease, debris, and materials that may harbor noxious weeds and their seeds. This may require the use of a pressure hose. Cleaning shall occur off Federal lands.

Re-vegetate new roads (closed temporary and system), primary skid trails, and log landing areas as part of the final sale contract work. Use locally collected native grass species including: pinegrass (*Calamagrostis rubescens* Buckl.), squirreltail (*Elymus elymoides* (Raf.), Swezey, Sandberg bluegrass (*Poa secunda* J. Presl), blue wildrye (*Elymus glaucus* Buckl.), and basin wildrye (*Leymus cinereus* L.), or native cultivars (commercial varieties of native grasses) including red fescue (*Festuca rubra* L.) and big bluegrass (*Poa ampla* Merr.). Areas should be seeded as a mixture at approximately 10 lbs/acre. All seeds would be certified as “All States Noxious Weed Free.”

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

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

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

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

The silviculture prescriptions and burn plans for each unit will include the location of sites identified by the botanist where actions are needed to avoid disturbance.

Seed the first season following treatments with appropriate seed mix to out-compete existing weed species as soon as possible to avoid site dominance.

RHCAs

Refer to Appendix B for specific units within RHCAs

RHCA stream classes and boundaries are as follows:

RHCA Class	Category	Width Each Side (feet)
2	Perennial, fish-bearing streams	300
3	Perennial, non-fish bearing streams, ponds, lakes, reservoirs, and wetlands greater than 1 acre	150
4	Intermittent streams, wetlands less than 1 acre, landslides	50

Noncommercial thinning would not cause a reduction in shade on perennial streams (Class II and III) with the exceptions of thinning to promote deciduous trees and shrubs. Trees to be cut would depend on tree height, slope and distance to stream. Thinning around hardwoods would be coordinated with the fisheries biologist or hydrologist.

Additional riparian shrub planting would be done at new and reconstructed stream crossings.

To prevent browsing on aspens, fencing or individual tree cages would be installed, or as available thinning slash would be arranged to protect sprouts. Aspen plantings would be done in some locations to augment the residual aspen or restore it to the site.

No machine fire lines would be constructed within RHCAs.

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

Fire prescriptions for RHCAs would provide for a mosaic of burned and unburned areas to retain sufficient soil cover for infiltration. Fire ignition would not occur within 50 feet of the stream channel, but the fire would be allowed to back into the 50 foot buffer. Exceptions would be allowed after coordination with the fisheries biologist, or hydrologist and botanist where this would better meet RMOs.

Locating industrial camps will be avoided in RHCAs.

When consistent with other management actions, slash would be left on skid trails, temporary roads, and roads to be closed.

Tree-length yarding would not be permitted within RHCAs.

Thinning slash will be directed toward the stream channel to increase woody structure and roughness and to reduce livestock access.

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

Additional retention of felled trees will occur in Wiley Creek, Wiley Creek tributary 1, and Double Cabin Creek.

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

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

1. Pulling cable (winch lining) from an existing road in an RHCA.
2. Using existing roads as landings in RHCAs, such as in units 98, 113, 196, and 243.
3. Constructing spur roads to access landings within units. New landings will be located outside RHCA.

Portions of RHCAs located on the uphill side of access roads would be included in upland harvest units.

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

Ponds, seeps and wet areas that could be used by Columbia spotted frog will be avoided during harvest activities.

Soils and Geology

Refer to Appendix D Soil Condition Analysis for specific units with mitigations

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

Skid trails would be designated and approved prior to logging by the timber sale administrator and would be located on already disturbed areas where possible. Where practical, skid trails would avoid ephemeral draws. Crossings would be perpendicular to ephemeral draws. Keep detrimental soil disturbance to less than 20 percent of the area.

Grapple piling equipment would remain existing disturbed area to limit the amount of detrimental soil conditions. In undisturbed areas, grapple pile equipment would be allowed to make 1 or 2 passes to move between skid trails and other detrimentally disturbed areas. Machinery would be limited to slopes less than 35 percent.

On slopes where erosion in the fireline could occur, water bars (a small trench to direct the flow of water off the line) would be dug into the fireline. On slopes from 0 to 30 percent, waterbars would be placed every 60 feet. On slopes over 30 percent, waterbars would be placed every 25 feet.

Any evidence of recent slope movement in units 20, 33,36, 84, 86, 89, 93, 98, 99, 107, 122, 124, 130, 132, 139, 144, 179, 180, 185, 186, 189, 192, 215, and 242 requires consultation with the geologist.

Water Quality/Fisheries

Refer to Appendix B for specific units within RHCAs elements

Ground based equipment would not be used on the old road prism, just below Road 16 running from Elkhorn Spring to Elkhorn Campground.

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

Project plans will be reviewed by geologist for springs within dormant landslide terrain.

Skid trails and temporary roads would be designed to reduce the concentration of flows and to encourage the flow of water off of them.

Landings and main skid trails within 300 feet of landing used in harvest operations would be scarified and seeded to increase infiltration and prevent surface erosion. Landings that are

located on a gravel road or at turnouts that will remain open to traffic use would be exempt from the scarification and seeding requirements.

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

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

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

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

Suspension of use would occur when road use is contributing to sediment detachment and transport (i.e. rutting 1 to 2 inches deep) muddy ditch water to prevent siltation outside of the roadway.

Wildlife

Refer to Appendix B for specific units with wildlife elements

Goshawk

A 400-acre post fledging area has been established around each known nest site. No management activities, including underburning activities, would occur inside the 30-acre nest stand. Burning activities within the post fledging areas would be designed to protect overstory trees.

There would be a seasonal restriction (March 1 to August 31) on commercial harvest, precommercial thinning, and underburning within 0.5-mile of an active nest. This seasonal restriction may be waived on an annual basis if a nest inventory determines that breeding is not active.

A seasonal restriction (March 1 to August 31) would also apply (within 0.25 mile of nests) to new road construction on roads.

Seasonal restrictions (March 1 to August 31) on hauling would be applied within 0.25 mile of known nests. Haul restrictions would not apply to arterial or collector roads.

Bald Eagle, Golden Eagle and Osprey Nests

Activities would be restricted within 0.5 mile from March 1 to August 15 for golden eagles.

Activities would be restricted within 0.25 mile (0.5 mile line of sight, 1 mile for blasting) from January 1 to August 31 for bald eagles.

Activities would be restricted within 0.25 mile of active osprey nests.

Other Raptors

No management activities (including underburning) would occur within 330 feet of nest site (primary zone). Between 330 and 660 feet around a nest site (secondary zone), habitat-modifying treatments are permitted. Modified treatments are intermediate treatments between that required in the primary zone and that normally prescribed outside the whole protection zone. Operations would be restricted for both primary and secondary zones between March 1 and August 1. Exceptions would be evaluated on a case by case basis by the wildlife biologist.

Deer and Elk

Seasonal restriction on harvest, thinning, fuels and related activities would be implemented between December 1 and May 1 in General Forest Winter Range and in Winter Range allocations. Within winter range road construction, reconstruction and inactivation would be restricted between December 1 and May 1 of each year. Within General Forest, road work would not be restricted except on roads that are accessed through winter range on roads that are not designated open during the seasonal closure.

Activities within elk calving areas will be seasonally restricted from May 15 to June 30.

Snags/Down Logs

Snags that pose a safety hazard would be felled.

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

Burning within goshawk post-fledging areas, pileated feeding habitat, and connective corridors would be designed to minimize impacts to mid and overstory cover, snags and large down wood. These activities would be coordinated with the wildlife biologist.

Range/Minerals

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

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

Recreation

No hauling of commercial products or heavy equipment on the day before the opening of and all weekends of general rifle deer hunting season, in accordance with Ochoco NF Commercial Road Rules.

Commercial harvest, thinning, and burning activities would be coordinated with special use permit holders or their representatives, as needed.

Hazard trees will be cut from designated dispersed sites within harvest units.

Visual/Scenic Resources

Tree marking paint would be used to designate trees to be harvested (as opposed to trees to be retained) in partial retention corridors on Road 16.

Roads

New roads will be closed at the completion of proposed activities.

Temporary roads will be limited to areas on less than 20%, and do not entail complex stream crossings or drainage structures. All temporary roads will be decommissioned at the completion of harvest activities.

The use of Road 1670 from 1670050 to 1670200 will be prohibited.

Roads across scablands would not be throughcut or trenched to prevent concentrating flows. Waterbars and drains should be located to allow the water to disperse on rocky apron areas before flowing downhill through deeper side slope soils.

All roads located on dormant landslide terrain should be reviewed by the Geologist to check for stability. If unstable areas are identified, stabilization designs such as spot rock, geotextile or realignment through sensitive terrain to reduce the potential for reactivating slope movement would be conducted.

Monitoring

Post-project surveys and monitoring of noxious weed infestations, including mineral sources, would be conducted to evaluate the effects of the project on noxious weeds and to continue eradication treatments. Post-project surveys would identify new noxious weed infestations while they are small.

Temperature monitoring would continue on selected stream reaches such as Shotgun, Drake, and Wiley Creeks. Pre and post-activity temperature and shade monitoring would be done below aspen treatments in the Wiley Creek drainage. Aspen plantings would be surveyed until establishment.

Occupancy and reproduction in mapped raptor territories would be monitored during and after project implementation.

Snag levels would be surveyed in selected areas during project preparation and after implementation.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. **Table 2-5** compares the proposed treatments of each alternative. Information in **Table 2-6** is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. **Table 2-7** is a comparison of proposed treatments within Forest Plan management areas.

Table 2-5 Proposed Activities

Proposed Activities	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)
Total Treated Area	0	14,000	13,725
Harvest – Total	0	6,857	5,102
Sanitation		237	237
Individual Tree Selection		5,285	3,781
Commercial Thinning		1,125	918
Aspen Treatment		210	166
Noncommercial Thinning – Total	0	11,039	10,833
Precommercial Thinning		7,711	7,501
Juniper Thinning		3,327	3,332
Fuel Treatment – Total	0	11,400	11,061
Underburn (prescribed fire)		7,952	8,315
Grapple Pile		3,433	2,579
Hand Pile		15	15
Logging Systems	0	6,857	5,102
Tractor		6,163	4,836
Skyline		512	110
Horse		182	156
Roads (miles)			
Construction	0	9.3	0.4
Reconstruction	0	18.0	18.0
Decommissioning	0	2.5	0.8
Estimated Volume from Commercial Harvest (million board feet)	0	20.5	15.3

Table 2-6 Comparison of Alternatives

	Alternative 1. No Action	Alternative 2. Proposed Action	Alternative 3
Restoration of HRV (60 seral stages):	In 20 years, 20 seral stages are within HRV. Departure from HRV increases.	In 20 years, 29 seral stages are within HRV. Departure from HRV decreases.	In 20 years, 25 seral stages are within HRV. Departure from HRV decreases at lower rate than alternative 2.
Restoration of LOS (% of PAG): DGF PAG, min. HRV 26%, 4% exist. DF PAG, min. HRV 44%, 6% exist. PP PAG, min HRV 44%, 2% exist.	In 20 years, amount of LOS compared to HRV DGF PAG, 23% DF PAG, 18% PP PAG, 5% Increased risk of mortality not included	In 20 years, % increase over alternative 1 DGF PAG, increases 23% DF PAG, increases 33% PP PAG, increases 16% Lowered risk of mortality	In 20 years, % increase over alternative 1 DGF PAG, increases 21% DF PAG, increases 33% PP PAG, increases 16% Lowered risk of mortality
Treatment in LOS stands	No treatments in LOS.	Harvest on 573 acres changes multi strata LOS to single strata. Additional 100 acres of precommercial thinning and underburning.	Harvest on 249 acres changes multi strata LOS to single strata. Additional 416 acres of precommercial thinning and underburning.
Risk of mortality due to insect and disease	No treatment proposed. There are 3,954 acres at high risk to disease and insects.	Harvest and pre-commercial thinning would reduce stocking to recommended levels on 68 percent of stands identified as overstocked. Treats 2,569 acres at high risk to disease and insects. Harvest and precommercial thinning would reduce susceptibility to future bark beetles.	Reduces stocking to recommended levels on 55 percent of stands identified at risk. Treats 2,415 acres at high risk to disease and insects. Would treat similar amount of area at high risk as Alternative 2, but treatment less effective on 12% of treated area because stocking would remain above recommended levels.
Harvest in connective corridors	0 acres	82 acres harvest.	72 acres harvest.
Aspen treatments	No aspen treatment proposed. Some aspens stands would continue to decline as conifer encroachment continues.	Treatment on 475 acres including 210 acres of harvest with objective of aspen restoration.	Treatment on 410 acres including 166 acres of harvest with objective of aspen restoration.

Chapter 2 – Alternatives, Including the Purposed Action

	Alternative 1. No Action	Alternative 2. Proposed Action	Alternative 3
Proposed treatments in RCHAs	0 acres	Prescribes commercial harvest and associated treatments on 210 acres, additional noncommercial thinning and fuels treatment on 766 acres, fuel treatments only on 205 acres.	Prescribes commercial harvest and associated treatments on 166 acres, additional noncommercial thinning and fuels treatment on 766 acres, fuel treatments only on 196 acres.
Roads in RCHAs	No new roads	This alternative would construct 311 feet of new road in the RHCAs of Stewart Creek, Keeney Creek, and Poison Creek. Three road crossing include temporary stream crossings. About 317 feet of temporary road construction adjacent to Maury Creek RHCA. Road decommissioning on 0.9 mile of open road and road closure on 0.8 miles of currently open system road.	This alternative would not construct any new or temporary roads within RHCAs. Road decommissioning on 0.1 mile of open road and road closure on 0.7 mile currently open road.
Grass and shrub community restoration	0 acres	Juniper cutting would occur on 3,327 acres. About 2,003 acres would return to grass and shrub dominance.	Juniper cutting would occur on 3,332 acres. About 2,003 acres would return to grass and shrub dominance.
Fuel reduction	No fuels treatments are proposed. About 5,875 low fire intensity stands would move to mixed or high intensity fire within 5-10 years. 7,936 acres of mixed fire intensity would move to high fire intensity.	Proposed treatments would move 6,859 acres from mixed and high fire intensity to low fire intensity. 3,330 acres of low fire intensity would be maintained.	Proposed treatments would move 5,661 acres from mixed and high fire intensity to low fire intensity. 3,176 acres of low fire intensity would be maintained.
Sensitive plants	No impacts to sensitive plants.	Populations or potential habitat for Peck's mariposa lily (<i>Calochortus longebarbatus</i> var. <i>peckii</i>) occurs in or near units 29, 58, 124, 222, 249, 264, 267, and 276.	Same as Alternative 2.

Chapter 2 – Alternatives, Including the Purposed Action

	Alternative 1. No Action	Alternative 2. Proposed Action	Alternative 3
Scablands	No impacts to scabland habitat.	Units potentially affecting scabland habitat include 13, 21, 29, 53, 61, 68, 71, 87, 88, 96, 111, 151, 158, 161, 164, 200, 202, 220, 233, 238, and 269. Of particular note are unit 13, where new road construction would be necessary to harvest this unit.	Same as Alternative 2, only new roads will not be constructed across scablands.
Noxious weeds	Noxious weeds occur throughout the project area. Treatment strategies will continue.	Potential to risk to further spread noxious weeds from management activities. Treatment units associated with infestations include 32, 93, 97, 113, 164, 166, 200, 233, 243, 265, and 276.	Same as Alternative 2
Soil disturbance	No ground disturbing activities would occur. Existing detrimental soils would not be further disturbed or tilled.	6,174 acres would be harvested using ground based equipment. An additional 19 acres of detrimental soil disturbance from road construction.	5,119 acres would be harvested using ground based equipment. Less than 1 acre of detrimental soil disturbance from road construction.
Water yield	Equivalent Harvest Area from past harvest would continue to decrease as canopy cover and leave area index increases. All areas remain below the Forest Plan threshold.	Equivalent Harvest Area remains above 25 for 6 years in the Maury Creek subwatershed and for 7 years the Indian Creek subwatershed. There is a 47% increased risk of a 10-year flood or greater to occur in the Maury Creek subwatershed and a 52% increased risk of a 10-year flood or greater to occur in the Indian Creek subwatershed.	Equivalent Harvest Area remains above 25 for 1 year in the Maury Creek subwatershed and for 7 years the Indian Creek subwatershed. There is a 10% increased risk of a 10-year flood or greater to occur in the Maury Creek subwatershed and a 52% increased risk of a 10-year flood or greater to occur in the Indian Creek subwatershed.
Temperature	There would be no reduction in shading from this alternative and no increase in temperatures.	Commercial harvest of conifers in conjunction with aspen treatments in unit 61 has the risk of reducing shade in the short term; however, temperatures should still meet State standards.	Proposed activities should not reduce shading of fish bearing or non-fish bearing perennial streams.

Chapter 2 – Alternatives, Including the Purposed Action

	Alternative 1. No Action	Alternative 2. Proposed Action	Alternative 3
Sediment and turbidity	Sediment and turbidity levels would not change.	Ground based units within 200 feet of streams (units 86, 87, 97, 121, 264, and 276) have the potential to deliver 57% of new sediment to streams. This alternative has a moderate risk to deliver sediment to streams but should meet State standards.	Ground based units within 200 feet of streams (units 97, 121, 264, and 276) have the potential to deliver 25% of new sediment to streams. This alternative has a low risk to deliver sediment to streams but should meet State standards
Sensitive aquatic species habitat	No impacts to sensitive aquatic species.	Potential impact to sensitive aquatic species habitat from the Wildcat Creek culvert replacement and the two temporary culverts on Tom Vawn Creek and Wiley Creek tributary 1. Impacts would not likely contribute to a trend towards federal listing.	Potential impact from the Wildcat Creek culvert replacement. Impacts would not likely contribute to a trend towards federal listing.
Goshawk habitat	No treatments in post-fledgling areas, core nest areas or suitable goshawk habitat outside of post-fledgling areas. Maintain the existing 13,987 acres of habitat.	Alters 2,472 acres of suitable goshawk habitat in post-fledgling areas. Reduces nesting suitability on 1,806 acres in post-fledgling areas.	Alters 2,320 acres of suitable goshawk habitat in post-fledgling areas. Reduces nesting suitability on 1,240 acres in post-fledgling areas.
Pileated woodpecker habitat	No change on 563 acres of designated feeding habitat. 2,851 acres of primary reproductive habitat would remain in the project, which is above HRV.	Maintain existing habitat on 439 acres of designated feeding habitat. Habitat suitability would be reduced on 124 acres. 1,612 acres of primary reproductive habitat would be present, which is within HRV.	Maintain existing habitat on 440 acres of designated feeding habitat. Habitat suitability would be reduced on 123 acres. 2,008 acres of primary reproductive habitat would be present, which is within HRV.
Primary cavity excavator habitat	Maintain existing acres of fir-dominated understories and trend towards fir dominated habitats. Projections indicated that the HRV would not be attained 50 years in the future.	Restore habitat on 3,079 acres, and bring the habitat to within HRV. After 50 years, the habitat is expected to increase by 1,436 acres.	Restore habitat on 2,318 acres, and bring the habitat to within HRV. After 50 years, the habitat is expected to increase by 899 acres.

Chapter 2 – Alternatives, Including the Purposed Action

	Alternative 1. No Action	Alternative 2. Proposed Action	Alternative 3
Elk habitat	No satisfactory cover or marginal cover would be treated and no additional roads closed. There would be no initial change in HEI value in any allocation. Over time the HEI is expected to increase in Winter Ranger, but continue to decrease in General Forest Winter Range and General Forest.	During project implementation, there would be an initial decrease in overall HEI in all allocations. Even after road closures, HEI would remain below existing conditions in all allocations due to decrease cover quality. This alternative could cause disturbance to elk from human activity associated with project implementation. Reduced cover would occur in 68% of elk calving habitat.	During project implementation, there would be an initial decrease in overall HEI in all allocations. Even after road closures, HEI would remain below existing conditions in all allocations due to decrease cover quality. Reduced cover would occur in 62% of elk calving habitat.
General Forest HEI , Forest Plan Goal 28, HEI Value	45	39	41
General Forest Winter Range HEI Forest Plan Goal 6, HEI Value	82	22	66
Winter Range HEI , Forest Plan Goal 6, HEI Value	28	11	12
Sensitive, threatened, and endangered wildlife species.	No effect to any sensitive, threatened, or endangered species.	May effect, not likely to adversely affect Canada lynx. May impact individuals or habitat, but not likely to result in a trend toward federal listing for bald eagles, Peregrine falcon, bufflehead, western sage grouse, gray flycatcher and California wolverine.	Same as Alternative 2.

Table 2-7 Comparison of Alternatives by Forest Plan Management Area

Management Area	Area Within Project Area (acres)	Alternative	Harvest and Associated Treatments (acres)	Additional Noncommercial Treatments (acres)	Additional Fuels Reduction Treatments (acres)
Old Growth	627	Alternative 1	0	0	0
		Alternative 2	0	0	0
		Alternative 3	0	0	0
Eagle Roosting Area	42	Alternative 1	0	0	0
		Alternative 2	2	40	0
		Alternative 3	2	40	0
Developed Recreation	57	Alternative 1	0	0	0
		Alternative 2	36	1	0
		Alternative 3	57	0	0
Riparian and RHCA	2,114	Alternative 1	0	0	0
		Alternative 2	248	785	224
		Alternative 3	193	771	215
Winter Range	3,773	Alternative 1	0	0	0
		Alternative 2	505	2,224	0
		Alternative 3	24	2,491	0
General Forest Winter Range	1,749	Alternative 1	0	0	0
		Alternative 2	613	627	0
		Alternative 3	154	1,086	0
General Forest	16,458	Alternative 1	0	0	0
		Alternative 2	5,010	1,441	2,503
		Alternative 3	3,582	2,236	2,473
Visual Management Corridor	1,491	Alternative 1	0	0	0
		Alternative 2	757	162	213
		Alternative 3	656	241	173

CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2.

Specialists' reports provide the basis for the conclusions discussed in this chapter. Specialists' reports were prepared for Forest Vegetation, Botany, Water Quality, Minerals and Geology, Soils, Aquatic Species, Wildlife, Fuels, Heritage Resources, and Roads. All of these specialists reports are contained in the project files; these reports have been incorporated by reference (40 CFR 1502.21) at the appropriate places in this DEIS. The information in this chapter summarizes the affected environment, direct, indirect, and cumulative effects of the alternatives along with conclusions and supporting rationale. Further information on the specifics of the affected resources such as historical conditions, assumptions, methodologies, analyses, references, and technical documentation can be found in the individual specialists' reports in the project file.

Past, Present, and Reasonably Foreseeable Future Actions

Timber harvest and road construction activities have occurred across much of the project area in the past. The implications of these actions will be discussed in Chapter 3 of this document under existing conditions for each resource.

Davis Creek Burn – The Prineville BLM is preparing to prescribe burn 1,344 acres south of Arrowwood Point and adjacent to the project area boundary in 2008. The objectives are to reduce juniper and improve the growth of native grasses and shrubs for wildlife habitat. Prescribed burning in East Maury units 233, 236, 241, 253, 259, 262 and 280 would be included in the Davis Creek project.

West Maury Fuels and Vegetation Project – In April, 2005 a decision was made to implement fuels and vegetation activities in the West Maury project area. This project area encompasses all of the Maury Mountains west of the East Maury project area. The Indian Creek and Maury Creek subwatersheds overlap both project areas. The project includes harvest, noncommercial thinning and fuel treatments with the objective of restoring historic forest conditions and fire regimes. Implementation began in 2006 and will continue for several years.

Stream Restoration work – In February 2005, a decision was made to repair headcuts and complete riparian planting. These activities have been identified in areas where stream bank erosion is causing head cutting, increasing in-channel erosion, and lowering water tables. Headcut repair activities include installing step pool structures to reduce the flow rates, increasing the amount of riparian vegetation, and stabilizing stream banks to decrease overall sediment delivery in the long term. Additional work includes riparian planting. This stream restoration work is occurring in various locations throughout the project area. Areas identified include Wildcat Creek, Drake Creek, and Shotgun Creek.

Noxious weeds – The Ochoco National Forest noxious weed environmental assessment authorized treatments of existing noxious weed populations along Forest Service roads 16 and 1680. Noxious weed species include diffuse, spotted, and Russian knapweeds and Canada thistle. Treatments include the use of chemicals, limited hand pulling, and biological control. Noxious weeds have been identified at approximately 80 sites within the project area.

Continued Grazing – There are three allotments within the project area. The Forest Service will update all three Allotment Management Plans in the Maury Mountains area. Maury Mountain Allotment Management Plan EIS was completed in 2006. The decision from the EIS included resting pastures and allotments. Approximately 50% of the planning area will be rested for ten years. One pasture was eliminated from grazing all together. The plan also includes activities that will improve riparian conditions based on recommendations in the Maury Mountain Watershed Analysis. The plan includes provisions related to the range utilization standards contained in the Forest Plan as amended.

Routine and Annual Road Maintenance – Road grading would be done on Forest Roads 16 and other roads as needed. There are also proposals to replace the Drake Creek Bridge (Forest Road 16 east) but has not been funded at this time but could be funded within the next 5 years.

Recreational activities - The area is used for a variety of recreational activities such as hunting, OHV use, and dispersed camping. Recreational activities are expected to continue at current or slightly increased levels.

Resource Conditions Relative to the Purpose and Need

Late and Old Structure (LOS)

Affected Environment

Seral Structural Stages and Historic Range of Variability (HRV)

The Interim ecosystem standard included in the Regional Foresters Plan Amendment (1995) contains a requirement to “characterize the proposed timber sale and its associated watershed for patterns of stand structure by biophysical environment and compare to the Historic Range of Variability” and to identify structural conditions and biophysical environment combinations that are outside of the historic range of variability (HRV) conditions to determine potential treatment areas.

The Viable Ecosystems model provides a process to apply the ecosystem standard to project-level planning. This system compares existing vegetation with site potential (or biophysical environment). The model focuses on relationships between combinations of vegetation structure and species composition, and habitat requirements for animals, insects, and plants. The Viable Ecosystems model stratifies the environmental gradient using plant associations. The Viable Ecosystems Management Guide (VEMG) (Simpson and others 1994) was used within the Maury Watershed Analysis to characterize and compare seral structural conditions to HRV and contains a description of Viable Ecosystems and analysis methods and tools used to conduct the analysis.

The VEMG is designed to be applied at both the forest and the sub-watershed scale. HRVs referenced in the VEMG are based on conditions of local lands from approximately 1820 to 1900.

The upland forest areas within the East Maury project area have been characterized using the plant association concept. Plant associations are a land classification which is based on the probable, or projected, plant community which will occupy a site given enough time and an absence of disturbance influences. The plant associations for the entire Ochoco National Forest have been mapped using the classifications described in “Plant Associations of the Blue and Ochoco Mountains” (Johnson and Clausnitzer 1992). The mapping was based on 1:12000 aerial photography and extensive fieldwork.

The Ochoco National Forest has defined eight plant association groups for upland forest and woodland sites. These groups contain plant associations of similar biophysical environments, productivity, and disturbance regimes. Six plant association groups occur within the East Maury project area. The Dry Ponderosa Pine and Juniper Steppe plant association groups are too small to be analyzed meaningfully and have been combined with the Moist Ponderosa Pine and Juniper Woodland plant association groups. There are approximately 3,175 acres of nonforest area within the project area.

Table 3-1 Plant Association Groups in the East Maury Project Area

Plant Association Group	Total Area (acres)
Dry Grand fir	7,115
Douglas-fir	6,221
Ponderosa Pine	3,763
Western Juniper	3,965
Total	21,064

The VEMG (Simpson and others 1994) describes a seral/structural matrix for characterizing forest vegetation within each of the plant association groups. The matrix has three seral stages based on species composition (early, mid, late), and each of these is subdivided into five size/structural conditions (grass/forb/shrub, seedling/sapling, pole, small trees, large trees). The grass/forb/shrub condition is only reflected in the early seral condition. Matrix cells are further subdivided to reflect relative differences in tree density, subscripts “a” and “b” are used to denote high and low density, respectively. For example, L4a describes a late-seral species composition, small-sized trees, at a high-density level. An example matrix is shown in **Table 3-2**.

Table 3-2 Viable Ecosystem Seral/Structural Matrix

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

Satellite imagery from 1999, updated to 2004 through change detection analysis, has been used to determine the current distribution of seral structural stages. The resolution of the satellite imagery is approximately 1/6th of an acre. Each 1/6 acre is assigned to one of the VEMG matrix classifications depending upon species composition, structure, and density. The satellite imagery captures changed conditions in seral structural conditions due to past harvest and other vegetation management activities that occurred before 2004.

The current distribution of seral structural stages across the project area is due in large part to past vegetation management. Harvest activity began in the early 1900s as local mills were established within and adjacent to land that became Ochoco National Forest (established in 1910). Early harvest consisted of selective cutting for local consumption or for shipment to local communities and occurred at lower elevations on the outer edges of the project area. From 1960 to about 1995, forest vegetation management policy emphasized harvest of large overstory ponderosa pine through partial or complete overstory removal of trees larger than 21 inches DBH. Stands selected for harvest had fully stocked understories composed of young ponderosa pine or mixtures of ponderosa pine, Douglas-fir and to a lesser extent grand fir. Overstory removal harvest also included some commercial thinning of smaller trees in some stands. Harvest was followed by precommercial thinning on a portion of the harvested area. In addition to overstory removal, some stands without healthy, viable understories were clearcut and planted in the 1980s and 1990s. Most harvest and precommercial thinning was followed by prescribed burning. An estimated 80 acres of juniper cutting in several patches occurred in the late 1980s for the purpose of improving shrub habitat. **Table 3-3** shows the amount of harvest and precommercial thinning treatments since 1970 by decade within the project area. Intensive cutting did not occur in the project area during the 1960s. The extent of pre-1960 harvest is unknown.

Table 3-3 Acres by Harvest and Precommercial Thinning by Decade

Harvest type	1970 - 1979	1980 -1989*	1990 -1999*
Overstory removal		3,875	1,270
Partial overstory removal	8,112	1,568	
Individual tree selection			714
Clearcut		216	283
Precommercial thinning		3,246	2,401

* Harvest in 1980s and 1990s occurred on 4,225 acres treated in the 1970s.

Timber sales in the project area included Arrowwood, Blunderbuss, Canine, DDuck, Double Cabin, Parrish, Robinhood, Shotgun, Whitewash, and Windytom. Based on a cursory visual inspection, selective harvest has also occurred on the majority of private lands adjacent to the project area.

Past harvest and clearcutting has resulted in a reduction of large tree structure on approximately 11,800 acres distributed evenly across Dry Grand Fir, Douglas-fir and Ponderosa Pine sites. However, most of this area continues to have a portion of the original overstory with large tree stocking levels ranging from 1 up to 6 trees per acre. Stand growth during this time has replaced

a small a portion of the overstory. Precommercial thinning has reduced the amount of dense stands by approximately 5,600 acres although stand growth since thinning has returned some stands to dense conditions.

Overstory removal harvest resulted in stands dominated by pole to small size trees (5 to 14 inches DBH typically) and would be captured in current satellite imagery as structure class 3 or 4. Partial overstory removal and individual tree selection would also be characterized as structure class 3 and 4 but would also include a small amount of class 5 (trees greater than 21 inches). Clearcuts would be characterized as grass/forb/shrub (structure class 1) or seedling/sapling (structure class 2) depending on development since planting. Precommercial thinning decreased the amount of dense stand conditions (a – high density from table 2).

Stand growth and disturbance since 2004 that changed vegetative stages has not been included. These changes would include slightly increased canopy closure due to ingrowth and expanded conifer dominance on sites identified as grass, shrub, and forb (E1). They would also include mortality due to insects and disease, resulting in an increase in the E1 condition. The amount of change since 2004 is so small that it would not meaningfully alter the analysis. The effects of past harvest, fire, and mortality were incorporated into the 2004 satellite analysis.

Tables 3-4 through **3-7** display the existing condition and the HRV for four plant association groups in the project area. Seral structural stages that meet LOS criteria are shaded. Stages that are deficient compared to the HRV also are shaded. In most plant association groups, large structural stages are deficient (structure code 5). The grass, forb, shrub stage (E1) is also deficient in the Dry Ponderosa Pine, Juniper Woodland and Juniper Steppe groups. Excess stages in most groups include pole and small trees especially in dense stands (stands with average diameters of 5 to 20.9 inch diameters with more than 55 percent crown closure). Based on this analysis 25 seral structural stages are below the HRV, 25 are above, and 48 are within.

The consequences of this imbalance are fewer stands dominated by large trees and less shrub and grassland habitat for those species with these requirements. Dense stands increase the rate of loss of large trees due to competition-related stress. The risk of uncharacteristically severe fire behavior is high. Loss of ground vegetation in dense stands means the landscape is less resilient to intense precipitation events resulting in less water storage and more erosion.

Late and Old Structure

Late and Old Structure (LOS) is an important vegetative condition specifically identified in the Eastside Screens. The Eastside Screens define LOS as vegetative structures in which large trees are a common feature. It goes on to identify two different structural conditions, multi and single strata.

Satellite imagery is used as the landscape analysis tool to estimate the existing amount of LOS. The Viable Ecosystem size/structure class 5 (21 inch diameter or greater) is used to identify existing LOS. Differentiation between multi- and single-strata LOS is based on the “a” and “b” density classifications. The amount of each LOS type by plant association group was compared to its corresponding HRV. LOS strata are shaded in **Tables 3-4 to 3-7**.

Currently, the project area contains an estimated 1,700 acres of LOS. Most of the LOS, about 1,567 acres, is in a multi-strata condition. Historically, the overall amount of LOS would have ranged between 6,674 and 12,375 acres. A large proportion of LOS would have been single strata due to the frequent low-intensity fires which were the dominate disturbance regime in the

area. In the Dry Grand Fir PAG, two of three possible LOS strata are currently within the historic range and cumulatively are within the total historic range for multi strata LOS. Ponderosa Pine and Western Juniper PAGs are also within the historic range for the multi-strata, late seral LOS. Douglas-fir PAG is below the historic range for multi-strata LOS. All plant association groups are below the historic range for the single-strata condition. The VEMG analysis revealed large excesses in young, smaller, dense forest. The amount of area dominated by late successional conifer species is also higher than was found historically.

Table 3-4 Dry Grand Fir Plant Association Group

SS Stage	Low (acres)	High (acres)	Existing (acres)
E1	143	499	441
E2a	0	0	26
E2b	214	570	587
E3a	71	214	34
E3b	285	855	116
E4a	171	285	1,428
E4b	684	1,140	2,829
E5a	171	285	519
E5b	684	1,140	81
M2a	0	71	3
M2b	214	570	88
M3a	0	143	8
M3b	214	570	18
M4a	214	399	311
M4b	855	1,596	354
M5a	143	356	241
M5b	570	1,425	23
L2a	0	143	0
L2b	0	0	0
L3a	0	143	0
L3b	0	0	0
L4a	114	285	2
L4b	29	71	0
L5a	228	456	6
L5b	57	114	0

Table 3-5 Douglas-fir Plant Association Group

SS Stage	Low (acres)	High (acres)	Existing (acres)
E1	311	1,245	312
E2a	0	0	12
E2b	0	623	181
E3a	0	125	62
E3b	0	498	34
E4a	249	498	1,245
E4b	996	1,993	1,030
E5a	436	623	50
E5b	1,744	2,491	4
M2a	0	0	0
M2b	0	623	1
M3a	0	0	0
M3b	0	311	2
M4a	62	249	3
M4b	249	996	12
M5a	62	187	0
M5b	249	747	0
L2a	0	62	8
L2b	0	249	256
L3a	0	249	50
L3b	0	62	7
L4a	199	399	1,659
L4b	50	100	648
L5a	199	399	632
L5b	50	100	13

Table 3-6 Ponderosa Pine Plant Association Group

SS Stage	Low (acres)	High (acres)	Existing (acres)
E1	188	941	167
E2a	0	0	36
E2b	0	188	73
E3a	0	38	32
E3b	0	151	13
E4a	0	75	43
E4b	0	301	65
E5a	0	75	1
E5b	0	301	0
M2a	0	0	2
M2b	0	188	18
M3a	0	38	16
M3b	0	151	2
M4a	0	75	125
M4b	0	301	121
M5a	0	113	0
M5b	0	452	0
L2a	0	0	22
L2b	0	376	273
L3a	38	113	104
L3b	151	452	1
L4a	0	151	1,829
L4b	753	1,355	740
L5a	0	151	73
L5b	1882	2,484	9

Table 3-7 Juniper Plant Association Group

SS Stage	Low (acres)	High (acres)	Existing acres
E1	1,988	2,783	452
L2a	0	0	239
L2b	199	398	362
L3a	0	0	304
L3b	199	398	82
L4a	0	0	1,764
L4b	596	1,193	713
L5a	0	0	45
L5b	199	477	4

The information displayed in **Table 3-8** includes all LOS stages within the project area, regardless of patch size. The Ochoco National Forest has identified a minimum patch size of 5 acres that must be met in order to qualify as an LOS “stand” as described in the Eastside Screens (the January 11, 2008, Forest Vegetation Analysis Report for this project includes additional information).

Table 3-8 Existing Distribution of LOS Compared to Historic Range of Variability

Plant Association Group	Seral Structural Stage	Historic Range of Variability (acres)	Existing LOS		
			Total LOS (acres)	Multi Strata (acres)	Single Strata (acres)
Dry Grand fir	Early Seral	855 -- 1140	600	519	81
	Mid Seral	713 – 1,781	264	241	23
	Late Seral	285 -- 570	6	6	0
Douglas-fir	Early Seral	2,180 – 3,114	54	50	4
	Mid Seral	311 – 934	0	0	0
	Late Seral	249 – 499	645	632	13
Ponderosa Pine	Early Seral	0 – 376	1	1	0
	Mid Seral	0 – 565	0	0	0
	Late Seral	1,182 – 2,635	82	73	9
Juniper	Late Seral	199 -- 477	48	45	4
Total Acres		6,674 – 12,375	1,700	1,567	134

In the East Maury project area most LOS is located in the Maury Creek drainage, upper Drake Creek area, north of Tower Point and near Tom Vawn Creek. From 1970 to about 1995, management direction of major timber sales within these drainages concentrated on harvest of large trees. However, most remaining stands still have a component of large trees that can be maintained and augmented over time. Some areas nearly meet the large tree criteria for LOS and present opportunities for expanding the size of existing LOS patches and developing new LOS. LOS occurs in small patches of 5 to 133 acres.

Due to the current multi-strata, dense conditions within LOS, most large trees are at higher risk of mortality than in stands not currently meeting LOS criteria. These trees are more susceptible to insect and disease problems. Monitoring in stands where treatments similar to the proposed action have been implemented has shown increased diameter growth rates and improved vigor of large residual trees (District Files).

At this time there are approximately 1,322 acres meeting LOS criteria for large trees and minimum stand size of 5 acres (1,700 acres of accumulated pixel data from satellite imagery). Conditions on 14,076 acres are such that development and improvement of late and old structure can be accelerated by thinning now. Within the 14,069 acres, 4,047 acres have significant pine overstory at risk due to overstocked conditions (includes stands with 3 or more trees per acre larger than 21 inches in diameter. There are 7,256 acres that currently have stocking levels conducive to growth and maintenance of large trees and would not benefit from treatment at this time.

Growth measurements in stands with basal areas less than 80 sq.ft. show typical diameter growth on dominant trees of 2.5 inches per 10 years. At this growth rate, trees that are 12 inches in diameter may become 21 inches in diameter within 40 years. In dense stands (basal area greater than 80 sq. ft.), growth is typically less than 1.2 inches diameter per 10 years. Twelve-inch diameter trees would require at least 75 years to grow larger than 21 inches in diameter. With

continued growth and new regeneration, basal area increases which causes reduced growth rates on individual trees and increases competition stress leading to higher bark beetle susceptibility. Multi-strata conditions would redevelop in the absence of further disturbance.

Current opportunities for developing open, park like stands of ponderosa pine occur mostly on sites within the dry grand fir, Douglas-fir and moist ponderosa pine plant associations (approximately 14,900 acres).

Sartwell (1971) found that large ponderosa pine in dense stands are at higher risk of mortality due to bark beetle than understory trees on low productivity areas. Growth and development of additional large trees is stagnated at these stocking levels and larger trees are at high risk of mortality at these stocking levels.

Environmental Consequences – Late and Old Structure

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

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

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

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

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

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

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

Alternative 1

Alternative 1 would create no immediate changes in the seral structural distribution in any PAG. The existing and projected amounts of LOS in Alternative 1 are displayed in Table 3-10. The proportion of dense young stands (3a and 4a) structures will continue to increase, large overstory trees will continue to decline. Although growth will occur that may increase the number of large trees overtime, competition related mortality increases the amount of dead and down wood in these same stands. Growth is slower on individual trees increasing the time to develop into large trees. Increased ground and ladder fuels and high crown closure will maintain a high risk of intense fire behavior. At the same time, increasing and sustained high stand density will reduce the amount of ground vegetation that is important for soil protection and forage. In the absence of catastrophic disturbance the seral structural stages do move toward HRV in some stages but other stages depart further from HRV with increases in late seral species composition due to mortality of large pine and increasing stand density.

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

No treatments would occur under this Alternative. LOS stands would remain dense with high risk of competition-related mortality, especially the large tree component. Review of the annual aerial surveys for insect and disease occurrence showed several LOS stands with current bark beetle

activity. LOS stands would remain at high risk of severe wildfire due to high canopy closure, ladder and ground fuels.

Alternative 2

Harvest, precommercial thinning and prescribed burning would decrease stand density by reducing understory trees, ladder fuels, ground fuels and canopy closure. These changes will result in higher growth rates, lower incidence of insect and disease mortality, faster development of large trees, and reduced risk of high intensity fire. These treatments would increase grass, forb and shrub cover.

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

Since the emphasis of treatment in East Maury project area is development and maintenance of LOS, both Alternative 2 and Alternative 3 are designed to treat a portion of LOS stands with harvest, pre-commercial thinning and prescribed fire. **Table 3-9** displays the amount of existing LOS stands treated by alternative and plant association group in the project area. Only LOS stands less than 100 acres are proposed for treatment.

Table 3-9 Alternatives Comparison of Treatments within LOS

Alternative	No Action (acres)	Alternative 2 (acres)	Alternative 3 (acres)
Harvest with pre-commercial thinning and fuel treatment	0	573	249
Precommercial thinning and fuel treatment	0	81	315
Prescribed fire only	0	19	101
Total LOS Treated	0	673	665

Treatments in LOS would generally move stands in a multi-strata condition (as shown in **Photo 1**, next page) to or towards a single-strata condition (as shown in **Photo 2**). Stands would continue to be in an uneven-aged condition. Reducing stand density would reduce competitive stress on the remaining trees. This would result in more large trees being maintained over time, as well as encouraging the development of additional large trees (Cochran and others 1994). The abundance of early-seral species would be maintained and enhanced in the long-term; however, late-seral species would continue to be present in stands where they exist prior to treatment. Grand fir and Douglas-fir would be retained both in the overstory (all trees >21 inches diameter) as well as lesser amounts in the understory.

The overall amount of LOS would not change immediately due to treatment, although 573 acres of multi-strata LOS would be converted to single-strata LOS. Multi-strata conditions would remain on 100 acres of LOS where only pre-commercial thinning or prescribed fire is done. No activities are proposed in the remaining 649 acres.

By year 20, the amount of multi-strata LOS in the Douglas-fir PAG would increase to be within the historic range. By year 50, the amount of multi-strata LOS remains within range for all PAGs except Ponderosa Pine. This alternative results in the greatest amount of single-strata LOS in both the long and short term, although the overall amount of single strata does not reach the historic range within the 50-year projection period.

Table 3-10 displays the current and projected levels of LOS for the Dry Grand Fir, Douglas fir and Ponderosa Pine plant association groups and compares them to the HRV for each LOS structural category by alternative. The juniper plant association group was not projected but would show increased LOS development with time although at a slower rate. They would also show similar results for the both action alternatives. LOS development in these plant association groups would be slower in Alternative 1.

Photo 2-1 Multi-strata Grand fir LOS stand.



Photo 2-2 Single-strata Grand fir LOS stand.



Table 3-10 Comparison and Projection of LOS by Alternative (from pixel data)

Plant Association Group	Time Period	LOS Structural Category	Alternative 1	Alternative 2	Alternative 3	HRV
Dry Grand Fir	Current Level or Immediately Post Treatment	Multi-Strata	1.2%	1.2%	1.2%	8-15%
		Single-Strata	2.3%	2.3%	2.3%	18-38%
		Total	3.5%	3.5%	3.5%	26-53%
	20 years Post Treatment	Multi-Strata	7.3%	7.1%	7.2%	8-15%
		Single-Strata	6.2%	8.3%	7.2%	18-38%
		Total	13.4%	15.5%	14.4%	26-53%
	50 years Post Treatment	Multi-Strata	16.8%	16.8%	16.8%	8-15%
		Single-Strata	10.6%	14.2%	12.3%	18-38%
		Total	27.4%	31.0%	29.1%	26-53%
Douglas Fir	Current Level or Immediately Post Treatment	Multi-Strata	1.7%	1.7%	1.7%	11-19%
		Single-Strata	4.8%	4.8%	4.8%	33-54%
		Total	6.4%	6.4%	6.4%	44-73%
	20 years Post Treatment	Multi-Strata	11.5%	11.2%	11.3%	11-19%
		Single-Strata	11.5%	13.5%	13.0%	33-54%
		Total	23.0%	24.7%	24.3%	44-73%
	50 years Post Treatment	Multi-Strata	27.9%	27.6%	27.7%	11-19%
		Single-Strata	20.1%	22.9%	22.1%	33-54%
		Total	48.0%	50.5%	49.9%	44-73%
Ponderosa Pine	Current Level or Immediately Post Treatment	Multi-Strata	1.9%	1.5%	1.6%	0-6.5%
		Single-Strata	0.2%	0.7%	0.6%	20-58%
		Total	2.2%	2.2%	2.2%	50-95%
	20 years Post Treatment	Multi-Strata	3.1%	2.8%	2.8%	0-9%
		Single-Strata	2.0%	2.9%	2.8%	50-86%
		Total	5.0%	5.7%	5.7%	50-95%
	50 years Post Treatment	Multi-Strata	6.4%	6.1%	6.2%	0-9%
		Single-Strata	3.6%	5.2%	5.0%	50-86%
		Total	10.0%	11.3%	11.2%	50-95%

While both action alternatives reduce the risk of losing large old pine to wildfire, some mortality of large pine is expected after prescribed burning. Trees are more at risk in units that have missed several fire entries (mixed and high fire intensity). Mortality from prescribed fire on the Ochoco National Forest between 1986 and 2000 is approximately 5% (Schulz, personal communication, 2007). By contrast, 48% of the area of the 18,000 acre Hash Rock Fire in the Mill Creek Wilderness in 2000 had 100% mortality from stand replacement fire.

Alternative 3 – Seral Structural Stages and HRV

Approximately 50 percent fewer acres of LOS would be harvested in Alternative 3 than in Alternative 2, although the total amount of pre-commercial thinning is about the same. In addition, treatment in stands not currently meeting the LOS criterion for large trees would result in a 16 percent increase in LOS in 20 years compared to Alternative 1 (No action).

The overall amount of LOS would not change immediately due to treatment, although 249 acres of multi-strata LOS would be converted to single-strata LOS. Multi-strata conditions would remain on 416 acres of LOS where only pre-commercial thinning or prescribed fire is done.

Precommercial thinning without harvest would remove smaller diameter trees and reduce some competitive stress on the remaining trees but would not decrease density sufficiently to promote continued growth and development of overstory trees. However, there would be small reduction in competition and stress related mortality. This effect would not last as long as it would in stands that also have harvest proposed. Ladder fuels would be partially removed in precommercial thinning. Early-seral species or disease-resistant trees would be selected for retention where possible. Because only small trees would be removed, the amount of competition among the remaining trees would vary depending on the existing stand density and number of trees greater than 9 inches dbh. Disease in trees larger than 12 inches dbh, such as dwarf mistletoe, would not be reduced. The ability to change species dominance from late seral to early seral would be limited where there is an abundance of late-seral trees 9 inches dbh and larger.

By year 20, there would be an increase in the amount of LOS over Alternative 1 but less than Alternative 2. This trend continues through the 50-year projection period.

Cumulative Effects

There are no active or planned timber sales within the East Maury project area that would alter the amount of LOS or change species composition. The effects of past harvest and other activities have been included in the description of the existing condition. There are no other vegetation projects (i.e. precommercial thinning or fuels reduction activities) currently ongoing or planned within the area.

Most of the private ownership adjacent to the project area is xeric ponderosa pine or juniper. Approximately 400 acres of privately owned forestland contains little, if any, LOS. It is foreseeable that land management practices on these lands would neither favor the development of additional LOS nor remove existing LOS.

LOS Connectivity

Affected Environment

The Interim Management Direction (Eastside Screens) specified in the Regional Forester's Plan Amendment 2 includes connectivity maintenance and reduced fragmentation of late and old structural stage stands.

LOS stands greater than 100 acres and management allocated old growth are connected by forest stands dominated by trees sized between 9 and 21 inches DBH (structure stage 4). Designated connecting corridors typically contain scattered individual or groups of large trees. Corridors have been located to incorporate small LOS stands less than 100 acres in size. Because of the overall deficiency in the amount of LOS and the distance between LOS stands corridors in the project area must include young stands with average diameters less than 9 inches dbh.

Old growth connectivity was analyzed against the Interim Wildlife Standard. Connectivity criteria are summarized as follows:

- Each old growth stand should be connected to other old growth at least 2 different ways.
- Average diameter of trees within the corridors should be greater than 9 inches DBH.

- Canopy closure (CC) should be greater than 50 percent (or in the top 1/3 of site potential).
- Corridor width should be greater than 400 feet wide.

The Maury Mountains are a small, isolated forest 21 miles long by 5 miles wide, surrounded by dissimilar vegetation types. The landform is dominated by a ridge through the middle running east to west. Stream courses and the corresponding denser vegetation generally run north and south. Most Dry Grand fir and Douglas-fir plant associations are found on the north slope in a band approximately 3 miles wide. Drier plant associations dominated by ponderosa pine and western juniper are on the south slopes and near the forest boundary. Consequently, connectivity is geographically limited.

While most sites within the watershed are capable of producing greater than 50 percent crown closure, sustainability of this high density is not probable over the long term. At 50 percent crown closure, most stands in the watershed are susceptible to a number of insect and disease problems capable of causing severe mortality and consequent loss of crown closure. Forest stands self thin at stocking levels above 60 percent of maximum density and this level of stocking is sometimes referred to as the “zone of imminent competition mortality” (Powell 1999). Riparian corridors generally have the highest productivity potential (and are expected to provide the best connective habitat) but were more severely damaged by defoliation during the 1992 western spruce budworm epidemic than adjacent stands. They are also highly susceptible to stand replacing fire events such as the West Fork Mill Creek in the Hash Rock Fire (2000) and the East Fork Allen Creek in the Maxwell Fire of 2006.

The analysis shows that the most common limiting factors for connectivity between LOS stands are:

- older clearcuts that are less than 400 feet apart,
- extensive overstory removal,
- physical restrictions such as ridges, meadows or other environmental conditions which result in major plant association changes. For example, an old growth stand located in a dry grand fir site would not be well connected by a corridor crossing a low site ponderosa pine stand, and
- road development in stream corridors.

Most LOS stands have potential to expand in size in a relatively small timeframe. Silvicultural treatments including harvest and precommercial thinning can accelerate growth and development of large trees within existing LOS stands and in the connecting corridors. The distribution of LOS across the watershed can be improved.

Environmental Consequences – LOS Connectivity

Three connectivity corridors have been located between existing LOS stands. In addition, the management allocated old growth west of Drake Creek is connected to LOS stands west of the project area. There are 289 acres in connective corridors.

Alternative 1

No treatments in mapped connective corridors would occur in Alternative 1. Connective corridors would remain densely stocked and would be slow to develop large trees. The structural

complexity and canopy closure would be retained, at least in the short term. Individual tree mortality would be expected in stands with canopy closure greater than 50 percent. Large ponderosa pine often would be most susceptible to competition related mortality.

Table 3-11 shows the proposed treatments for each alternative.

Table 3-11 Acres of Treatment in Connectivity Corridors by Alternative

	Harvest and Associated Treatments	Precommercial thinning	Fuel treatment only	Total Acres Treated
Alternative 1	0	0	0	0
Alternative 2	83	10	85	178
Alternative 3	72	12	71	155

Alternative 2

Harvest, precommercial thinning, juniper thinning and fuel treatments are proposed in a portion of connectivity corridors in Alternative 2. Harvest units that overlap corridors include units 15, 79, 93, 97, 98, 113, 119, 121, and 151. Treatments are prescribed to move these stands toward LOS conditions. Treatments would maintain existing large trees and promote development of additional large trees. Treated portions of corridors would continue to be dominated by medium to large trees but have fewer trees less than 21 inches DBH and less vertical complexity. Canopy closure in treated portions of corridors would be reduced to less than 50 percent to allow growth and to reduce risk to large trees. By reducing canopy closure below 50 percent and stand density below the upper 1/3 of site potential a forest plan amendment is required for Alternative 2.

Treatments promote growth and development of the residual trees, reducing competition related stress and reducing the risk of mortality. Reduced stocking, ladder fuels and ground fuels would reduce the potential for high intensity fire. Treatments would also increase the similarity in stand structure, species composition and density between connective corridors and LOS stands.

Some species that select for more open forest conditions may find the habitat more favorable after treatment. However, treated habitat within corridors may be less desirable for species that have limited mobility, that are vulnerable to predation, or that are sensitive to climatic conditions. For these species this alternative will compound the effects of the fragmentation that has occurred in the past, particularly the fragmentation of old growth habitat. Where these treatments occur within young stands, accelerated development of large trees would likely improve habitat conditions within corridors in the long term.

Prescribe burning is prescribed within connective corridors on 86 acres under this alternative. It is not anticipated that underburning would result in substantial changes in seral structural condition. However trees up to 3 inches dbh and fine fuels in the understory would be reduced, which could also affect visual cover and climatic moderation within the corridors. Some loss of large woody debris and snags, along with a limited amount of mortality to trees more than 3 inches dbh may occur where there are accumulations of fuel. It is anticipated that the level of retention post treatment should still provide adequate cover and structure to facilitate travel by most species that would use these corridors.

Alternative 3

The amount of harvest and associated treatments proposed in Alternative 3 is slightly less than the proposed action (see **Table 3-11**). Harvest units in mapped connective corridors include 79, 93, 97, 119, 121 and 151. Effects would be similar to Alternative 2 as described above. By reducing canopy closure below 50 percent and stand density below the upper 1/3 of site potential a forest plan amendment is required for Alternative 3.

Cumulative Effects – LOS Connectivity

There are no active or planned timber sales within the East Maury project area that would alter stand conditions in connective corridors. The effects of past harvest and other activities have been included in the description of the existing condition. There are no other vegetation projects (i.e. precommercial thinning or fuels reduction activities) currently ongoing or planned within the area. Connections with LOS stands west of the project area have been maintained in the West Maury Fuels and Vegetation Management Project.

Forest Health

Affected Environment

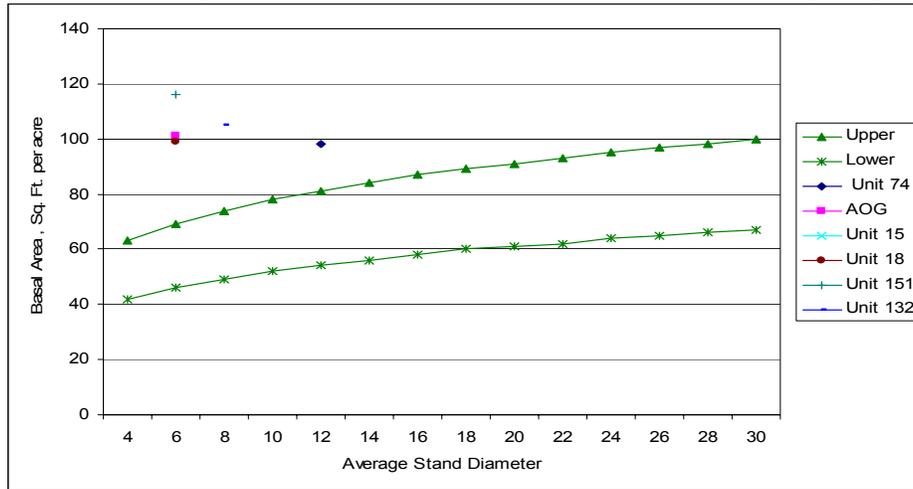
Past management practices, including fire exclusion and overstory removal harvest, have favored the development of stands, which are now considered to be out of balance when compared to their historic conditions. Historically (100+ years ago) stands in the project area would have commonly had more large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

Trees in densely stocked stands with low growth become vulnerable to insects and disease. Competition from intermediate and suppressed trees in ponderosa pine stands reduces growth of dominant and codominant trees (Cochran, 1993). Increased stand density and the trend toward late seral species composition have created conditions such that many stands are “imminently susceptible” or at high risk of tree mortality. A stand is classed as imminently susceptible when conditions are such that it is very likely to experience significant change in structure or character as a result of insect attack and/or fire in the near future. Procedures to identify stands with imminent susceptibility are based on published risk and hazard ratings applicable to biophysical sites on the Ochoco NF, local knowledge and field data (Maffei and others, 1996). Stocking level deviation above recommended levels is a major factor in imminent susceptibility.

Treatments which result in stand density at the recommended stocking level allows the remaining trees to capture most of the site resources without competition between trees that reduces individual tree growth causing eventual mortality. The level varies depending on site quality, tree size and species. Recommended stocking levels are derived from “Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington: An Implementation Guide for the Umatilla National Forest” (Powell 1999). Sites within the project area are similar to those found on the Umatilla NF. The Forest vegetation Report for the East Maury Project includes diameter distribution tables and graphs for selected stands displaying existing stocking by diameter class and species and post treatment stocking by diameter class.

Figure 3-1 compares existing stocking levels in selected stands with recommended stocking levels for ponderosa pine on grand fir sites. The recommended stocking levels are represented by nearly parallel lines running from left to right across the graphs. Points plotted on the graph represent actual basal area and average diameter data from surveys of typical stands that have been selected for treatment. Average diameter ranging from 5 to 10 inches indicated most of the stocking is from small trees, although tree size varies from seedlings to large trees up to about 45 inches diameter. The relatively high basal area indicates the level of risk to both large and small trees but particularly to large trees. Recommended stocking levels for maintaining ponderosa pine on Douglas-fir sites are similar, as well as, the actual data from surveys on Douglas-fir sites. Additional stocking comparisons are available in the East Maury Forest Vegetation Report.

Figure 3-1 Stocking Levels for Ponderosa Pine in the Grand fir/pinegrass PA



In the East Maury project area, dense stands and stands with a high proportion of mid and late seral species are susceptible to multiple insect and disease factors that may cause mortality. Current stand conditions have been grouped to facilitate comparison of alternatives in **Table 3-12**. Groupings are based on stocking levels, insect and disease factors, and large trees at risk

- **Stand Condition 1** includes stands at high risk due to density (Basal area greater than 95 sq. ft. or more than 3 trees per acre greater than 21 inches in diameter). These stands are multi-strata with a considerable number of large trees and include most LOS stands. Other stands within this group meet LOS criteria except for the amount of large trees.
- **Stand Condition 2** There is moderate risk of competition related mortality (generally basal area greater than 75 sq. ft., single strata). Single-strata, dense stands with few large trees. Without treatment expect higher levels of bark beetle mortality in short term. These stands have potential for speedy (40 to 80 years) LOS development if growth is maintained and/or accelerated. Thinning would produce a merchantable product.
- **Stand Conditions 3 and 4** are low risk at this time but stocking control will benefit long-term growth and vigor (young stands and plantations). Small diameter, single-strata, overstocked stands with few large trees. Proposed treatments would include pre-commercial thinning and/or prescribed fire.
- **Stand Condition 5** are stands with severe dwarf mistletoe problems.

Large trees have a high risk of mortality from competition stress, insect and disease factors and high intensity fire in dense stands. **Table 3-12** compares the amount of treatment for Alternatives 2 and 3 and the effectiveness of the proposed treatment by stand condition. Table 3-12 also displays the amount of area where treatment is less effective because harvest is deferred due to 1) higher stocking levels to meet stream management objectives and 2) reduced road access in Alternative 3 precluding the use of logging equipment. No treatments that alter stand condition or susceptibility to insect and disease problems or competition related mortality would occur in Alternative 1.

Table 3-12 Comparisons of Alternatives to Stand Condition and Risk

Stand Condition and Risk	Total Area (acres)	Alternative 2		Alternative 3	
		Area (acres)	Area Treated (%)	Area Treated (acres)	Area Treated (%)
Stand condition 1:	3,954	2,371	59	1,714	43
Stand condition 1: Amount of area partially treated due to higher stocking requirements to meet stream management objectives and/or to lack of road access (Alternative 3)		198	5	701	17
Stand condition 2	7,352	4,324	59	3,069	42
Stand condition 2: Amount of area partially treated due to higher stocking requirements to meet stream management objectives and/or to lack of road access (Alternative 3)		465	6	1,556	21
Stand conditions 3 and 4:	3,255	3,255	100	3,255	100
Stand condition 5: Severe dwarf mistletoe problems	358	237	66	237	66
Total	14,919	10,850		10,532	

Treatment of stands at high risk would provide the greatest return in terms of growth and vigor gains and the highest potential for development of LOS structure. It would not be desirable to treat all at-risk stands at once because it is important to maintain a diverse landscape. Treatments in RHCAs would be less effective because higher stocking levels would be retained to maintain shade and to reduce soil disturbance adjacent to streams.

Table 3-13 displays the amount of affected area infested by major insects or disease problems in the East Maury project area. Most stands contain more than one insect or disease factors at this time.

Table 3-13 Area Affected By Insects or Disease

Level of activity or severity	Bark Beetle (acres)	Dwarf Mistletoe (acres)	Root Disease (acres)
High or Severe	1,214	1,652	
Moderate to Low	6,692	13,142	660
Total	7,906	14,794	660

Bark Beetles – Aerial insect and disease surveys for years 1996 through 2006 show numerous active mortality centers due to bark beetle feeding. Stand exams and field reconnaissance also identified bark beetle activity and susceptible stand conditions. Stands at risk of bark beetle

attack have stocking levels above the upper management zone for a given plant association (Cochran, 1994). The higher the stocking is above recommended levels the higher the probability for mortality and the mortality is likely to be more dramatic.

Dwarf Mistletoe – In the project area, severity of dwarf mistletoe infection varies from lightly infected stands with occasional trees or groups of trees infected to severe infections where most trees are affected by dwarf mistletoe. Approximately 350 acres in stands severely infected with ponderosa pine dwarf mistletoe occur between Indian Creek and Double Cabin Creek. Most overstory trees were removed from these stands in the 1970s and 1980s and some pre-commercial thinning was done also but these treatments did not to reduce mistletoe sufficiently to allow height growth to outpace the upward spread of the disease. These stands have scattered larger overstory ponderosa pine over a dense uneven-aged understory. Dwarf mistletoe infects most branches of most trees and is continuously spreading from larger trees to understory trees and from lower branches to upper branches. Height growth is retarded so none of the trees are able to outgrowth the spread of dwarf mistletoe. Barrett suggested that in the absence of acceptable height growth and numerous infections in the upper crowns ten or more years after initial thinning it would be better to clear the site and plant (1985).

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

The widespread trend toward species compositions dominated by Douglas-fir and grand fir (mid and late seral stages) has contributed to more frequent and severe epidemics. Large amounts mortality as a result of budworm epidemics contributes to high fuel loadings and fire hazard, with high risk of severe wildfire. In the summer of 1992, all areas within the project area with a component of Douglas-fir and/or grand fir had visible defoliation and topkill. Spruce budworm damage was assessed during the field review using the defoliation severity rating from the Region 6 Stand Examination Program. No budworm defoliation has been found since the summer of 1992. Foliage recovery has been rapid. However, trees with topkill have lost much potential for height growth and remain susceptible to bark beetle attack. In addition, habitat conditions that promoted an epidemic population of budworm remain.

Root Diseases – Although root disease was detected on only 660 acres during stand exams it is a common component of forest communities and occurs in most stands. Susceptibility to root rot and stem decays increase with later seral species. Root rots and stem decays in late seral stands contribute to the late seral character and improve the quality of certain wildlife habitats requiring late seral conditions. In order to meet HRV for late seral stages, not all stands with high levels of root rot and other insect and disease conditions would be treated at this time.

Table 3-14 displays the seral/structural stages by PAG that are considered to be at high risk of damage by insects and diseases. Stands with conditions 1 and 2 from **Table 3-12** contain high proportions of these stages.

Table 3-14 High Risk Stages by Plant Association Group

Plant Association Group	High Risk Stages
Dry Grand Fir	E3a, E4a, E5a, M4a, M5a, L3, L4, L5
Douglas-fir	E3a, E4a, E5a, M4a, M5a, L3, L4a, L5a
PP	M4a, M5a, L4a, L5a

Currently, there are about 8,582 acres within the project area that are in stages rated as high risk. The historic level of high risk stages ranged from 2,357 to 6,397 acres.

Environmental Consequences - Forest Health

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

Susceptibility to dwarf mistletoe would be reduced by: (1) favoring non-host tree species; (2) reducing dense multilayered canopy conditions favorable to seed dispersal; and (3) improving tree vigor which would allow for increased tree height growth.

Alternative 1

No actions would be taken to reduce susceptibility to insects and diseases. Vegetative development would continue dependent on the conditions and successional trends which currently exist. More of the project area would develop conditions such as high density and an abundance of later-seral species. High risk stages would become more abundant in the future. In 20 years the amount of high risk area is projected to increase by an additional 3,500 acres.

Overstocked stand conditions contributing to bark beetle infestation would remain and increase with time. Trees would continue to die from bark beetle feeding contributing to snag habitat and foraging opportunities for wildlife but also higher fuel loads and loss of old growth trees. No thinning would occur. Dwarf mistletoes in untreated stands would continue to spread and cause growth loss and contribute to mortality. Development of large structure would be slowed. Stands not treated would contribute to higher risk of intense fire.

No treatments would occur that reduce the amount of mid and late seral conifers currently present. The trend toward increasing amounts of mid and late seral stocking would continue resulting in increased habitat for western spruce budworm and other defoliating insects. Treatments to reduce stand density or change species composition would not occur in Alternative 1. Conditions conducive to root disease and stem decays would remain and increase from present levels.

Alternative 2

In Alternative 2 harvest and pre-commercial thinning would reduce stocking to recommended levels on 68 percent of stands identified as overstocked. Additionally, treatment of approximately 663 acres would reduce stocking but to levels above recommended. These areas

are generally within RHCAs where stream management objectives require higher stocking levels.

Treatments would reduce susceptibility to future attacks by bark beetles. These treatments help by reducing stocking to levels that allow individual trees to grow and increase vigor sufficiently to withstand bark beetle attack. Stocking control would help maintain the existing large tree component that is deficient in many areas. **Table 3-15** compares the area of treatment for bark beetle under each alternative.

Table 3-15 Bark Beetle Activity and Proposed Treatment

Level of activity and Proposed Treatment	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)
High activity and mortality harvest and pre-commercial thinning	0	811	713
High activity and mortality pre-commercial thinning only	0	0	96
Low to moderate activity harvest and pre-commercial thinning	0	2,980	2,601
Low to moderate activity pre-commercial thinning only	0	0	374

Approximately 38 percent of stands infected with dwarf mistletoe would be effectively treated in Alternative 2. Dwarf mistletoe would not be eradicated from these stands but reduced. More open stands would reduce the spread of mistletoe. Growth rates would improve allowing height growth to outpace mistletoe infection. Proposed treatment on 237 acres of severely infected forest (Unit 244) includes girdling overstory trees greater than 21 inches diameter with dwarf mistletoe to prevent re-infection of the understory. Other treatments include commercial harvest of infected trees less than 21 inches in diameter and pre-commercial thinning of the understory with an emphasis on mistletoe reduction. Approximately 470 trees with an average diameter of 23 inches would be girdled or topped. It is expected that sufficient trees (generally seedlings and saplings) would remain to meet minimum stocking requirements and planting would not be necessary. This stand is located in an area where surveys have shown snag deficiencies. **Table 3-16** displays compares treatment for dwarf mistletoe infection.

Table 3-16 Dwarf Mistletoe Treated by Alternative

Dwarf Mistletoe Severity	Total Acres Affected	Alternative 2 (acres)	Alternative 3 (acres)
Severe infections, 2 or more species, most trees infected	1,652	960	780
Moderate to light infections, 1 or 2 species infected	13,142	4,715	4,120

Harvest and pre-commercial thinning included in Alternative 2 would reduce the amount of budworm host species (Douglas fir and grand fir) and favor retention of ponderosa pine and western larch. Thinning both commercial and pre-commercial reduces dense stand and multiple canopy conditions that contribute to budworm habitat and improves tree vigor and the ability to recover from defoliation.

Alternative 3

Alternative 3 would reduce stocking to recommended levels on 55 percent of stands identified at risk. Alternative 3 is similar to the proposed action in partially treating 663 acres within RHCAs. In addition, 1,594 acres would still have stocking above recommended levels because harvest is deferred due to lack of road access.

Alternative 3 would treat a similar amount of area with active bark beetle mortality as does the Proposed Action. However, 12 percent of the treated areas would only be pre-commercially thinned and would still have higher than recommended stocking with low to moderate risk of bark beetle activity. In addition, stands only pre-commercially thinned would return to high risk status sooner than the Proposed Action

Thinning included in Alternative 3 would effectively treat 31 percent of stands infected with dwarf mistletoe. Although, additional acres would be pre-commercial thinned in Alternative 3 the treatments would be less effective because dwarf mistletoe infections in overstory trees would not be treated at the same time. Trees over 21 inches in diameter would also be girdled in unit 244.

Fewer dense multi-strata stands would be thinned in Alternative 3 which would maintain a larger amount of budworm habitat. Fewer damaged trees would be cut.

Conditions conducive to root disease and stem decays would remain and increase from present levels. Treatments in the Proposed Action and Alternative 3 would have similar effect. Mortality due to root disease would be reduced.

Cumulative Effects – Forest Health

There are no active or planned timber sales within the East Maury project area that would reduce the amount of area in the high risk stages. The effects of past harvest and other activities have been included in the description of the existing condition. There are no other vegetation projects (i.e. precommercial thinning or fuels reduction activities) currently ongoing or planned within the area.

Upland Grass and Shrub Communities

Affected Environment

Upland shrub communities are an important component of ecosystems in the Maury Mountains providing soil protection and wildlife habitat. Historically they occurred on droughty sites with relatively shallow soil that were slow to develop conifer cover. Vigorous shrub and grass cover made conifer establishment difficult because of the competition for available water. Young trees that did become established were often excluded from these sites by frequent fires. Fire exclusion and heavy historic grazing were major factors that allowed forest expansion into these sites. As western juniper (and in some cases ponderosa pine) cover expands into these areas, grass and shrub cover declines. Various studies have been referenced concerning the ability of juniper to out-compete other vegetation for available moisture (Gedney and others, 1999).

The HRV for grass and shrub dominated communities on sites identified as western juniper woodland, western juniper steppe and dry ponderosa pine in the East Maury project area is between 2,084 and 3,315 acres. Currently small scattered openings totaling 554 acres within these plant association groups are shrub dominated. Small juniper cutting projects conducted in

and adjacent to the project areas within the last 15 years have resulted in dramatic development of sagebrush, bitterbrush and bunchgrasses.

Other upland shrubs including serviceberry (*Amelanchier florida*), cherry (*Prunus*), current (*Ribes*), rose (*Rosa*) and snowberry (*Symphoricarpus*) occur on dry grand fire, Douglas-fir and mesic ponderosa pine sites. These shrubs favor open stands with low canopy cover and decline under dense conifer shade. In northeastern Oregon, shrub crown cover was found to rapidly decline once overstory canopy cover exceeded 50 percent (Hedrick and others 1968). Western juniper has also increased in abundance within these plant association groups and competes with other conifers and shrubs for site resources.

Mountain-mahogany (*Cercocarpus ledifolia*) is an important shrub in the project area. Mahogany tends to be fire intolerant but regenerates easily with bare mineral soil and lack of overstory cover (Schultz, 1990). Mahogany is preferred browse so often individual plants are maintained as short hedged shrubs. This shrub is currently found in most stands within the project area and is often associated with small rock outcrops. Extensive thickets of mature mahogany are located at the forest shrub-land interface on the lower, drier elevations in the project area on both the north and south aspects. Historically, mahogany thickets occurred upslope of current locations but were shaded out by expanding conifer cover. Young, vigorous individuals are found in many areas where thinning and prescribed burning have created gaps in conifer cover. However, most mahogany in the project area is mature or senescent.

Environmental Consequences – Upland Shrubs

Alternative 1

No treatments for juniper reduction would occur in Alternative 1. Juniper dominance and conifer cover would increase with a resulting decrease in grass and shrub cover. The proportion of juniper on ponderosa pine, Douglas-fir and grand fir sites would continue to increase.

Alternative 2

In Alternative 2 juniper cutting would occur on 3,327 acres on sites identified on dry ponderosa pine and juniper sites and would result in approximately 2,003 acres returned to grass and shrub dominance. The remaining acres would have reduced stocking of ponderosa pine or large juniper. In addition, some merchantable juniper may be removed within units with prescribed harvest and would be cut or girdled in precommercial thinning units. Junipers larger than 21 inches in diameter or with old growth indicators would remain. Prescribed fire will follow juniper cutting on approximately 1,347 acres to reduce fuels and to reduce stocking of seedling and sapling junipers.

Increased moisture availability from juniper cutting and nutrient recycling due to the effects of fire would increase grass and shrub development. As a result of decreased stand density on more mesic sites shrub and grass cover would increase from recruitment of new plants and growth of existing plants.

Underburning in the Maury Mountains south of Arrowwood Point in 1999 (Robinhood Unit 3) was hot enough to kill some old (over 10 feet tall) mahogany plants, but resulted in seedling establishment. New plants are now 1 to 4 feet tall. A project to promote new mahogany by cutting juniper and using prescribed fire to remove old mahogany in the upper Hammer Creek drainage in the West Maurys in 1996 was also successful. It is anticipated that the prescribed fire treatments proposed in this project would also rejuvenate mountain mahogany. Establishment and survival of

mountain mahogany seedlings would increase in treated stands in response to reduced conifer cover and exposed mineral soil. Other types of shrubs including currant, snowberry, rose and bitterbrush would increase from more vigorous sprouting and from recruitment of new seedlings.

Alternative 3

Alternatives 2 and 3 include essentially the same amount of juniper cutting because the difference between these alternatives concerns road access for harvest equipment. Additional road access is not need for juniper cutting. There would be similar effects to upland shrub communities.

Cumulative Effects – Upland Shrubs

There are no active or planned activities in the project area that would alter the amount of area dominated by juniper. The effects of past juniper cutting and other vegetation management activities have been included in the description of the existing conditions as described previously. Implementation of the Maury Mountain Allotment Management Plan EIS includes resting approximately 50 percent of the project area for another ten years. Shrub cover in this area has already expanded and will continue development. Proposed treatments in the uplands would open conifer canopy and allow increased grass and shrub development and compliment allotment resting. In areas with continued grazing, better overall forage conditions would encourage more dispersed grazing and browsing with potentially less pressure in riparian areas.

Riparian Plant Communities

Affected Environment

The Inland Native Fish Strategy, Decision Notice and Finding of No Significant Impact (1995) established Riparian Habitat Conservation Areas and standards for management activities. The standard for silvicultural practices includes treatments “to acquire desired vegetation characteristics where needed to attain Riparian Management Objectives”.

Desired vegetation characteristics include variable stocking, large trees providing root strength in the riparian area, multiple age classes, healthy, full crowns for shade, room for shrub and deciduous trees, and healthy aspen clones. The effects of the proposed action and alternative 3 on Riparian Management Objectives including large woody debris, width/depth ratios, and pools are discussed later in the Aquatics section under RHCAs. Water temperature and sedimentation are discussed in the Water Quality section.

Photo 3-3. Conifer encroachment on aspen



Riparian broadleaf shrubs within the project area typically include alder (*Alnus*), willow (*Salix*), birch (*Betula*), dogwood (*Cornus*), cherry (*Prunus*), elderberry (*Sambuccus*), and currant (*Ribes*) species. Existing occurrence and density of these shrubs are less than historic conditions. Along many streams, lowered water tables due to channel downcutting, increased density of conifer cover, historic over grazing by livestock and big game browsing, and competition from conifer

encroachment is reducing the potential for these shrubs to develop and grow. A wide range of stand conditions occur adjacent to streams in the project area. The most prevalent conditions, however, are densely stocked stands dominated by young trees with scattered large overstory trees. Basal area in stands selected for precommercial thinning range from 80 to 148 sq. ft. per acre. Trees per acre range from 200 to 1200. Approximately 92 percent of the units have fewer than 10 trees per acre larger than 21 inches dbh. All overstory trees in these units are at higher risk for competition related mortality at these stocking levels. Large trees are important components of riparian plant communities by providing streambank stability, shade and future large woody debris. Large trees with higher crowns allow shrub development in the understory because early morning or late afternoon sunlight is available.

The increasing density of young conifers in riparian areas prevents woody vegetation such as alder, willow, aspen, and shrubs from expanding. Conifers compete with these species for sunlight and water; many of these broadleaf species are shade-intolerant. The roots of shrubby vegetation help to stabilize stream-banks and act as a roughness element that reduces the velocity and erosive energy of over-bank flow during high water events. Conifers do not provide the same bank stabilizing function as broadleaf shrub species with their ability to spread horizontally by sprouting. Invigorated aspen and shrub communities would increase shade and contribute to lower water temperatures in streams.

Aspen grows in self-perpetuating clones in areas of locally high moisture such as meadows, seeps, and adjacent to streams. Aspen occurs throughout the project area. Today, most aspen clones are in poor health and are receding in area; some consist of only one to three trees. The reasons for aspen decline include conifer encroachment and increasing density; over browsing by livestock, deer, and elk; and loss of habitat where the water table has dropped due to stream down-cutting. Reducing conifer encroachment re-invigorates aspen by increasing the available sunlight, moisture and growing space for aspen.

The project area contains an estimated 46 aspen stands. Most drainages contain small aspen communities. Stand vigor varies from the relatively healthy aspen located at Parrish Spring to single remaining aspen with few or no sprouts in other areas. Evidence of historic aspen occurrence remains in several streams where no live sprouts are found. Several aspen stands in the project area have been thinned previously and have shown a strong growth response especially where exclosure fencing or caging have been installed.

As shown on Photo 3, aspen and cottonwood stands are being crowded out by conifer encroachment and regeneration suppressed by cattle and wildlife. Alder, willow, and other deciduous riparian vegetation have decreased in the project area due to conifer encroachment, shading by upland vegetation, and grazing by cattle and wildlife.

Environmental Consequences – Riparian Plant communities

Alternative 1

No treatments to maintain or increase riparian plant communities would occur in Alternative 1. Conifer stand density would continue to increase in areas adjacent to streams reducing individual tree growth rates and increasing competition related mortality in large overstory trees. Aspen stands proposed for treatment in the Alternatives 2 and 3 would continue to decline as conifer encroachment continues. Other riparian shrubs would continue to decline in abundance.

Alternative 2

Total treatment in RHCAs is 1,253 acres with 475 acres focused on aspen treatment. Commercial harvest and associated precommercial thinning would occur in 18 separate units (28 aspen stands) for a total of 210 acres within RHCAs. Treatments in these areas focus on removal of conifer cover in and around aspen stands and areas where aspen occurred historically. Aspen planting would occur at several sites to augment existing sprouts or to restore aspen to sites where the entire clone has died. Other broadleaf shrub species would be expected to increase where harvest and associated treatments are conducted. Additional noncommercial thinning on 265 acres is proposed to improve aspen conditions.

Commercial harvest in Alternative 2 is proposed in portions of RHCAs in Double Cabin, Drake, Indian, Keeney, Maury, Parrish, Stewart, Wildcat, and Wiley creeks and tributaries. No heavy or OHV equipment would be used in the RHCAs. Two units (44 acres) would be included in adjacent skyline harvest, 2 units (20 acres) would be winch lined to a tractor positioned outside of the RHCA and the remaining units (147 acres) would be horse logged. Some larger conifers (<21 inches diameter) will be felled and left on site to augment low down wood levels in Wiley and Double Cabin creeks.

The treatments are designed to treat the area immediately in and around aspen stands and also to thin the slopes above selected aspen stands to increase moisture availability in the riparian area. After treatment the aspen sites would have reduced cover until the aspen and other broadleaf shrubs can respond. Response time and amount will vary by current aspen condition, post treatment protection (fencing or debris) and intensity of treatment, but generally would be apparent within three years. In aspen stands selected for commercial harvest of conifers, pre-commercial thinning without harvest would not sufficiently reduce conifer cover to best promote increased growth and development of aspen.

Non-aspen associated noncommercial thinning will occur on approximately 554 acres within RHCAs. Tree height, slope steepness and aspect will determine which trees would be cut in order to maintain shade in the primary shade zone. No trees except for juniper would be cut within 10 feet of streambanks. Noncommercial thinning would reduce stocking in trees less than 9 inches dbh and junipers less than 21 inches dbh except for junipers old growth characteristics. Because of the existing stocking of trees between 9 and 21 inches stocking levels would remain higher than in stands with commercial harvest. This higher residual stocking is expected to maintain shade while allowing some increased growth of individual trees and shrub development.

Reduced conifer cover around broadleaf shrubs would reduce competition for moisture and light. Precommercial thinning younger thickets in the vicinity of larger trees would promote the survival of existing large trees and allow development of additional large trees.

Underburning would occur on a portion of 814 acres after noncommercial thinning is completed. Underburning prescriptions include a no ignition buffer and retention of 50 percent of the ground surface unburned within RHCAs. Treatments would be designed to reduce smaller fuels within the RHCAs, may be used to reduce stocking of conifer seedlings, and to rejuvenate grass and shrub cover. Prescribed fire and associated harvest and pre-commercial thinning would reduce fire hazard and the potential for severe wildfire within the RHCA. Reducing fuels protects large wood on the ground and standing trees for future LWD recruitment needed for fish habitat. The unburned areas would maintain filtering to avoid adding sediment to stream waters.

By reducing stocking, the combined treatments would promote uneven-aged stand development; improve individual tree crown growth and vigor; and aspen and shrub development.

Proposed harvest and associated treatments outside of RHCAs would result in improved upland forage opportunities as more ground vegetation develops as a result of increased sunlight and water availability. Improved upland forage would potentially reduce the browsing pressure currently experienced within RHCAs and allow for more shrub cover along streams.

Alternative 3

Activities in Alternative 3 are the same as those proposed in Alternative 2, except that commercial harvest in Alternative 3 is reduced to 166 acres. Harvest on 47 acres around aspen would be deferred because these areas do not have road access for harvest equipment although precommercial thinning would still occur. Total treatment in RHCAs is 1,231 acres with 410 acres focused on aspen treatment.

The effects on aspen and riparian shrub communities are essentially the same as for Alternative 2 except there would be reduced effectiveness in 2 aspen stands located in Stewart Creek and a tributary of Drake Creek commercial harvest is not proposed because road construction is deferred. Precommercial thinning would still occur within these aspen stands and in the adjacent uplands but would not reduce stocking of trees larger than 9 inches dbh. Stocking would remain above recommended levels with reduced growth response of aspen and the remaining conifers.

Cumulative Effects – Riparian Plant Communities

Past, present, and reasonably foreseeable actions with effects that could combine with effects of the proposed action, and which would result in effects to riparian plant communities include riparian planting, construction of enclosure fences and individual cages, stream channel restoration, and livestock grazing.

In the last several years, shrub planting has occurred on Double Cabin, Indian, Maury, Wiley and Indian Creeks. Riparian plantings and the protection of riparian vegetation with enclosures and cages have contributed to increased extent and development of riparian shrub habitat. Proposed commercial harvest, precommercial thinning and prescribed burning would allow increased growth of planted shrubs.

Changes in grazing management as a result of the Maury Mountains Allotment Management Plan EIS will be implemented in revised allotment management plans for the three allotments in the East Maury Project Area (Double Cabin, East Maury, and Shotgun). Measures to improved channel condition include moving water troughs out of riparian zones, fencing or enlarging enclosures at spring source areas at water developments, developing more water sources in the uplands, earlier season of use, and resting pastures.

Recent stream restoration projects on Double Cabin Creek, Shotgun and Wildcat Creeks to control headcuts have been completed. Headcut repair benefits riparian shrub development by maintaining and improving water availability.

The effects of restoration activities (planting, protection, headcut repair, off-site water for grazing) when combined with the effects of this project on riparian plant communities complement each other in promoting riparian plant communities. Considering past, present, and reasonably foreseeable activities, aspen clones would be expected to be maintained or increased in extent and vigor.

Fuels

Affected Environment

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

In the East Maury project area, open ponderosa pine-dominated forests were maintained by frequent, low-intensity surface fire. According to the Maury Mountains Watershed Analysis:

- More of the Maury Mountains are covered by dense stands of small trees than were present historically, and there are fewer large fire adapted pines. The risk of crown fire in these stands is high.
- Stands that were thinned and burned in the 1980s and 1990s are in need of thinning and burning to maintain low surface fuels and ladder fuels, or the risk of crown fire will increase.

Fire regimes describe the role of fire as a disturbance process for a given landscape. A fire regime is defined as the fire frequency or interval as “the average number of years between fires” and severity as the “effect of the fire on the dominant over story vegetation” (Hardy and others 2001, Schmidt and others 2002). The majority of the East Maury project area is classified as Fire Regimes I and III which correlates with the ponderosa pine, and Douglas-fir PAGs on south aspects and dry grand fir PAGS at higher elevations on north aspects. Juniper woodland and steppe PAGS are classified as Fire Regime II. Fire regime is a reflection of the biophysical environment that occurs across a landscape, hence none of the alternatives would have any effect on fire regime. In the low intensity fire regime, in which fire occurs frequently, fire intensity is generally low because there is less fuel to support a fire. In the mixed intensity and stand replacement (high intensity) fire regimes, in which fire occurs less frequently, fire intensities tend to be higher because there is more time between fires for surface fuel and ladder fuels to accumulate. **Table 3-17** displays fire regimes, fire frequency and biophysical environment common to the East Maury project area.

Table 3-17 East Maury Fire Regimes

Fire Regime	Average Frequency	Biophysical Environment	Current Level
I	0-35 years	Dry, low-elevation forest dominated by Ponderosa pine. Frequent, low intensity surface fires kept these stands mostly open, and fuel light. Average return of 17.5 years, burning a historic average of 1,371 acres per year in the East Maury project area.	48%
II	0-35 years	Grassland, sage steppe, juniper steppe sites.	19%
III	0-50 years	Dry mixed conifer (grand fir, Doug fir, ponderosa pine) sites.	33%

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

Historically, the dominant fire regime in the Maury Mountains was Fire Regime I, a regime of low-intensity fire with an average fire return interval of less than 25 years. As fuel loadings and stand densities have increased, mostly due to fire suppression, forest conditions have become more susceptible to high-intensity fires; the number of acres in the moderate and high-intensity fire regimes has increased, while the number of acres in the low-intensity fire regime has decreased. Currently, areas within this fire regime exhibit a moderate amount of departure (42%) from reference conditions, primarily a deficiency of stands dominated by large trees in open vegetation/fuels conditions.

Within Fire Regime II which includes juniper woodlands and steppe, there is a lack of open, early-seral condition compared to reference conditions. This results in a moderate amount of departure (53%) and is classified as condition class 2.

Fire Regime III comprises 33 percent of the project area. Current vegetation and fuels conditions are similar to reference conditions, with departure at 24 percent and in condition class 1.

Condition Class describes changes in stand conditions and fire effects caused by fire exclusion. Condition classes are generally equivalent to low, moderate and high departure from the historic range of variability (HRV). Some of the characteristics of the 3 condition classes are **Table 3-18**.

Table 3-18 Characteristics of Condition Classes for Fire Regime I, Dry forest

Condition Class 1	Condition Class 2	Condition Class 3
<ul style="list-style-type: none"> • Low intensity fire has occurred within 10-15 years • Surface flame lengths 2-4 feet • non-lethal fire effects • ladder fuels scattered, clumpy • crown base heights > 6ft • crown fire potential low • light smoke, short duration • canopy closure <55% 	<ul style="list-style-type: none"> • No fire has occurred for 30-60 years • Surface flame lengths 4 to 8 ft • mixed fire effects (between 20% and 80% mortality to overstory) • ladder fuels filling in understory • moderate to high crown fire potential • canopy closure 55% to 70% 	<ul style="list-style-type: none"> • No fire has occurred for 60+ years • Surface flame lengths over 8 ft • lethal fire effects • ladder fuels abundant • crown fire potential is high • heavy long term smoke from complete combustion tree growth is reduced • tree mortality increases

Fire effects on specific components of the forest ecosystem have been described and assigned to each condition class (Hungerford 1996, Agee 1993). These effects in turn affect soil condition, water quality, habitats for aquatic, wildlife and plant species and other ecosystem components. Severe fire effects can increase the potential for noxious weed establishment and damage cultural resources. Some of the fire effects on forest floor components in each Condition Class are shown in **Table 3-19**.

Table 3-19 Burn Severity Classification

Forest floor Component	Low Severity Fire Condition Class 1	Mixed Severity Fire Condition Class 2	High Severity Fire Condition Class 3
Litter	Scorched, charred, consumed	Consumed	Consumed
Duff	Intact, surface charred	Deep charred	Consumed
Woody debris – small, < 3 in. diam.	Partly consumed - charred	Consumed	Consumed
Woody Debris – large, > 3 in. diam	Charred	Deep charred, consumed	Consumed
Ash color	Black	Light gray	Reddish orange
Mineral soil	Unchanged	Unchanged	Altered structure, hydrophobic
Soil temp at 0.4 in	< 120 F	210-390 F	>490 F

Currently in the East Maury project area, there are:

- 5,875 acres of low severity fire (Condition Class 1);
- 7,936 acres of mixed severity fire(Condition Class 2); and
- 7,256 acres of high severity fire (Condition Class 3).

The East Maury Project Fuels Report contains additional information concerning fire effects on broadleaf shrub species. Generally, plant species found in this project area are adapted to recurring fires either through sprouting capabilities or by a preference for bare mineral soil for seedling establishment.

Additional information in the report includes an analysis of fire suppression costs. Fire suppression cost can be reduced by approximately one third in treated stands.

Environmental Consequences - Fuels

Surface fuels consist of natural fuels (pine needles, sticks, downed trees, grass) and activity fuels (slash), which are a product of mechanical thinning. The amount of surface fuel on a site is referred to as a fuel load, and is measured in tons per acre. The greater the fuel load, the more intensely a fire can burn. Fine fuels (less than 3 inches in diameter) are the primary influence on rate-of-spread (how fast a fire moves) and flame lengths (measured in feet from the ground to the tip of the flame).

Ladder fuels are trees in the forest understory which provide a ladder for fire to move from the forest floor to the overstory (crown). As ladder fuels increase, the risk of crown fire increases. Ladder fuels are reduced by thinning trees mechanically (with chainsaws) and then underburning to treat the slash, or by underburning alone (thinning with fire). Underburning also prunes the lower branches of larger trees, increasing the canopy base height, which reduces the risk of crown fire. Underburning is usually not prescribed for reducing trees more than 3 inches in diameter.

Descriptions of specific fuel treatments are provided in **Appendix A**. **Appendix B** identifies treatments by unit.

Alternative 1

Stands that are currently in low intensity (Condition Class 1) as a result of being thinned and burned in the 1980s and 1990s would not be maintained, and would transition into mixed intensity (Condition Class 2) within the next 5 - 10 years. **Photo 3** shows the surface and ladder fuels that have accumulated in East Maury unit 40 since it was commercially harvested, thinned, and burned in 1993.

Table 3-20 shows the probability of mortality from a wildfire in East Maury unit 40, a stand currently representing Condition Class I (low intensity conditions), under similar temperature and moisture conditions to those of the 18,000 acre Hash Rock Fire in 2000 and the 9,000 acre Maxwell Fire in 2006. The probability of mortality was modeled using Fuels Management Analyst (Carlton 2005) and stand exam data.

Table 3-20 Tree Mortality from Wildfire in Condition class 1 (Unit 40)

Tree Species	Diameter (inches)	Height (feet)	Crown Ratio	Trees Per Acre	Crown Scorched (%)	Probability of Mortality (%)
Douglas-fir	4	12	0.55	9	100	100
Douglas-fir	8	40	0.35	8	0	36
Douglas-fir	16	65	0.40	30	0	11
Ponderosa Pine	21	100	0.35	4	0	6

Photo 3-4 East Maury Unit 40 Condition Class 1 moving towards Condition Class 2



Photo 3-5 East Maury Unit 26 currently in Condition Class 3



Under the no action alternative, the amount of forested acres within the mixed and high-intensity fire regimes are expected to increase as fuel accumulates faster than it decomposes and the

number of trees per acre in the understory increases. Limited vegetation management, wildfire suppression, and insect and disease mortality would continue the trend of fuel loadings accumulating in the form of dead and down trees, small diameter trees growing into the overstory, and dense crown conditions.

Fire in these stands could be intense, stand replacing events, which could result in the loss of late and old structure, wildlife habitat cover, and consumption of large woody material and structure in riparian areas. **Photo 3** shows the surface and ladder fuels that have accumulated in East Maury unit 26. Unit 26 is currently representing Condition Class 3 (high intensity fire).

Table 3-21 shows the probability of mortality from a wildfire in this unit under similar temperature and moisture conditions to those of the 18,000 acre Hash Rock Fire in 2000 and the 9,000 acre Maxwell Fire in 2006. The probability of mortality was modeled using Fuels Management Analyst (Carlton 2005) and stand exam data.

Table 3-21 Tree Mortality from Wildfire in Condition Class 2 (Unit 26)

Tree Species	Diameter (inches)	Height (feet)	Crown Ratio	Trees Per Acre	Crown Scorched (%)	Probability of Mortality (%)
Ponderosa Pine	1	4	0.35	177	100	100
Ponderosa Pine	4	12	0.55	394	100	100
Ponderosa Pine	8	35	0.40	106	100	99
Ponderosa Pine	16	75	0.55	156	100	96
Ponderosa Pine	21	100	0.35	10	100	93

Alternatives 2 and 3

These alternatives include several types of fuel reduction activities including activity-fuels underburning, natural fuels underburning, and piling. The amount of each fuel reduction activity varies by alternative as displayed in **Table 3-22**.

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

Table 3-22 Acres of Fuel Reduction Activities

	Alternative 2	Alternative 3
Commercial harvest, precommercial thinning and fuel treatments (grapple piling and/or underburning)	6,857	5,102
Noncommercial and fuel treatment	4,426	5,976
Prescribed fire only (underburning or thin with fire)	2,717	2,647

Prescribed fire operations that are conducted after harvest and thinning operations would reduce activity fuels (i.e. slash). These fuels are surface fuels and consist of limbs, branches, tree tops, and small trees. Based on prescribed fires in the Trout, Mill, Yobear, and Sheep Rock areas, 40

to 70 percent of the surface area of prescribed fire units is burned, thereby removing surface fuels. These fire operations would reduce the density of seedlings and saplings (generally less than 3 inches dbh) in these stands and help to maintain early seral species compositions. Because ponderosa pine and western larch are fire-tolerant species, small trees of these species are more likely to survive while fire would kill many of the small fir trees. In addition to removing activity fuels, prescribed fire operations would also reduce some of the natural fuel accumulations. Prescribed fire in these stands would also prune the lower branches of larger trees, increasing the distance from the forest floor to the crowns of those trees, making them less susceptible to high-intensity wildfire.

Activity fuels created by commercial harvest and precommercial thinning cause a short-term increase (up to 6 years) in the potential for high-intensity wildfire because they increase the amount of surface fuels. For the first year after thinning, the fuel moisture in green slash makes it unavailable to burn, unless a wildfire occurs under extreme conditions (Rothermel and others 1986). After approximately 1 year, the slash has dried out, needles have turned red, and slash is available to burn. Should a wildfire occur during this time, the additional heat generated by the increased fuel load has the potential to cause undesired effects to the surrounding stand, soils, and other resources. This hazard is mitigated by either lopping (cutting) the slash to reduce the height of the fuel bed so that it is under 12 inches, or by piling the slash. Lopping and piling both reduce fire intensity by rearranging fuels. In units that have been lopped, after 2 or 3 years the slash gets further compacted by winter snows and can be burned with a low-intensity underburn. This delay also allows for the redistribution of nutrients from the slash back into the soil (Graham et al. 1999).

Some medium and large trees may also be killed by fire; the trees most likely to be killed by fire operations are fire-intolerant species such as fir. Based on past experience, between 1 and 5 percent of the medium and large trees may be killed.

Underburning or thin with fire would occur in several stands with the objective of maintaining the potential for low intensity fire of Condition Class 1. Small trees less than 3 inches dbh would be killed and prevent development of ladder. Prescribed fire in these stands would also remove some ladder fuels by pruning the lower branches of larger trees, increasing the distance from the forest floor to the crowns of those trees, making them less susceptible to high-intensity wildfire.

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

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

Reducing fuels would increase the likelihood that wildfires would be suppressed while they are small and would reduce the risk of wildfires spreading between NFS lands and private lands.

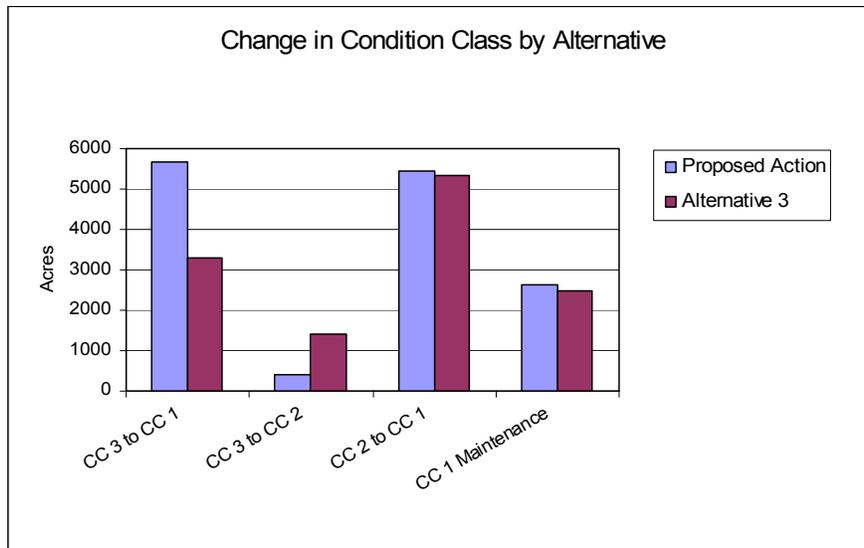
Finally, unplanned ignitions in or near management allocated old growth areas may be more successfully suppressed.

Table 3-23 compares alternatives by the change in condition class that would result from proposed treatments. Changes in condition class would result from reductions in surface fuels, ladder fuels and stand density. The Alternative 2 would reduce the potential for high intensity fire by 1) reducing surface fuels, which would shorten the flame lengths of surface fires, 2) would increase the distance from the ground to the base of the canopy, requiring longer flame lengths to initiate tree torching, and 3) would decrease crown density, making it harder for fire to travel from tree to tree.

Table 3-23 Comparison of Alternatives

Change in Condition Class	Alternative 2, acres treated	Alternative 3, acres treated
CC 3 to CC 1	5685	3310
CC 3 to CC 2	425	1414
CC 2 to CC 1	5433	5350
CC 1 Maintenance	2634	2479

Figure 3-2 Change in Condition Class by Alternative



Alternative 2 would move more acres of condition class 2 and 3 (mixed and high intensity fire conditions) into condition class 1 (low intensity fire condition) than Alternative 3.

Alternative 3 was developed to respond to the Key Issue of road construction (see Ch.2). As a result of reduced road construction and access to stands, implementing Alternative 3 will result in fewer acres of crown density reduction, moving fewer acres from Condition Class 3 to Condition Class 1. Table 5 and Figure 3 display changes in condition class by alternative.

In addition to stimulating the growth of large trees, opening the forest canopy in East Maury will increase the availability of sunlight, moisture and nutrients on the forest floor, which will increase the quantity and vigor of native grasses, forbs and shrubs. The average temperature and wind speed will increase, and average humidity decrease. This will lower fine fuel moisture, the

amount of moisture in grasses and pine needles. Lowering fine fuel moisture will facilitate the spread of low-intensity surface fire, which will maintain low levels of surface fuels and ladder fuels, which will decrease the probability of crown fire. **Table 3-24** shows changes in fine fuel moisture by alternative.

Table 3-24 Changes in Fine Fuel Moisture by Alternative

Percent of moisture in fine fuels	Alternative 1	Alternative 2	Alternative 3
0 %	1,854	1,854	1,854
1 %	0	0	156
2 %	36	37,525	35,614
3 %	5,637	13,886	15,551
4 %	46,020	282	373
5 %	0	0	0
Analysis area	53547		

The analysis area for fine fuel moisture modeling included the project area and adjacent lands within approximately 2 miles of project boundary.

Cumulative Effects - Fuels

Past harvest, precommercial thinning, slash piling and prescribed fire have reduced stand susceptibility to damaging fire. The effects of these were taken into account when describing the affected environment and the number of acres currently in each condition class.

The Davis Creek Burn is a 1344 acre wildlife burn on the Prineville BLM, south of Arrowwood Point, scheduled for 2008. The objectives are to reduce juniper and improve the growth of native grasses, forbs and shrubs. The burn will move the project area from Condition Class 2 back towards 1. Burning which could occur on the Forest Service side of the boundary as part of the Davis Creek burn has been included in this analysis (units 233, 236, 241, 253, 259, 262, 280). There are no other activities in the project area that would reduce fuels and result in changes in condition class.

Livestock grazing in the project area could reduce fire spread in open stands with light fuels by reducing grass, which helps carry fire thru a stand. The amount of reduction would depend on how intensely an area is grazed and how productive the grass is in any given year. Livestock grazing does not affect fire intensity in closed canopy, multi-storied stands with heavy surface fuel loading. Livestock grazing does not effect the distribution of condition classes because grazing does not alter stand structure and density.

The East Maury allotment will not be grazed for the next 10 years, which will increase the amount of grass in prescribed fire units, resulting in increased fire spread potential. This allotment covers approximately half of the project area.

Potential Fire Behavior and Probability

Affected Environment

Potential fire behavior and probability for the East Maury project area was analyzed utilizing FlamMap, Version 3 (Finney and others n. d.) and ArcFuels (Ager 2005). Modeling was used to predict various fire behavior characteristics and probabilities of occurrence for Alternative 1 (no

action) to assess the affected environment as well as the two action alternatives to assess changes as a result of proposed treatments. All assessments used the same weather and fuel condition scenario so that the effects of different alternatives could be consistently compared. Scenarios were modeled under hot dry conditions with a 10 mile per hour northwesterly wind across the project area. Fire behavior attributes assessed include flame length and potential crown fire activity.

Flame length is the distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface); flame length is an indicator of fire intensity. Flame lengths less than 4 feet are generally of low enough intensity that suppression crews can directly attack the fire, while flame lengths more than 4 feet require that control lines be built using heavy equipment. Flame lengths more than 8 feet generally require indirect suppression tactics and in many cases indicate intensities high enough to result in stand replacement events. Changes in flame length by alternative are shown in **Table 3-25**. The analysis area for flame length modeling included the project area and adjacent lands within approximately 2 miles of project boundary.

Table 3-25 Comparison of Alternatives by changes in Flame Length

Flame Length (feet)	No Action (acres)	Alternative 2 (acres)	Alternative 3 (acres)
0	1,854	1,854	1,854
2	0	7,766	5,518
4	9,266	8,602	8,616
8	2,667	1,950	1,953
11	3,218	1,342	981
20	36,542	32,033	34,625
Total Analysis Area	53,547		

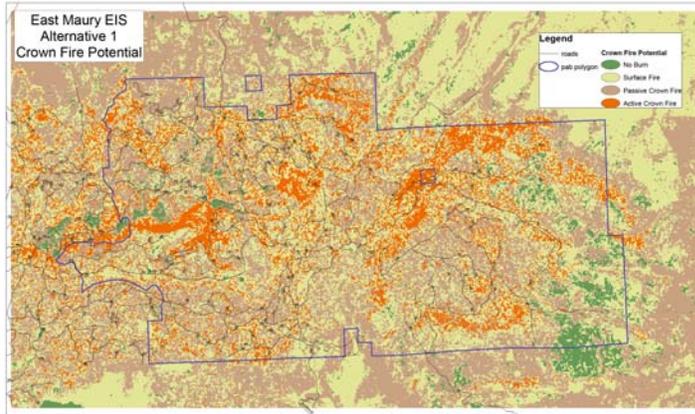
Two types of potential fires were predicted; surface fire (no crown fire) and crown fire (both passive and active). Crown fire activity can be used as an indicator of potential stand effects with surface fire generally having the least effect on stand structure, density, and composition while crown fire generally indicates a fire behavior resulting in at least partial stand replacement. Maps 3-1, 3-2, and 3-3 compare alternatives by changes in crown fire potential.

Alternative 1

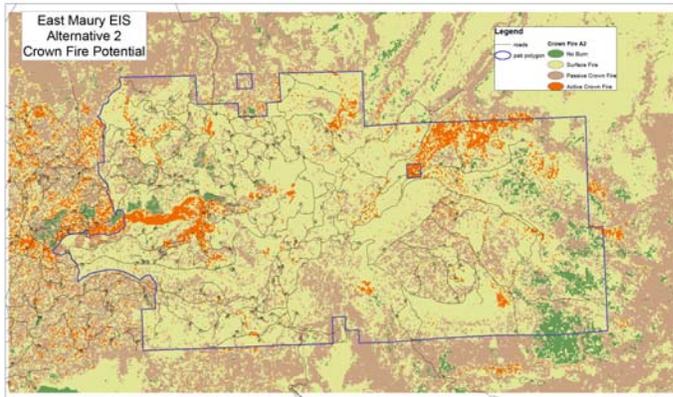
There would be no activities that would result in modifying fire behavior across the project area other than continued fire suppression efforts for unplanned wildfires. Fuel conditions within the area currently support potentially high fire intensities and a large amount of potential crown fire behavior. See **Map 3-1**. Continued stand growth, successional changes, and continued fire exclusion would result in these indicators increasing over time.

Alternatives 2 and 3

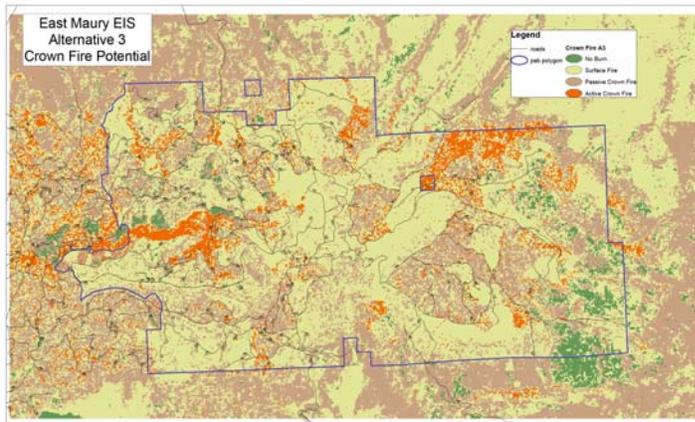
All action alternatives include activities that would modify fire behavior by reducing ground fuels, reducing ladder fuels (small understory trees), and removing activity-generated fuels following commercial harvest and precommercial thinning. Both action alternatives would result in reducing areas that support higher flame lengths. Both action alternatives reduce the amount of area which could potentially support crown fire.



Map 3-1 Crown fire potential, should a fire occur under the current condition



Map 3-2 Crown fire potential after implementing Alternative 2



Map 3-3 Crown fire potential after implementing Alternative 3

Cumulative Effects – Potential Fire Behavior and Probability

Determining more specific potential effects of wildfire for alternatives is not possible, due to so many unknown variables, such as fuels conditions during a wildfire event, weather, suppression forces available, and other factors. However, risk of future wildfire, and its potential effects to different plant association groups and seral/structural stages, would vary by alternative, corresponding to the degree of thinning and fuels management activities. Alternative 1 maintains the highest risk, and could decrease with thinning and burning that would occur outside the East Maury project. Other alternatives would result in a more substantial reduction in wildfire risk, with Alternative 2 resulting in the lowest risk of future wildfire. Alternative 3 would result in a lower risk of wildfire than Alternative 1.

Livestock grazing in the project area could reduce flame lengths and spread rates in open stands with light fuels by reducing grass, which helps carry fire through a stand. The amount of reduction depends upon how intensely an area is grazed and how productive the grass is in any given year. Livestock grazing does not affect fire intensity in closed canopy, multi-storied stands with heavy surface fuel loading, nor the distribution of condition classes because grazing does not alter stand structure and density.

There are no other activities in the project area that would reduce fuels and result in changes in fire intensity condition class. Also, there other activities in the project area that would modify fire behavior.

Forest Wood Products and Jobs

Affected Environment

For the purposes of describing socio-economics effects on the economy, the economy was considered central and southeastern Oregon. The effects to the local economies are based on the estimated number of jobs created. The bulk of the area and communities potentially influenced by actions on the Ochoco National Forest lie within Deschutes, Crook, and Jefferson, the southern most part of Wheeler, eastern most part of Grant, and the northern most sections of Harney and Lake counties. This is referred to as the Zone of Influence. The major population centers within the Zone of Influence and their population figures based on the 2000 census are displayed in **Table 3-26**. The total population for the 5-county area during the 2000 Census totaled 234,235. Populations and change for the region and by each individual county are displayed in **Table 3-26**.

Table 3-26 Central Oregon Population Growth

County	Population		Change	Percent (%)
	1990 Census Data	2000 Census Data		
Jefferson	13,676	19,009	5,333	39.0
Deschutes	74,958	115,367	40,409	53.9
Crook	14,111	19,182	5,071	35.9
Wheeler	1,380	1,550	170	11.0
Grant	7,855	7,950	95	1.2
Harney	7,060	7,609	549	7.8
Lake	7,176	7,422	245	3.3
Total	126,265	178,089	51,824	40.0

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

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

According to the 2000 Census, the labor force in Oregon as a whole increased 18 percent. Estimated civilian labor force in the 5-county area was:

- Crook, 7,525, up 12 percent since the 1990 census;
- Deschutes, 57,614, up 40 percent since the 1990 census,
- Jefferson, 8,570, up 31 percent since the 1990 census,
- Wheeler, 598, up 14 percent since the 1990 census,
- Harney, 3,110, up 16 percent since the 1990 census;
- Grant, 4,051, down 4 percent since the 1990 census, and
- Lake, 3,371, down 9 percent since the 1990 census.

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

The unemployment rate in Oregon as a whole was 5.7 percent (U.S Department of Commerce, 2001). Unemployment rates in the individual counties were:

- Crook, 9.1 percent;
- Deschutes, 6.4 percent;
- Jefferson, 6.5 percent;
- Wheeler, 10 percent;
- Harney, 8.8 percent;
- Grant, 12.1 percent; and
- Lake, 10.1 percent.

Since then the economies have had both better and worse years. Overall, however, all counties have seen a decrease in unemployment since 2003. As of October 2007, the unemployment rate in Oregon as a whole was 5.5 percent (Labor Trends, 2007). Unemployment rates in the individual counties were: Crook 6.1 percent,

- Deschutes 4.8 percent,
- Jefferson 6.4 percent,
- Wheeler 4.9 percent,
- Harney 5.8percent,
- Grant 6.3 percent, and
- Lake 6.5 percent.

The economies of Deschutes and Jefferson counties, followed by Crook, are the most robust in the Zone of influence. In Deschutes County, although there has been an increase in the number of jobs created, the huge increase in the labor force (up 40%) has negated much of this success, at least in terms of the unemployment rate. Crook County overall economic diversity is dominated by one manufacturing sector industry (lumber and wood products) and one wholesale trade sector company (Les Schwab), and is lower than the other two. Future projections call for continued growth and diversification of these economies. Even in Crook, with the announcement by Les Schwab that they are moving their corporate headquarters to Bend, economic expansion is still expected to increase. However, because of their diversity all three county economies are expected to remain strong.

Wheeler (small agricultural based economy), Grant (heavy reliance on lumber and wood products and government), Harney (Government and agriculture), and Lake (heavy reliance on lumber and wood products, government, and agriculture) counties' economies, due to their small size and lack of diversity, have had their economies lag substantially behind Crook, Deschutes and Jefferson counties' and Oregon's as a whole. Future projections also call for continued slow growth in these three economies (U.S Department of Commerce, 2001; Oregon Employment Department, 1992; Yohannan personal communications, 2006).

Although the past decade (1990-2000) has seen a significant reduction in employment within the lumber and wood products industry, the lumber and wood products industry is still an important contributor to the local economies. In 2000, 1,510 people in Crook County were employed in the lumber and wood products industry. This accounted for 25 percent of all wage and salary employment in the county, and represented the third highest paying job in the county. Since then, with the closure of additional sawmills, employment in the lumber and wood products has decreased. As of October 2007, there were 1,010 people employed in this sector. This accounted for 14 percent of all wage and salary employment in the county, a decrease of 12 percent. Moreover, almost all these jobs are located in the logging and secondary wood products sectors, not the higher paying sawmill sector.

Again in 2000, 14,770 people in Deschutes County were employed in the lumber and wood products industry. This accounted for 17 percent of all wage and salary employment, and represented the seventh highest paying job in the county. As of October 2007, there were 14,090 people employed in this sector.

In Jefferson County, 1,150 people were employed in the lumber and wood products industry. This accounted for 19 percent of all wage and salary employment, and represented the third highest paying job in the county. As of October 2007, 200 individuals were employed in this sector.

In Harney County, 204 people were employed in the lumber and wood products industry. This accounted for 11 percent of all wage and salary employment, and represented the highest paying job in the county. Today, only a handful of people still work in this sector.

In Grant County, 370 people were employed in the lumber and wood products industry. This accounted for 14 percent of all wage and salary employment (because of the limited industry base in the manufacturing sector, the State does not separate out the lumber and wood products from the other manufacturing employment. This number represents all manufacturing employment), and represented the third highest paying job in the county. As of October 2007, 250 individuals were still employed.

In Lake County, 290 people were employed in the lumber and wood products industry, and other manufacturing. This accounted for 13 percent of all wage and salary employment, and represented the third highest paying job in the county. Today 310 people are employed. Wheeler County has no manufacturing sector industries (U.S Department of Commerce, 2001; Labor Trends, October 2007).

Environmental Consequences – Forest Wood Products

Alternative 1

There would not be any activities implemented; therefore, no jobs would be created. As a result there would be no direct benefits to the local or regional economies. In all actuality, the No Action Alternative would have negative impacts to local and regional economies because forest product jobs would not be maintained. The ability to substitute this material from another source is questionable given the current availability of timber, especially from Federal lands. As noted in the affected environment section, Crook County no longer has any primary manufacturing capacity and more than half of the direct jobs supported by the harvesting, transporting, and processing of timber are associated with primary manufacturing. However since the activities would take place in Crook County, it is likely that many of the logging jobs that would be supported under Alternatives 2 and 3 would in fact be associated with Crook County's logging industry. It is also unlikely that many of these local logging jobs would be supported by another harvest activity on the Ochoco National Forest or within the Zone of Influence. This would result in some downward pressures on all facets of Crook County's economy.

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

Alternatives 2 and 3

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

Table 3-27 shows the estimated annual job and income by alternative. These estimates are for commercial forest products, noncommercial thinning, piling of small woody debris (slash), road construction, road reconstruction, road decommissioning, and prescribed fire. No attempt has been made to value what has been termed ecosystem service values. This type of analysis, if done at all, is more appropriate at the Forest Plan level, not at the project level Bartuska (2000) and a United States Court of Appeals, 9th circuit Memorandum (2006).

Timber harvest jobs and income shown in **Table 3-27** are based on State-wide relationships and are not necessarily the expected impact in any one county. Because of this, the estimated jobs and income figures are likely to be higher than what one would expect in a less developed rural

economy. For example, the indirect and induced jobs described above would be less in a rural economy such as Crook’s as money “leaks” out of the local economy to Redmond, Bend, and the Willamette Valley. The jobs and income associated with the road work are directly tied to Crook County’s economy (Phillips 2005). However, they are based on all road work within the County. Because the road work on the Forest is generally less intensive, the number of jobs portrayed in **Table 3-27** is likely overstated.

Over half of the timber jobs displayed in **Table 3-27** are associated with primary manufacturing (sawmills), and since there is no certainty on where this manufacturing would occur (may not be processed even within the Zone of Influence); it is not possible to predict where many of these jobs would exist.

Table 3-27 Projected Annual Employment and Income

	Alternative 2	Alternative 3
Jobs (Direct), commercial harvest	156	115
Jobs (Indirect), commercial harvest	78	58
Total Jobs commercial harvest	234	173.5
Personal Income (Direct), timber harvest (\$1000)	6,537	4,840
Jobs, road work (miles)	8.8	4.6
Income, road work (\$1,000)	0.28	0.15
Jobs, pre-commercial thinning	14.9	16.3
Jobs, slash piling	2.3	7.3
Jobs, prescribed fire	25.3	31.6

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

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

It is reasonable to expect a good proportion of the pre-commercial thinning work would go to minority-based small businesses, as they have in the past. The vast majority of these businesses and their employees are based along the I-5 corridor, so most of the disposable income from these activities would not flow into local communities. There would be some local economic activity generated from these activities but it may be outside the area. The primary services needed by the workers would be food and shelter. Local businesses that can supply food (grocery stores and restaurants) and other services would capture most of the money being spent by the workers in the area. Some businesses may need to increase their employment, either by

temporarily adding employees, or giving present employees more hours. This would likely result in increased local household incomes during implementation of project activities. Since these businesses have supported similar workforces in the past, capitol expansion would probably not be required.

Within the social context presented above, the action alternatives have the potential to bring in workers from the outside to perform logging and related activities. While the outside workforce is more likely to be racially diverse than the local resident population, the residents have worked effectively with and supported anticipated fluctuations in the workforce expected with the implementation of either alternative 2 or 3.

Cumulative Effects – Forest Wood Products and Jobs

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

Water Quality

Water quality is addressed in this document through analysis of several parameters including water yield, temperature, sediment and turbidity. Detailed analysis of water quality is contained in the Hydrology Report. Refer to that report and Appendix X for more detailed information on water quality.

Equivalent Harvest Area was used to evaluate the risk to water quality and stream bank stability. While the model was developed to evaluate third through fifth order drainages and has primarily been used to evaluate watersheds and sub-watersheds, almost all the studies of water yield and peak flow have been based on much smaller (first and second order) drainages (Anderson, 1989). Headwater streams, used in the studies, are especially sensitive to increases in flow due to faster delivery of water, less opportunity for channel storage, and greater chance of synchronization. Therefore, water yield effects resulting from proposed treatments analyzed by the Equivalent Harvest Area model should also reflect effects to the second and third order drainages of concern in the project area. The Equivalent Harvest Area model does not measure direct effects. It is based on the principal that reduced canopy closure will reduce interception and evapotranspiration and will increase snow accumulation. The probability of an event (flood) occurring can be increased by increasing the runoff efficiency of a drainage by road construction, increasing the snow pack through unit size and distribution, increasing snow melt rate through reducing canopy closure, or increasing the amount of water available by removing vegetation. Standing dead trees no longer transpire but still would effect interception and snow accumulation. An overview of the EHA calculation process and assumptions made in this analysis are included in the Hydrology Report (Attachment A).

Water Yield

Affected Environment

Peak annual flows resulting from snowmelt normally occur in March through April in the project area. However, peak annual flows resulting from rain-on-snow events in early winter have produced some of the highest flows over the last 50 years. High flows can also result from intensive convective thunderstorms that cause flash floods during the spring and summer. The probability of having a flash flood increases as the elevation and precipitation decrease. This is primarily as a response to vegetation and ground cover. Forest canopy tends to buffer the intensity of thunderstorms at higher elevations. Peak flows are probably earlier and higher than historically due to soil loss, compaction, timber harvest, road construction and loss of floodplain storage caused by entrenched channels. This has been offset somewhat by increased understory canopy cover.

Prior to European settlement, frequent fires maintained lower evapotranspiration and interception rates by maintaining very open under stocked stands and substantially reducing juniper and marginal conifer stands. Water storage in wetlands and beaver ponds coupled with decreased water loss also contributed to higher base flows. Currently many of the conifer stands are over stocked and conifers and juniper have moved into formerly unforested areas and wet meadows. Increases in base flow due to removing trees tend to be short term (5 to 10 years) and return to pre-disturbance levels as other vegetation utilizes the increase in available water, such as grasses and shrubs in juniper stands and remaining trees in higher precipitation zones.

Stream surveys conducted between 1988 and 2005 identified numerous headcuts in the project area, making these streams susceptible to damage during increased flows. The old valley bottom road north of the historic Maury Ranger Station has been captured by Maury Creek in multiple reaches, making the main stem of the creek susceptible to increased flows. Stream restoration projects were conducted in 2007 on Double Cabin Creek to control headcuts. Similar work was also previously accomplished on Wildcat Creek and Double Cabin Creek.

Watersheds and subwatersheds included in the analysis of water yield using the Equivalent Harvest Area model are:

- Upper Crooked River Watershed (Drake Creek and Pine Creek Subwatersheds including the Stewart and Tom Vawn drainages)
- Crooked River above the North Fork Watershed (Maury Creek Subwatershed)
- Camp Creek Watershed (Indian Creek and Lower Camp Creek Subwatersheds)

Measurable increases in flow start showing up when EHA reaches about 20 to 25 percent (Hibbert, 1965; Douglas, 1967; Rothacher, 1971; Megahan, 1976; Troendle and Leaf, 1980; Bosch and Hewlett, 1982), and should be roughly proportional to the percentage of the area above that value. The Forest Plan assigned an Equivalent Harvest Area threshold of 35 percent to all watersheds in the Maury Mountains that flow into the Crooked River above Bowman Dam. This threshold was based largely on the lack of anadromous fish in this area. The threshold value identifies the upper limit that is compatible with watershed sensitivity, without incurring damage in a major storm event. The assigned threshold of 35 percent indicates low sensitivity. However, the high incidence of headcuts in streams in the project area and the problem with the old road in Maury Creek identified since the Forest Plan was released, indicate the watersheds are highly sensitive and a threshold of 25 percent would be more appropriate. The Equivalent

Harvest Area threshold should be interpreted as a point above which detrimental impacts may occur, should a 10-year or greater storm or melt event take place (Anderson, 1989).

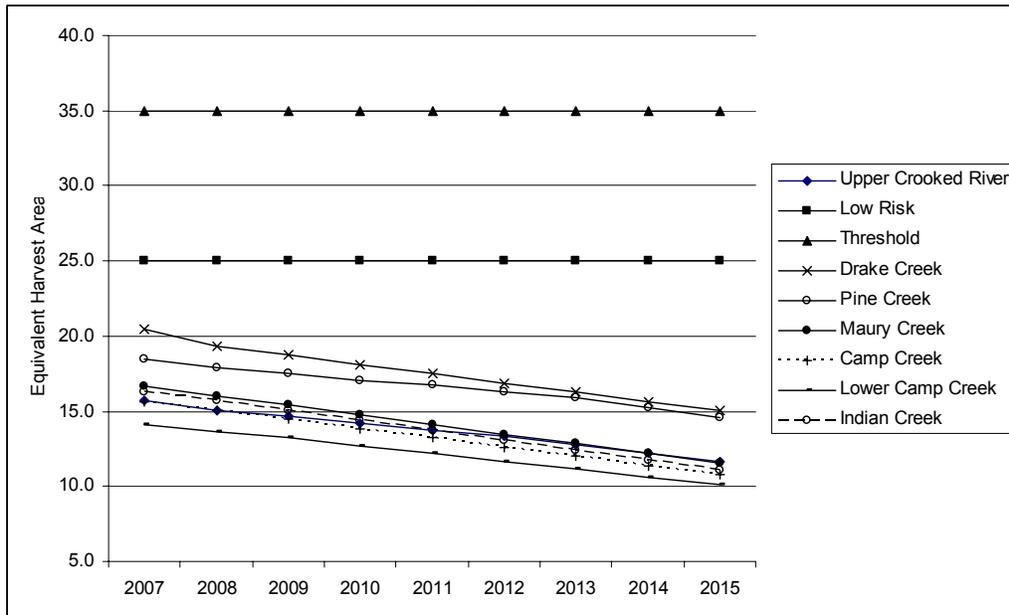
Environmental Consequences – Water Yield

Alternative 1

Alternative 1 would not result in a change in canopy closure, interception, or evapotranspiration. There would not be a change in snow pack or change in snow melt rate. This would result initially in maintenance of current trends in infiltration and runoff, soil moisture and flow. Potential for impacts to sensitive stream channels would remain the same as under the current condition. Over time Equivalent Harvest Area (from past treatments) would continue to decrease as canopy cover and leaf area index increase. As shown on **Figure 3-3**, all watersheds and subwatersheds are under the Forest Plan Equivalent Harvest Area threshold of 35% and also are below the recommended threshold of 25% (low risk) during the period of time being evaluated. Thus, the probability of a flood event occurring would not be changed by this alternative initially and the probability of such events would tend to decrease over time in the absence of large scale disturbance.

Retention of high density stands across the landscape does increase the potential risk of high intensity disturbance, and the development of such fuel accumulations in a contiguous arrangement increases the probability of such disturbances to occur at a large scale. There would likely be an increase in Equivalent Harvest Area commensurate with the size and intensity of the fire. It is difficult to predict the time, or the scale and intensity at which such future events might occur, but more intense fire behavior at a larger scale would be expected to occur under this alternative than under an alternative that reduces fuel accumulations and breaks up their continuity.

Figure 3-3 Equivalent Harvest Area Alternative 1



If a large scale disturbance were to occur in the future, then there would be potential for peak flow increases in affected drainages. Increased flow due to higher snowpack accumulation and faster snow melt rate, or increased water availability through reduced transpiration, could result

from large scale, high intensity event(s), which could increase the probability of a flood occurring. Headcut repairs that have been completed should help to stabilize drainages enough make stream systems better able to handle moderate increases in peak flows, but they would still be sensitive to impacts from 50 or 100-year events.

Alternative 2

Alternative 2 proposes harvest on 29 percent of the project area. Increases in snow accumulation, faster melt rates, and increased soil moisture in harvested areas may result in increased peak flows. Woods (2007) concluded that thinning treatments did affect the rate of snow melt and could substantially change the timing and magnitude of snowmelt runoff. Changes in snow accumulation may not be directly correlated to increased peak flows in larger streams due to the synchronization or desynchronization of flows in tributaries. For example the timing of snow melt may be delayed on north-facing slopes or drainages, while it may be relatively rapid on south-facing slopes or ridges. **Table 3-28** shows the amount of snow water equivalent found in partial harvest studies. Treatments proposed under this alternative would reduce basal area (BA) canopy closure and leaf area index, and thus would likely increase snow accumulation equivalent within treated stands, increase the melt rate and increase the soil moisture. There is potential for this situation to contribute to higher peak flows, which could result in delivery of more water into sensitive stream systems, and thus increase the risk of in-channel erosion or channel migration.

Table 3-28 Partial Harvest Snow Water Equivalent Increases

Study	Type Harvest	Increase in Peak Water Equivalent	Location of Study
Anderson and Gleason (1960)	Selective Harvest	13%	California
Brendt (1961)	Selective Harvest	6%	Colorado
Goodell (1952)	Selective Harvest, 52% basal area removed	24%	Colorado
Troendal and Meiman (1984)	Partial Cutting 36% basal area removed	14%	Colorado
Wilm and Dunford (1948)	Selective Harvest	31%	Colorado
Woods (2007)	Thinning 16-33ft Spacing 50% basal area removed	35%	Montana

Alternative 2 proposes commercial harvest and non-commercial thinning treatments on about 67 percent of the forest plant associations in the project area. Harvest treatments would only be accomplished on about 40 percent of the forested area. The reduction of ladder fuels combined with fuels treatments would reduce the amount of area susceptible to stand replacement wildfire. Equivalent Harvest Area would continue to recover toward pre-treatment conditions from past harvest. **Figure 3-4** graphs Equivalent Harvest Area from 2007-2015 for Alternative 2. All watersheds and subwatersheds are under the Forest Plan Equivalent Harvest Area threshold and are at low risk from increased flows resulting from vegetative management during the period being evaluated, except for the following:

- **Maury Creek Subwatershed** – The Maury Creek Subwatershed is sensitive. Incising has occurred along the old road that used to access the Maury Ranger Station during the first half of the 20th century. The road up the bottom of Maury Creek is currently pirating the creek channel in several reaches. Increased snow accumulation associated with the Equivalent Harvest Area remaining above 25 percent for 6 years could increase the magnitude of peak flows in Alternative 2. Even without potential increases in flow from proposed treatments, there is a 47 percent risk of a 10-year or greater flood over this period, and a 22 percent risk of a 25-year or greater flood occurring in Maury Creek. This alternative would commercial harvest 43 percent of the forest plant associations in the Maury Creek Subwatershed.
- **Indian Creek Subwatershed** – This subwatershed is sensitive. There are extensive headcuts on Double Cabin Creek. Some stream restoration projects to repair these headcuts have been done and more are proposed. Headcuts have been identified by the Forest on Indian and Wiley creeks. Headcuts have been identified by the watershed council on private lands on Indian Creek, Double Cabin Creek, and Parish Creek. Increased snow accumulation associated with the Equivalent Harvest Area remaining above 25 percent for 7 years could increase the magnitude of peak flows in Alternative 2. Even without potential increases in flow from proposed treatments, there is a 52 percent risk of a 10-year or greater flood over this period, and a 25 percent risk of a 25-year or greater flood occurring in affected drainages in the Indian Creek Subwatershed. This alternative would accomplish commercial harvest on 54 percent of the forest plant associations in the Indian Creek Subwatershed.

Although EHA rises above 25% (but less than 35%) for the forested portion of Lower Camp Creek Subwatershed on Forest Service administered land this represents less than 10 percent of the total area in the Camp Creek Watershed. Based on positioning of Forest Service administered land, there is low risk of adverse affects to the main stem of Camp Creek from this alternative.

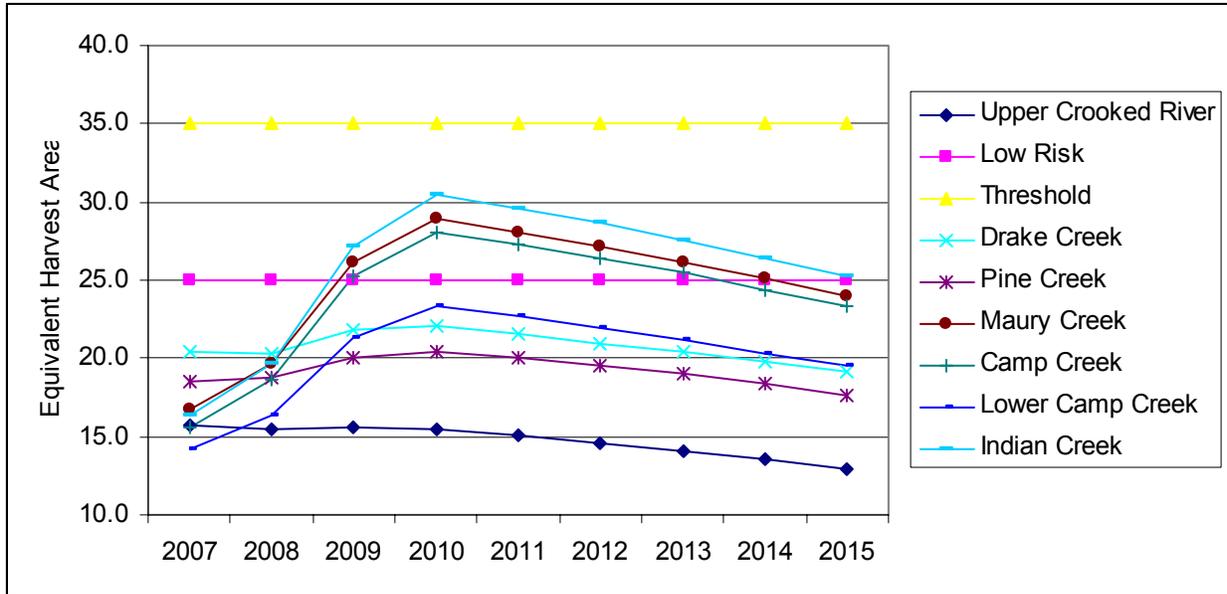
This alternative would also construct new roads which could increase the efficiency of runoff. There are about 67 miles of identified perennial and intermittent streams in the planning area and an unknown amount of ephemeral streams. Increased road density within 400 feet of identified streams should be representative of that for the entire drainage system. There would be 2.4 miles of new system and temporary road constructed within 400 feet of streams and 4.3 miles of existing road that would be reopened for haul. This equates to a 3.6 percent increase in the drainage network resulting from new roads and a 6.4 percent increase resulting from reopening existing roads.

In Maury Creek Subwatershed, two roads, 1600-289-071 (0.4 miles) and 1600-474-061 (0.2 miles) are proposed within 400 feet of Stewart Creek. Road 1600-289-071 replaces an existing road poorly located near the stream channel. The existing road would be decommissioned and hydrologically restored in this alternative. In addition, a temporary road, 1670-350-098 would be constructed within 400 feet of Maury Creek on less than 20 percent side slope. This road would allow log landing areas to be placed farther away from the creek than in previous harvest layout and should result in less disturbance to the stream channel. Road 1670-350-098 would be located approximately 900 feet from Maury Creek and would allow shorter skidding distances potentially reducing the effects of skidding in this area on the drainage network.

Temporary roads would be decommissioned and new and reopened system roads would be hydrologically closed by the end of the sale. In many cases, the re-closed existing roads would

have better drainage than they had before reactivation. The density would be further reduced by closing 0.8 miles of currently open road and the decommissioning of 0.9 miles of currently open road.

Figure 3-4 Equivalent Harvest Area for Alternative 2 from 2007-2015



Alternative 3

Alternative 3 proposes harvest on 21.2 percent of the planning area. As described above, treatments proposed under this alternative would reduce basal area (BA), canopy closure and leaf area index. This alternative would likely result in increases in snow accumulation, faster melt rates, and increased soil moisture in harvested areas. Refer to **Table 3-28** (under Alternative 2) for information from studies of harvest effects on Peak Water Equivalent. These changes may result in increased peak flows which could result in delivery of more water into sensitive stream systems, and thus increase the risk of in-channel erosion or channel migration.

Alternative 3 proposes commercial harvest and non-commercial thinning treatments on about 52 percent of the forest plant associations in the project area. Harvest treatments would be accomplished only on about 27 percent of forested area. The reduction of ladder fuels combined with fuels treatments would reduce the amount of area susceptible to stand replacement wildfire. Equivalent Harvest Area would continue to recover toward pre-treatment conditions from past harvest. **Figure 3-5** graphs Equivalent Harvest Area from 2007-2015 for Alternative 3. All watersheds and subwatersheds are under the Forest Plan Equivalent Harvest Area threshold, and are at low risk from increased flows resulting from vegetative management during the period being evaluated, except for the following:

- **Maury Creek Subwatershed** – The Maury Creek subwatershed is sensitive. Increased snow accumulation associated with the Equivalent Harvest Area would be above 25 percent for 1 year and could increase the magnitude of peak flows in Alternative 3. There is a 10 percent risk of a 10-year or greater flood over this period, and a 4 percent risk of a 25-year or greater flood occurring in Maury Creek. This alternative proposes commercial harvest on 28 percent of the forest plant associations in the Maury Creek subwatershed. A reduction in

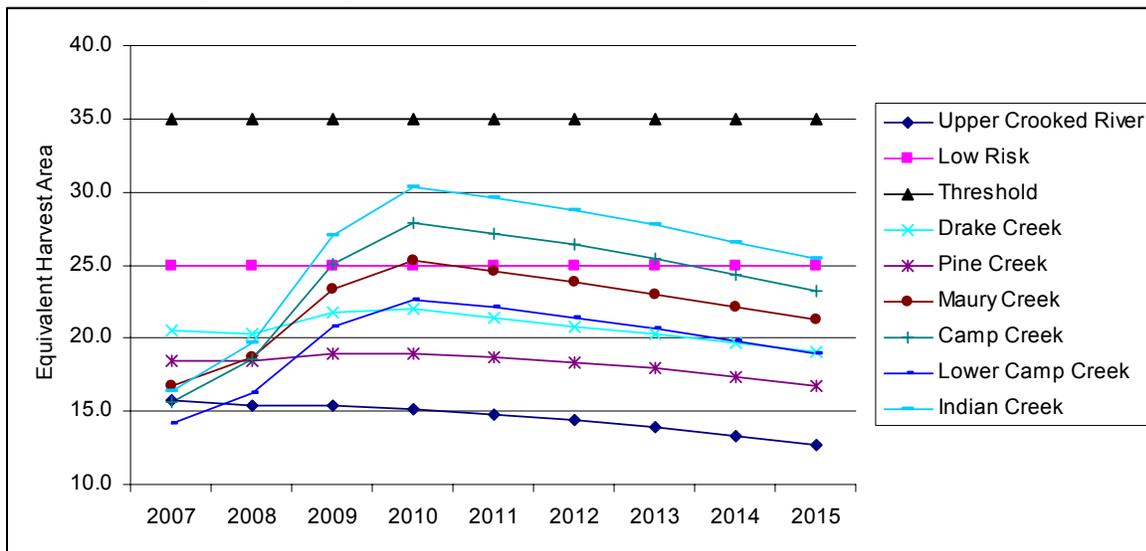
commercial harvest acres during layout due to the discovery of unmapped springs, wet areas, intermittent stream, access problems, and other factors would probably reduce the EHA associated with this alternative below 25% in this subwatershed.

- Indian Creek Subwatershed:** This subwatershed is sensitive. There are extensive headcuts on Double Cabin Creek on the Forest. Most of these have been stabilized by the District through headcut repair projects. Continuing headcut repair work is proposed on this creek. The Forest has identified headcuts on Indian and Wiley Creek on Forest Service administered lands and there are headcuts on private lands on Indian Creek, Double Cabin Creek, and Parish Creek. Increased snow accumulation associated with Equivalent Harvest Area remaining above 25 percent for 7 years could increase the magnitude of peak flows in Alternative 3. Even without potential increases in flow from proposed treatments there is a 52 percent risk of a 10-year or greater flood over this period, and a 25 percent risk of a 25-year or greater flood occurring in affected drainages in the Indian Creek Subwatershed. This alternative would accomplish commercial harvest on 42.4 percent of the forest plant associations in the Indian Creek Subwatershed.

Proposed treatments in Lower Camp Creek Subwatershed in Alternative 3 are similar similar to Alternative 2 and would be expected to also create a low risk of adverse effects in Camp Creek. This alternative would also construct new roads which could increase the efficiency of runoff. Alternative 3 would construct 95 percent less new system and temporary road within 400 feet of identified perennial and intermittent streams than Alternative 2 and would reopen 37 percent less existing road. This would reduce the increase in drainage density in Alternative 2 by more than half. As in Alternative 2, temporary roads would be decommissioned and new and reopened system roads would be hydrologically closed by the end of the sale. The density would be further reduced by closing 0.1 miles of currently open road and the decommissioning of 0.7 miles of currently open road.

In Maury Creek Subwatershed, temporary road 1670-350-098 would be located approximately 900 feet from Maury Creek and would allow shorter skidding distances potentially reducing the effects of skidding in this area on the drainage network.

Figure 3-5 Equivalent Harvest Area for Alternative 3 from 2007-2015



Cumulative Effects – Water Yield

Harvest and other management history are summarized on pages 3-2 to 3-3 and are also discussed in detail in the Hydrology Report. The treatment history has affected the ability of watersheds in the project area to capture and hold snow and thus the timing and magnitude of the release of water downslope or downstream. Proposed timber harvest and precommercial thinning in approximately 34 percent of the planning area (plus juniper thinning in an additional 13 percent) in the action alternatives, combined with past vegetative treatments, can reduce interception and evapotranspiration, increase snow accumulation, and change snow melt rate and timing. It is estimated that about 90 percent of the forested land has been at least lightly harvested in the past with about 90 percent of this harvested with ground based equipment. Increases in snow accumulation, faster melt rates, and increased soil moisture in harvested areas may still be contributing toward increased flows, but would not be measurable. The amount of snow water equivalent (the amount of water that would result from melting the snow) may have been increased in stands that have been partially harvested in the past (See **Table 3-28**).

The Equivalent Harvest Area model evaluated all timber harvest in the project area over the last 30 years, including subwatersheds which overlap the West Maury project area. Equivalent Harvest Area calculations assume all harvest activities for this project would occur between 2008 and 2010: 25 percent in 2008; 50 percent in 2009; and 25 percent in 2010. Non-commercial treatments (pre-commercial thinning and aspen treatments) would be completed by 2015. Normally there is at least a 10 percent reduction in commercial harvest during layout due to the discovery of unmapped springs, wet areas, intermittent streams, access problems, and other factors. It is assumed that natural fuels treatment would not remove enough canopy to produce a measurable increase in water yield. **Table 3-29** shows the Equivalent Harvest Area values from 2007 through 2015. Shaded areas have Equivalent Harvest Area greater than 25 percent, which predict potential measurable increases in flow which could increase the magnitude of peak flows.

Table 3-29 Equivalent Harvest Area 2007-2015

Watershed/Drainage	2007	2008	2009	2010	2011	2012	2013	2014	2015
Upper Crooked River Watershed									
Alternative 1	15.7	15.1	14.7	14.2	13.8	13.3	12.8	12.2	11.7
Alternative 2		15.4	15.6	15.5	15.1	14.6	14.1	13.5	13.0
Alternative 3		15.4	15.4	15.2	14.8	14.4	13.9	13.3	12.7
•Drake Creek Subwatershed									
Alternative 1	20.5	19.3	18.8	18.1	17.5	16.9	16.3	15.7	15.1
Alternative 2		20.3	21.8	22.1	21.6	21.0	20.4	19.8	19.2
Alternative 3		20.3	21.7	22.0	21.4	20.8	20.3	19.6	19.0
•Pine Creek Subwatershed									
Alternative 1	18.5	17.9	17.5	17.1	16.7	16.3	15.9	15.2	14.6
Alternative 2		18.8	20.0	20.4	20.0	19.5	19.1	18.3	17.6
Alternative 3		18.4	18.9	18.9	18.7	18.3	17.9	17.3	16.7
•Stewart/Tom Vawn drainages									
Alternative 1	9.4	9.1	8.8	8.4	8.1	7.7	7.4	7.0	6.7
Alternative 2		13.0	20.4	23.8	23.4	22.9	22.2	21.6	20.8
Alternative 3		11.3	15.3	17.1	17.1	17.1	17.0	16.8	16.7
Crooked River Above Northfork Watershed									
•Maury Creek Subwatershed									
Alternative 1	16.7	16.1	15.5	14.8	14.1	13.5	12.8	12.2	11.6
Alternative 2		19.6	26.1	28.9	28.1	27.1	26.2	25.1	24.0

Alternative 3		18.7	23.4	25.3	24.6	23.8	23.0	22.2	21.3
Camp Creek Watershed									
Alternative 1	15.6	15.0	14.5	13.8	13.2	12.6	12.0	11.4	10.8
Alternative 2		18.6	25.3	28.1	27.3	26.4	25.5	24.4	23.4
Alternative 3		18.6	25.0	27.8	27.2	26.4	25.4	24.4	23.3
Indian Creek Subwatershed									
Alternative 1	16.3	15.7	15.1	14.4	13.7	13.1	12.4	11.8	11.1
Alternative 2		19.7	27.2	30.4	29.6	28.6	27.6	26.4	25.3
Alternative 3		19.7	27.1	30.3	29.6	28.6	27.6	26.4	25.3
Lower Camp Creek Subwatershed									
Alternative 1	14.2	13.7	13.3	12.7	12.2	11.6	11.1	10.6	10.1
Alternative 2		16.4	21.3	23.3	22.7	21.9	21.2	20.3	19.5
Alternative 3		16.4	20.8	22.7	22.2	21.4	20.6	19.8	19.0

Activities that contribute to soil compaction such as logging, grazing or road construction have increased the efficiency of runoff in some areas. The combination of increased runoff efficiency and increased flow due to higher snowpack accumulation and snow melt rate, or water availability through reduced transpiration (harvest unit size and distribution) can increase the probability of a flood occurring. This may have contributed increased channel sensitivity causing headcuts to develop or to migrate. Stream entrenchment has reduced storage potential in alluvial aquifers. Upland storage has been lost due to road construction, erosion, and compaction. Changes in livestock management resulting from the updated Maury AMP will modify grazing effects in the future. Several headcuts have already been treated and more are planned to be treated in the near future. These changes should allow for vegetative recovery and channel stabilization in some of the sensitive streams. This should make these systems better able to carry peak flows with less risk of further in-channel erosion.

Harvest treatments on private lands below the Forest boundary have been similar to those on the Forest. There is currently no logging occurring on private lands in the project area. Based on species composition and past harvest activities, any future logging on private lands would probably be selective harvest. Commercial forest land is limited adjacent to the project boundary and is confined to several small stands totaling approximately 440 acres. The largest area is in the Indian Creek Subwatershed in the southwest corner of the project area. Forest cover does not extend very far below the Forest Boundary, changing to juniper within less than a mile. Therefore, potential future timber harvest on private lands would have a minimal affect on water yield in the project area.

Temperature and 303(d) List

Affected Environment

The Maury Watershed Analysis found redband trout are the only salmonid currently present in the watershed. As described in the section on Aquatic Species and Habitat section and the Aquatic Species Report, anadromous fish are not able to access streams in this project area because of downstream fish passage barriers. The Aquatic Species Report further states that there are no bull trout in the East Maury planning area. The temperatures in the INFISH Interim Riparian Management Objectives (Table 1A) are based on bull trout presence or potential. The State water quality standards more accurately reflect attainable conditions and target species (redband trout) found in the project area. The state standards (OAR 340-041-0028, approved by

EPA Mar 2004) say the 7-day average maximum temperature of streams identified as having salmon and trout rearing and migration should not exceed 64.4°F. Department of Environmental Quality (DEQ) assumes that waters meeting this standard will provide water temperatures suitable for redband trout spawning. Even though streams in the East Maury project area are not required to meet the state steelhead spawning standards, it appears streams that are meeting the 64.4°F threshold should also be meeting the spawning threshold (55.4°F between January 1 and May 15). Water temperatures over the 64.4°F threshold are not to be increased further except in accordance with water quality standards. The project incorporates design criteria to not allow a measurable increase to the 7-day moving average daily maximum water temperature on any adult holding habitat or spawning or rearing habitats in the project area. Refer to the Aquatic Species and Habitat section and the Aquatic Species Report for additional information on relationship between water temperature and fish habitat.

Shotgun Creek and Wildcat Creek are on the 2004/2006 state 303(d) list of Water Quality Limited Water Bodies for summer water temperature. The State listing of Shotgun Creek was based on erroneous 1991 data (see East Maury Hydrology Report). Shotgun Creek meets current state water quality standards. **Table 3-30** displays the 7-day average max water temperatures for stations on streams in the project from 1994 through 2007. Water temperatures over threshold are indicated by shading.

Table 3-30 7-day Average of Daily Maximum Stream Temperatures (°F)

Stream	1994	1995	1996	1997	1998	1999	2000	2001	2003	2004	2005	2006	2007
Double Cabin Creek													
Forest boundary	--	--	63.8	65.5	65.0	64.4	65.6	65.7	65.5	64.4	--	--	--
Drake Creek													
Forest boundary	66.3	69.8	67.1	72.4	62.9	68.5	69.0	69.8	63.1	63.0	63.0	62.4	64.3
Below Road 650	75.9	--	--	--	--	--	--	--	--	--	--	--	--
Maury Creek													
Forest boundary	--	73.2	--	78.7	--	71.2	70.1	68.5	--	--	--	--	--
Shotgun Creek													
Forest boundary	--	--	--	--	--	--	--	--	--	--	61.5	63.0	--
Above Road 1680150	--	--	--	--	--	--	--	--	--	--	59.8	58.1	62.2
Above aspen	--	--	--	--	--	--	--	--	--	--	56.8	55.9	59.0
Wildcat Creek													
Road 1680050	--	67.9	67.4	66.0	67.6	63.0	65.9	66.0	67.8	67.6	--	--	--
Wiley Creek													
Forest boundary	--	--	--	--	70.9	67.4	--	--	--	--	--	--	--

-- No data available

Environmental Consequences – Temperature and 303(d) Listed Streams

Alternative 1

There would be no reduction in shading from this alternative and no increase in water temperatures in the short term. The direct effect of this alternative is that shade would be retained as in the current condition and will likely increase in some stands with potential for canopy expansion. Canopy expansion is also expected on portions of 303(d) listed streams (Shotgun and Wildcat Creeks). Thus solar exposure would not be increased and there would not be a measurable increase in water temperature in the short term. However, over time fuel loading would continue the progression toward a higher risk of high intensity fire. In the long term there is potential for indirect effects associated with fuel loading that would carry a high

intensity wildfire. If a large scale high intensity fire was to occur, increased solar input to streams would result from decreased shade. Increases in water temperature would be proportional to the amount of canopy lost, the distance to the stream and the aspect. The effect would be most pronounced in confined valleys with dense understory. Increased water temperatures that could be triggered by future disturbance events would be offset to some degree by increased stream flows due to decreased evapotranspiration and interception and increased snow accumulation. While high intensity fire would have other adverse effects (such as sediment delivery), loss of shade on seasonal or intermittent streams would not have much effect on summer maximum stream temperatures. Summer maximum stream temperatures would be more likely to be affected if high intensity fire were to occur within stands that share perennial streams. It is difficult to predict the time, or the scale and intensity at which event(s) might occur, but it is expected that future fires would be larger and more intense than what happened historically due to increased ladder fuels and higher fuel loadings.

Alternative 2

There would be about 238 acres of commercial harvest and 846 acres of precommercial and juniper thinning in RHCAs in this alternative. This equates to about 14 percent and 48 percent of the fish bearing and perennial non-fish bearing RHCAs respectively.

Reductions in solar input resulting from shading are a primary factor affecting stream temperature. Shade functions (Beschta, et al., 1987) generally occur within 100-200 feet of the channel. Except for aspen restoration treatments, commercial harvest and non-commercial thinning in RHCAs would be designed to not reduce shading on fish bearing or non-fish bearing perennial streams. Solar Pathfinder shade monitoring of non-commercial thinning in RHCAs in 1998 found less than a 1 percent change within channel shade readings from pre-treatment observations (Fontaine, 1998). Removing conifers from aspen stands to improve riparian shrub production in commercial and non-commercial units may reduce shade for a short term, but should not result in a measurable increase in water temperatures. This is because the amount of area being treated in close enough proximity to water to affect shading is small in size relative to the length of stream. Commercial thinning of conifers would occur within 100 feet of aspen stands (including sprouts) and only a small portion of that area would be in a location that would influence the solar exposure of streams or water sources. In addition, areas treated within aspen stands are expected to increase their hardwood canopy in response to a reduction in coniferous canopy, so shading from aspen and other riparian hardwood species should increase in treated areas. There is potential for conifer thinning in aspen stands and prescribed fire to reduce shade for a short term, however, water temperatures should still meet state standards. No harvest associated with aspen improvement is proposed within RHCAs of 303(d) listed streams (Shotgun and Wildcat Creeks).

Approximately 39 percent of the RHCAs on fish bearing streams and 40 percent on perennial non-fish bearing streams are in units with prescribed fire. There is a risk of prescribed fire reducing shade; however, short term increases in temperature (up to 6 months) are allowed even on streams over threshold during riparian restoration activities to restore riparian vegetation (Oregon Water Quality Standards 340-041-0004(5)(a)). It is estimated that between 10 and 50 percent of the area in the RHCA within these units would burn at low intensity and in the outer portions of the RHCA further away from the stream. Ninety-five percent of the trees killed under proposed low intensity burning should be 3 feet or less in height. Based on Forest shade tables, a 3-foot tall tree would need to be within 5 feet of the stream to affect shade during the 8

hours in the middle of the day. In addition to the design element to maintain shade being carried forward to the burn plan, moisture conditions adjacent to streams would retard burning within this 5-foot swath when conditions would be right for burning the uplands.

Evidence of extensive historic aspen occurs in Wiley Creek Tributary 1. Juniper cutting in unit 267 in this drainage would allow for re-establishing aspen along the creek. Aspen would be planted and protected from grazing. Proposed juniper cutting would also stimulate growth and development of riparian shrubs planted in 2005 on this tributary. Increased aspen and riparian shrub development is expected to improve channel stability in this stream without reducing stream shade.

There would not be any measurable increase in water temperatures in fish bearing and perennial non-fish bearing streams (Class I-III). Activities proposed in RHCAs, including RHCAs for 303(d) listed streams, include design elements to promote attainment of RMOs over time. Prescribed burning and noncommercial thinning of conifers in aspen stands would occur within RHCAs on 303(d) listed streams (Shotgun and Wildcat Creeks). Along Wildcat Creek, burning would occur in Units 7, 8, and 9 and aspen restoration would occur in Units 19/29, 41/48, and 102. Along Shotgun Creek, burning would occur in Units 10, 81, and 123 and aspen restoration would occur in units 15 and 81. Thinning conifers and proposed fuels treatments would increase the growth rates of residual conifers and deciduous species such as aspen, alder, and willow. Conifer and deciduous species are expected to increase in vigor and would provide additional shade. In addition, conifer canopy expansion is expected to continue in untreated portions of streams. There is a potential to increase water temperature in intermittent non-fish bearing streams (Class IV) when they are flowing, but this should not result in a violation of state water quality standards because these streams go dry before peak water temperatures occur in the watershed.

Alternative 3

There would be about 159 acres of commercial harvest and 853 acres of noncommercial thinning in Class I–III RHCAs. This equates to 9 percent and 48 percent of fish bearing and perennial non-fish bearing RHCAs respectively.

As in Alternative 2, removing conifers from aspen stands to improve riparian shrub production in commercial and non-commercial units may reduce shade but should not result in a measurable increase in water temperatures. This is because the amount of area being treated in close enough proximity to water to affect shading is very small in size. Commercial thinning for aspen restoration adjacent to perennial streams would be accomplished using horse logging in Units 222, 243 and 264. Commercial thinning of conifers would occur within 100 feet of aspen stands (including sprouts) and only a small portion of that area would be in a location that would influence the solar exposure of streams or water sources. In addition, areas treated within aspen stands are expected to increase their hardwood canopy in response to and reduction in coniferous canopy, so shading from aspen and other riparian hardwood species should increase in treated areas. There is potential for conifer thinning in aspen stands and prescribed fire to reduce shade for a short term, however, water temperatures should still meet state standards.

Approximately 42 percent of the RHCAs on fish bearing streams and 45 percent on perennial non-fish bearing streams are in units with prescribed fire. There is a risk of prescribed fire reducing shade; however, short term increases in temperature (up to 6 months) are allowed even on streams over threshold during riparian restoration activities to restore riparian vegetation

(Oregon Water Quality Standards 340-041-0004(5)(a)). It is estimated that between 10 and 50 percent of the area in the RHCA within these units would burn with most of this being at low intensity and further away from the stream. Ninety-five percent of the trees killed under proposed low intensity burning should be 3 feet or less in height. Based on Forest shade tables, a 3-foot tall tree would need to be within 5 feet of the stream to affect shade during the 8 hours in the middle of the day. In addition to the design element to maintain shade being carried forward to the burn plan, moisture conditions adjacent to streams would retard burning within this 5 foot swath when conditions would be right for burning the uplands.

Evidence of extensive historic aspen remains in Wiley Creek Tributary 1. Juniper cutting in unit 267 in this drainage would allow for re-establishing aspen along the creek. Aspen would be planted and protected from grazing. Proposed juniper cutting would also stimulate growth and development of riparian shrubs planted in 2005 on this tributary. Increased aspen and riparian shrub development is expected to improve channel stability in this stream without reducing stream shade.

There would not be any measurable increase in water temperatures on fish bearing and perennial non-fish bearing streams (Class I-III). Activities proposed in RHCAs, including RHCAs for 303(d) listed streams, are designed to promote attainment of RMOs over time. Prescribed burning and non-commercial thinning of conifers in aspen stands would occur within RHCAs on 303(d) listed streams. Along Wildcat Creek, burning would occur in Units 7, 8, and 9 and aspen restoration would occur in Units 19/29, 41/48, and 102. Along Shotgun Creek, burning would occur in Units 10, 58, 81, and 123 and aspen restoration would occur in units 15 and 81. Thinning conifers and proposed fuels treatments would increase the growth rates of residual conifers and deciduous species such as aspen, alder, and willow. Conifer and deciduous species are expected to increase in vigor and would provide additional shade. In addition, conifer canopy expansion is expected to continue in untreated portions of streams. There is a potential to increase water temperature in intermittent non-fish bearing streams (Class IV) when they are flowing, but this should not result in a violation of state water quality standards because these streams go dry before peak water temperatures occur in the watershed.

Cumulative Effects – Temperature and 303(d) Listed Streams

Harvest and other management history are summarized on pages 3-2 to 3-3 and also discussed in detail in the Hydrology Report. Past logging, road construction, and grazing have reduced shading in the project area. This has been offset in some drainages by increased shading from dense overstocked conifers. Except for aspen restoration, no reduction of shading on fish bearing and perennial non-fish bearing stands is expected as a result of proposed timber harvest or non-commercial thinning based on project design. Refer to Design Elements for water quality and fish on pages 2-12 to 2-13. Possible short term reductions in shade resulting from conifer thinning in aspen stands and prescribed fire are not expected to produce any measurable increase in water temperature.

Connected and reasonably foreseeable activities that potentially affect water temperature on streams in the project area include:

Camp Creek Watershed:

West Maury Project – Fuels and vegetation management treatments

Double Cabin Creek – Headcut repair

Continued Allotment Grazing

Crooked River above North Fork Watershed:

Continued Allotment Grazing
Upper Crooked River Watershed:
West Maury Project – Fuels and vegetation management treatments
Continued Allotment Grazing

The allotment management plan for the three allotments in the East Maury Project Area (Double Cabin, East Maury, and Shotgun) will be updated based on the decision resulting from the Maury Mountain Allotment Management Plan EIS. Measures in the AMP designed to improved channel condition and reduce browse on palatable woody riparian vegetation include moving water troughs out of riparian zones, fencing or enlarging exclosures at spring source areas at water developments, developing more water sources in the uplands, earlier season of use, and resting pastures. It is reasonably foreseeable that there will be an improvement in riparian condition due to changes in the range utilization standards and updated allotment management plans. Studies in the intermountain region (Clary 1999) indicate that the height of grasses and forbs that are to be left in key riparian areas indicate a level of grazing that allows a corresponding recovery of palatable woody vegetation. Bank stability and channel geometry interact with vegetation but may not respond as well, depending on the extent of continued mechanical disturbance in the channel and the current channel condition.

Neither action alternative is expected to produce measurable increases in the maximum water temperature. All alternatives would meet state water quality temperature standards and INFISH riparian management objectives (RMOs). Ongoing recurring activities (including rotational grazing) would not increase in frequency, intensity, duration or extend under the 2006 AMP. For this reason, effects related to grazing under the 2006 AMP are not considered new or increased discharges which would trigger an anti-degradation review under the state water quality rules (OAR 340-041-0004(4)(a)).

Sediment and Turbidity

Affected Environment

It's estimated that most of the sediment in the streams in the East Maury project area is coming from in-channel erosion such as bank erosion, head cuts, and channel scour. Channel destabilization can result from changes in peak flows, sediment load, and livestock impacts, but down cutting in the Crooked River and Camp Creek appear to be a major cause for the instability. Potential increases from in-channel sources resulting from harvest and natural disturbance induced increases in runoff are addressed by the Equivalent Harvest Area model discussed in the section on Water Yield, above.

Turbidity is the degree to which suspended material in the water impedes light penetration. At the levels expected on the Forest, turbidity should not have a measurable effect on the aquatic community. State water quality standards direct that turbidity levels should not exceed background levels by more than 10 percent. The Forest Plan indicates that this would be accomplished by maintaining stream bank stability and implementing Best Management Practices (BMPs). The Environmental Protection Agency (EPA) stated that BMPs are the primary mechanism to enable achievement of water quality standards. BMPs that will be implemented in the project are included in **Appendix F**. BMPs are a set of specific guidelines for project planning and implementation to ensure protection of water quality and fish habitat. BMPs incorporate design elements and procedural requirements developed to address INFISH

standards, and they are based on supporting science, local experience and monitoring. For more detailed information on BMPs refer to the Hydrology Report or Appendix F. BMPs will be monitored to verify that management objectives are being accomplished.

Effects to water quality from accelerated sediment delivery related to timber harvest practices, fire, and road construction and use were evaluated by comparing the relative erosion and sediment delivery rates of the alternatives based on the Relative Erosion Rate (RER) model. The Relative Erosion Rate procedure evaluates sediment delivery. It evaluates direct changes to sediment load resulting from current management practices and average rates that reflect previous practices and recovery rates. The procedure does not calculate the actual sediment load, but calculates a relative erosion rate that is used to compare alternatives. For more specific information on this model refer the Hydrology Report.

The amount of sediment delivered from surface erosion and mass soil movement outside the stream channel is dependent on soil erosivity, the amount and type of ground disturbance, slope, and distance to the stream. A map showing the slope erosion hazard for the project area is on file at the Lookout Mountain Ranger District. About 66 percent of the sediment delivered to the stream from surface erosion comes from within 200 feet of the channel and more than 90 percent comes from within 400 feet. Sediment delivered from more than 30 to 100 feet from a defined channel appears to be primarily associated with water concentration areas such as ephemeral draws and swales. Within the first 200 feet, draw bottom roads and stream crossings are two of the primary contributors of sedimentation. In addition draw bottom roads prevent stream shading vegetative cover, contribute to losses of in-channel and future large woody debris (LWD) recruitment, and disrupt streamside water tables. Within the East Maury project area, there are about 3,111 acres within 200 feet of streams and 6,174 acres within 400 feet of streams on Forest Service administered lands.

High sediment levels may lead to channel type changes. For information of the effect of sediment on aquatic organisms, refer to the Aquatic Species section that follows and the Aquatic Species Report. The increase in Relative Erosion Rate calculated for the two action alternatives should be roughly proportional to the area treated and the miles of road and temporary road constructed or reconstructed, particularly within 400 feet of streams. Precommercial thinning was not included because it should not produce measurable increases in sediment. Sediment delivered from hauling should be proportional to the number of trips taken and number of miles traveled in the watershed, which should be roughly proportional to the volume harvested. Sediment delivered on any given year will vary depending on weather patterns, storm tracks, and snowmelt.

Environmental Consequences– Sediment and Turbidity

Alternative 1

The current trends in sediment delivery and turbidity levels would not change in the short term as a result of this alternative. Streams that are currently exhibiting erosion would continue to erode, and streams that are recovering may gradually transport less sediment from in-channel erosion as vegetation develops. Over time fuel accumulations may lead to a higher risk of large scale, high intensity fire. If such future events occur, there is a high probability of increased sediment delivery resulting in adverse effects to aquatic habitats. It is difficult to predict the time, scale and intensity at which such an event(s) might occur, but it is probable that fires burning through landscapes with high fuel loading and continuous fuel beds would exhibit more extreme fire

behavior, and would be larger and more severe than what happened historically. Refer to the section on Fire and Fuels for more detailed discussion on predicted fire regimes. High fire severity contributes to loss of organic material and vegetation at ground level, which can lead to higher surface erosion and reduced filtering of sediment. Thus there is higher potential for sediment to be delivered to stream systems during storm events in areas that have experience high fire severity, which could increase turbidity. For more discussion on potential impacts to soils, refer to the Soils section (pages 3- 115 to 3-121). Roads in the stream influence zone would not be inactivated (closed) or decommissioned. Thus, roads that are currently contributing sediment loads would continue to do so. On some of these erosion could become worse if cross drainage is not maintained.

This alternative would not contribute additional sediment loads to streams in the short term. If a large scale disturbance were to occur in the future, there would be potential for deterioration of channel conditions, especially if an intense storm event follows a high severity fire, but headcut repairs that have been completed should help to stabilize drainages, making them better able to maintain streambanks, dissipate energy and filter and store sediment.

This alternative does not propose any road closure or decommissioning, and would not facilitate road maintenance activities associated with project activities. So this alternative would not reduce the cumulative sediment delivery in the long run, but also would not result in ground disturbance from ripping and installing drainage structures. Precluding a large scale disturbance, sediment delivery from road systems would not be increased by this alternative except for that related to existing problem areas that would not be addressed under this alternative.

While Alternative 1 would not do anything to promote vegetative recovery, it would also not result in activity related ground disturbance or road construction. Therefore, vegetative development would continue on the current trend, precluding any large scale disturbance, without being affected by project generated sediment.

Alternative 2

This alternative proposes harvest on approximately 19 percent (1,198 acres) of the project area within 400 feet of streams (15 percent tractor, 1 percent skyline, and 3 percent horse). Ground based harvest units within 200 feet of streams that have higher potential sediment delivery are shown in **Table 3-31**. Relative Erosion Rate (RER) analysis indicates that about 57 percent of potential new sediment originates from timber harvest as shown in **Figure 3-6**. It is estimated about 25 percent of this logging generated sediment would come from 6 tractor units: 86, 87, 97, 121, 264, and 276. Alternative 2 proposes about 5.5 acres or between 0.5 and 1 mile of ground based harvest in the outer half of Class IV RHCAs (50 foot buffer) by either pulling cable or reaching into the RHCA with the boom on a feller buncher. Due to lower precipitation east of the Cascades and higher infiltration rates in the project area, restricting ground based equipment use in RHCAs would minimize overland flow and maintain buffer effectiveness at filtering sediment.

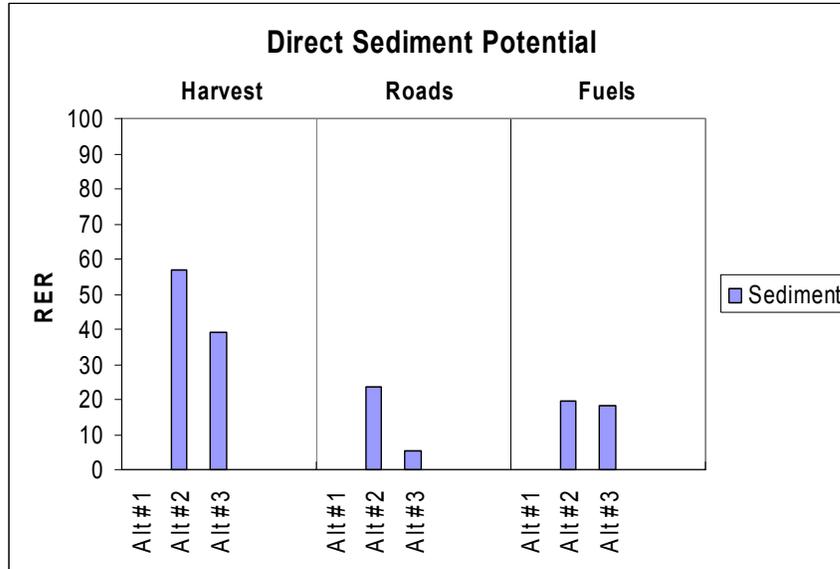
Table 3-31 Alternative 2 Tractor Units within 200 Feet of Streams

Unit ¹	20-35% High Erosive Soils (acres)	>35% Slope (acres)	Soils & Slope Concerns as % Unit within 200 feet of Stream	Within RHCA ¹
5		0.9	8.0	Y
15	0.9	0.4	23.6	
21	1.2	< 0.1	23.1	
33	1.7		20.5	
36	< 0.1		4.4	
45	0.3		28.9	
86	< 0.1		0.8	
87		0.3	2.2	
99	0.8		8.9	
121 ²	1.9		12.1	Y
151	0.6	0.9	13.3	
154 ²	0.5		10.9	Y
164	0.3		2.0	
181 ²	0.4		4.5	Y
258	0.2		10.2	
269	0.9		9.0	

¹ Units where soil erosivity or slope concern extends into the RHCA.

² Harvest in Class IV RHCA in these units.

Figure 3-6 Direct Sediment Potential



Based on design elements restricting ground based equipment in RHCAs, buffer effectiveness (Clinic, 1985; Reshin et al., 2006; Haupt & Kidd, 1990; Heade, 1990), and field observations, RHCAs in the project area would be effective at filtering harvest delivered sediment to streams. Monitoring of West Maurys project found substantial disturbance in ephemeral draws and swales from landings, whole tree yarding slash piles, and associated skid trails, which have the potential of being the main source of harvest generated sediment not filtered by the RHCA filter strips. To

reduce this effect, design elements such as limiting equipment used in swales and ephemeral draws and more scarification and seeding have been added. Landing location and size would be addressed during implementation planning.

This alternative proposes fuels treatments on 42 percent (2,599 acres) of the project area within 400 feet of streams. About 75 percent of this is activities fuels treatment associated with harvest and non-commercial thinning. Planned ignitions are designed to produce a mosaic burn and would occur at least 50 feet from streams unless designed to meet specific RMOs. In addition within RHCAs, only between 10 to 50 percent of the RHCAs are expected to burn with less than 5 percent exposed mineral soil. Burning would not be accomplished all at one time, but could take up to 10 years to complete depending on funding for non-commercial thinning and fuels breakdown time. Breaking up the fuels treatments over a number of years would reduce potential annual maximum sediment delivery from fuels. About 20 percent of the total potential new sediment from Alternative 2 would originate from fuels treatments.

This alternative would construct 1.0 mile of new system road and 1.4 miles of new temporary road within 400 feet of streams (0.25 mile/mile²). Stream crossings are major sediment delivery sites, concentrating runoff and transporting sediment down ditch lines, down the road surface, and can generate sediment on the approaches and at the crossing. New stream crossings would be constructed on Stewart Creek, Keeney Creek, and Poison Creek. Field review also identified sediment delivery concerns with the ford on an unnamed perennial non-fish bearing tributary of Drake Creek on Road 1600-650 and on an undersized culvert on fish bearing Wildcat Creek on Road 1680-050. The crossing on Wildcat Creek currently has stream overflow problems at the crossing as well as sediment delivery problems on the approach due to severe rutting. The ford on Road 1600-650 would be hardened. The 1680-050 would have reconstruction where needed for the sale with spot rocking on the approach to Wildcat Creek. After sale completion the undersized culvert would be pulled and the stream channel reconstructed to restore flow geometry, reduce potential sediment delivery, and allow fish passage. Peak flow concerns with temporary crossings on perennial streams on the 1600640-002 Road and the 1600452-258 Road would be addressed by installation of temporary bridges (gabion/cattle guard construction). This would also help discourage off-road travel use when the roads are re-closed. Long term sediment reductions resulting from road decommissioning include 0.9 miles of open road within 400 feet of streams. In addition this alternative would close 0.8 miles of currently open system road within 400 feet of streams. Reopening existing closed roads may require construction or reconstruction of stream crossings. The Relative Erosion Rates analysis indicates that about 24 percent of potential new sediment originates from roads.

Based on proposed design elements protecting stream channels from mechanical disturbance and restricting ground based equipment in RHCAs, maintaining filtering in fuels units, delaying burning in RHCAs with non commercial thinning slash, buffer effectiveness (Clinic 1985, Reshin et al. 2006, Haupt & Kidd 1990, and Heade 1990), and monitoring and field observations of similar projects on the Forest, streams in the planning area should meet state water quality turbidity standards in average runoff years. However, if a larger precipitation or runoff event (such as a 10 year event) occurs, there is a moderate risk of a measurable increase in turbidity due to the large percentage of the total area being treated, with about 20 percent having commercial timber harvest and 40 percent having fuels treatments) within 400 feet of streams. This is compounded in the Maury Creek and Indian Creek Subwatersheds by increased risk of peak flows. The EHA model in the water yield section indicates there would be a measurable

increase in water yield for 6 years in both these subwatersheds, much of which would come from increased snow pack. While changes in snow accumulation may not be directly correlated to increases in peak flow due to synchronization or desynchronization of flows in tributaries, there is a moderate risk in above average runoff years that the combined harvest generated and in channel sediment load would be greater than state water quality turbidity standards.

Alternative 3 - Sediment and Turbidity

This alternative proposes harvest on approximately 13.8 percent (852 acres) of the project area within 400 feet of streams (10.9% tractor, 0.4% skyline, and 2.5% horse). Ground based harvest units within 200 feet of streams that have higher potential sediment delivery are shown in **Table 3-32**.

About 32 percent less new potential sediment originates from harvest treatments in this alternative than in Alternative 2 (see **Figure 3-6**). It is estimated more than 25 percent of logging generated sediment would come from 4 tractor units: 97, 121, 264, and 276.

Table 3-32 Alternative 3 Tractor Units within 200 Feet of Streams

Unit	20-35% High Erosivity Soils (acres)	>35% Slope (acres)	Soils & Slope Concerns as % Unit within 200 feet of stream	Within RHCA ¹
33	1.7	0	20.5	
36	<0.1		4.4	
45	0.3	0	28.9	
99	0.8	0	8.9	
121 ²	1.9	0	12.1	Y
154 ²	0.5	0	10.9	Y
181 ²	0.4	0	4.5	Y
258	0.2	0	5.5	
269	0.9	0	9.0	

² Units where soil erosivity or slope concern extends into the RHCA

² Harvest in Class IV RHCA in these units.

This alternative proposes fuels treatment in 41 percent (2,511 acres) of the project area within 400 feet of streams. About 1,913 acres of harvest, non-commercial thinning, and fuels treatments; and 598 acres of natural fuels treatments are proposed within 400 feet of streams. New potential sediment originating from fuels treatments in this alternative are about the same as those in Alternative 2.

This alternative would not construct any new or temporary roads within 400 feet of streams. Stream crossings are a major sediment delivery sites, concentrating runoff and transporting sediment down ditch lines, down the road surface, and can generate sediment on the approaches and at the crossing. Field review identified sediment delivery concerns with the ford on an unnamed perennial non-fish bearing tributary of Drake Creek on Road 1600-650 and on an undersized culvert on fish bearing Wildcat Creek on Road 1680-050. The crossing on Wildcat Creek currently has stream overflow problems at the crossing as well as sediment delivery problems on the approach due to severe rutting. The ford on Road 1600-650 would be hardened. The 1680-050 would have reconstruction where needed for the sale with spot rocking on the approach to Wildcat Creek. After sale completion the undersized culvert would be pulled and the stream channel reconstructed to restore flow geometry, reduce potential sediment delivery, and allow fish passage. Long term sediment reductions resulting from road decommissioning

include 0.1 mile of open road within 400 feet of streams plus an additional 0.7 mile of non-system road that currently is not open but would be used. In addition, this alternative would close 0.7 miles of currently open system road within 400 feet of streams. About 78 percent less new potential sediment originates from roads in this alternative than in Alternative 2.

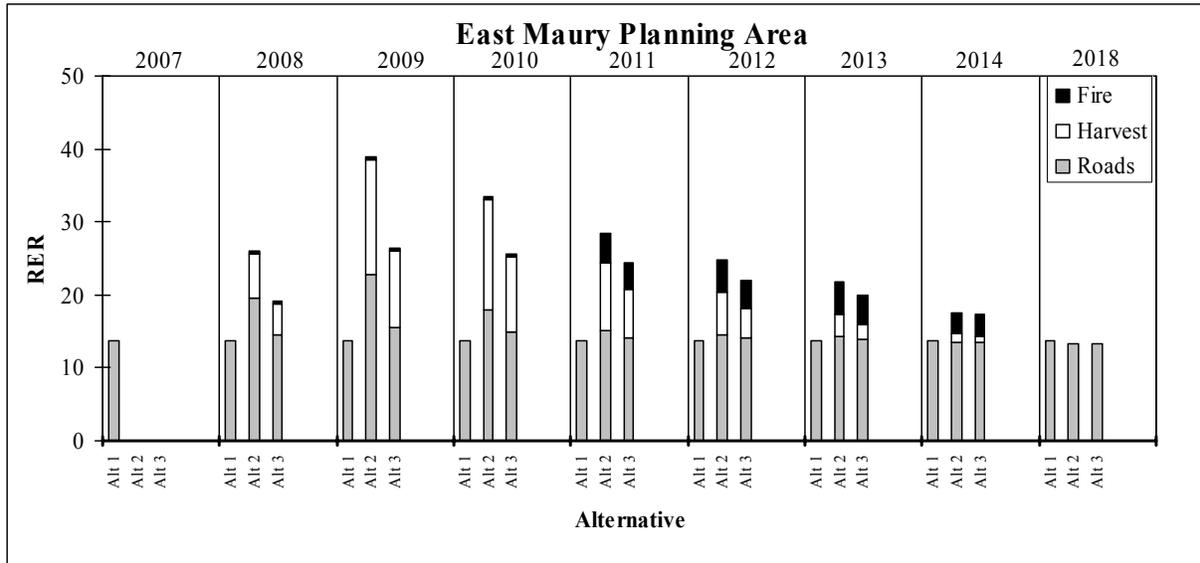
Most sediment delivered by this alternative to streams would come from stream crossings, road drainage close to streams and harvest and fuels treatments adjacent to Class IV streams and in ephemeral draws. The Relative Erosion Rates analysis indicates that Alternative 3 generates about 37 percent less potential new sediment than Alternative 2.

Based on proposed design elements protecting stream channels from mechanical disturbance and restricting ground based equipment in RHCAs, maintaining filtering in fuels units, delaying burning in RHCAs with non commercial thinning slash, buffer effectiveness (Clinic 1985, Reshin et al. 2006, Haupt & Kidd 1990, and Heade 1990), and monitoring and field observations of similar projects on the Forest, streams in the Drake Creek, Pine Creek, Maury Creek and Lower Camp Creek Subwatersheds, should meet state water quality turbidity standards. While sediment delivery to streams from vegetative management in the Indian Creek Subwatershed would also be substantially reduced, there would also be the risk of increased sediment and turbidity from in channel erosion in sensitive drainages in this subwatershed due to potential increases in peak flows. The EHA model in the water yield section indicates there would be a measurable increase in water yield for 6 years, much of which would come from increased snow pack. While changes in snow accumulation may not be directly correlated to increases in peak flow due to synchronization or desynchronization of flows in tributaries, there is a moderate risk on above average runoff years that the combined harvest generated and in channel sediment load would be greater than state water quality turbidity standards.

Cumulative Effects - Sediment and Turbidity

It's estimated that most of the sediment in the streams in the East Maury Planning Area is coming from in-channel erosion such as bank erosion, head cuts, and channel scour. There are extensive headcuts on Double Cabin Creek and upper Wildcat Creek. Headcuts have also been identified on Drake, Stewart, Indian, Shotgun and Wiley Creeks. Headcuts have been identified on private lands on Indian Creek, Double Cabin Creek, and Parish Creek. Ongoing headcut treatments in Double Cabin Creek in Wildcat Creek since 2003 have reduced sediment delivery. Headcuts will be treated in Drake Creek and Shotgun Creek in 2008-2009. Additional headcut repair work is being planned in Indian Creek in the near future. Headcut repair activities have a high potential for short-term, localized sediment delivery but should result in a decrease in sediment production within one year after completion. The action alternatives may contribute additional sediment loads to streams in the short term as shown in **Figure 3-7**. There is a potential risk of increased channel erosion if peak flows increase as a result of proposed treatments on sensitive streams, especially Maury and Indian Creeks.

Figure 3-7 RER Cumulative Sediment Delivery



Ground disturbance associated with trails, off highway vehicle (OHV) use, dispersed recreation, and firewood gathering may cause localized sediment delivery but is small on a watershed scale. Sediment from routine road maintenance, which is included in the model, was overestimated because the model assumes annual maintenance on open roads. It is estimated that most of management derived sediment delivered to streams by surface erosion on NFS lands in the project area is coming from roads. Open road densities within 400 feet of stream channels, the source area of an estimated 90 percent of surface sediment delivered sediment, are shown in **Table 3-33**. Proposed road closure and decommissioning would reduce the cumulative sediment delivery in the long run but ground disturbance from ripping and installing drainage structures would increase sediment the first year or two as shown in **Figure 3-7**.

Table 3-33 Open Road Densities within 400 Ft. of Streams

Watershed	Alt 1 (No Action)	Alt 2	Alt 3
Upper Crooked R.	3.8 mi/mi ²	3.7 mi/mi ²	3.8 mi/mi ²
	12.4 miles	11.9 miles	12.4 miles
Crooked R. above	2.8 mi/mi ²	2.6 mi/mi ²	2.8 mi/mi ²
N. Fork	6.3 miles	5.9 miles	6.2 miles
Camp Cr.	2.0 mi/mi ²	1.8 mi/mi ²	1.8 mi/mi ²
	8.2 miles	7.4 miles	7.4 miles
Project Area	2.8 mi/mi ²	2.6 mi/mi ²	2.7 mi/mi ²
	26.8 miles	25.2	25.9 miles

Livestock are probably the second largest non-background contributor of sediment in the planning area. Surface erosion can result from trampling and trailing but the primary effect is to channel condition. Channel condition can be affected by hoof action (i.e. trampling, hoof shear, post holing) and the reduction and vigor of palatable woody streamside vegetation. It is not possible to quantify livestock generated sediment because of the dispersed character of the impacts, problems with distinguishing between cattle and wildlife impacts, inability to attribute or portion channel effects specifically to livestock, and inability to separate long term effects from past management or events from current management. Because of this, livestock effects were not included in **Figure 3-7**. There is a potential indirect effect from increased livestock use in treated riparian areas due to removal of brush and down wood, increased grasses and forbs, increased palatability of forage resulting from higher nutrient content and new growth, and forage remaining succulent later into the season in riparian areas. Increased trampling of banks could increase sediment delivery and grazing on streamside vegetation could reduce shade. This would be partially offset by redistribution of livestock to new forage outside riparian areas and higher fuel levels being retained in RHCAs than on the uplands. Increased access would not occur until after fuels treatment of the slash from thinning. By the time this would occur, implementation of new allotment management plans for the Maury Mountains should be starting to improve riparian condition. The Maury Mountain Allotment Management Plan EIS was completed in 2006, and includes three allotments in the East Maury Planning Area (Double Cabin, East Maury, and Shotgun). Measures to improved channel condition include moving water troughs out of riparian zones; fencing or enlarging exclosures at spring source areas at water developments; developing more water sources in the uplands, earlier season of use; resting pastures; and excluding one pasture from grazing (approximately 1,500 acres).

Upward trends in riparian condition are also expected to continue due to range utilization standards implemented under the Grazing Implementation Monitoring Module (IIT, 2000) and the 2006 AMP. These utilization standards are used to determine when livestock are to be removed from pastures. Studies in the intermountain region (Clary, 1999) indicate that the height of grasses and forbs that are to be left in key riparian areas indicate a level of grazing that allows a corresponding recovery of palatable woody vegetation. Stream bank stability and channel condition improve with vegetative recovery, allowing the system to hold streambanks in place, to filter sediment in the water, and to capture and store sediment in the system.

The action alternatives would promote herbaceous and shrubby vegetation, especially in upland areas. With the rest period included in the 2006 AMP for East Maury Allotment, it is likely that ground vegetative cover will increase in that area more rapidly than it would under a continued annual grazing program. Ongoing recurring activities (including rotational grazing) would not increase in frequency, intensity, duration or extend under the 2006 AMP. For this reason, effects related to grazing under the 2006 AMP are not considered new or increased discharges which would trigger an anti-degradation review under the state water quality rules (OAR 340-041-0004(4)(a)).

Geology

Dormant Landslide Terrain

Affected Environment

The East Maury project area is located on the western corner of the Blue Mountains physiographic province, which also includes the Wallowa, Elkhorn and Strawberry mountains. The shaping of the landforms in the watershed is a reflection of the past geologic history of the area. The tectonic movement, uplift of the Blue Mountain anticline, and mass wasting processes have combined to create the broad ridges and steep draws. Mass wasting, sheet and rill are some of the physical processes currently in action. For more detailed discussion on geologic resources and potential impacts refer to the Geology Report.

Fifty-three percent of the underlying formations within the project area are resistant to chemical and mechanical weathering processes, 25 percent are intermediate in resistance and 22 percent are highly susceptible to chemical and mechanical weathering processes. The soil, which has formed on all the formations, combined with the ash, provides the majority of the present day stream sediment.

Based on an air photo interpretation, the East Maury project area has a series of dormant landslide scarps and debris lobes around the crest of the Maury Mountains (see **Map 6. Geology and Soils**). About 6,915 acres of the project area is on dormant landslide terrain (29 percent). The dormant landslide head scarps are on slopes greater than 40 percent and are generally associated with ridge tops. When the dormant landslides were more active 100,000 years ago, they contributed a portion of the existing sediment currently occupying the floodplains of the stream courses.

The visible landslides and related debris areas, depending on slope and aspect, are in a low to moderate risk for reactivation by management activities such as road construction or harvest, or by the continued weather pattern of higher precipitation. The Clarno and John Day formations underlie 25 percent of the project area, with an additional 20 percent of mapped Quaternary landslide debris. The high preponderance of clays provides ample slip surfaces for the large deep-seated landslides to move on. The remaining project area is at low risk for mass wasting instability by management activities or by the continued weather pattern of higher precipitation.

The current road system (98 miles) was developed across the project area on all the lithologies. About 39 miles of the system are located on dormant landslide terrain. In general, these miles of road on dormant landslide forms are at a slightly increased risk for potential mass wasting (cut and fill failures) when the soil and underlying landslide debris are saturated.

The dormant landslides with the project area were probably active through the past 100,000 years. They were probably triggered by combined tectonic activity and high precipitation. They naturally adjust as the streams cut the toes of the landslide debris and as natural fires, insect and disease infestations removed vegetation, allowing increased precipitation to saturate the soils.

Channel, sheet and rill erosion are the current dominant erosion processes across the project area under the current climatic conditions.

Environmental Consequences – Dormant Landslide Terrain

Alternative 1

Alternative 1 would allow the dormant landslide terrain to continue the natural process of erosion under the current precipitation pattern. There would be no change in direct, indirect or cumulative effects to dormant landslide terrain from this alternative.

Alternatives 2 and 3

Portions of the East Maury project area are underlain by active and dormant landslide terrain. When there is a change in the ground water flow through the unstable terrain, the potential is increased for slope movement. Rapid shallow debris flows and deeper rotational slides can result, altering the vegetation potential and possibly releasing sediment into the stream systems, depending on proximity to the riparian areas. Effects of the alternatives on the landslide terrain will be measured by: miles of road within dormant landslide terrain and mapped landslide debris; and acres of dormant landslide terrain and mapped landslide debris.

As shown on **Tables 3-34** and **3-35**, Alternative 2 proposes to reconstruct and construct 16 miles of new or temporary road and Alternative 3 proposes 3 miles, all underlain by dormant landslide terrain. The proposed roads underlain by dormant landslide terrain should be evaluated for stability concerns. Similar terrain and geology on the northern slopes of the Lookout Mountain District to the north have exhibited mass wasting events over the past wet winters. Construction of roads across landslide debris has the potential to compact the debris, creating a dam-like feature which could collect water upslope, increasing pore water pressure to the point of failure. Hillside cuts and fills should be minimized and adequate drainage maintained. When the unconsolidated landslide debris is saturated, there is a potential for movement with subsurface water flow down slope.

Table 3-34 Miles of Road on Dormant Landslide Terrain

Proposed Road	Alternative 2		Alternative 3	
	Total (miles)	On Dormant Landslide Terrain (miles)	Total (miles)	On Dormant Landslide Terrain (miles)
New Roads	7.1	5.0	0.1	0.1
New Temporary Roads	3.3	1.3	0.3	0.2
Roads to be Decommissioned	2.5	0.1	0.1	0.1
Roads to be Closed	2.0	1.0	2.0	1.0
Road Reconstruction	17.7	9.3	12.5	2.6
Total	32.6	16.7	15.0	4.0

The relative risk for reactivation of landslide terrain through road related activity is slightly higher for Alternative 2 than for Alternative 3; given the increase in construction of new system and temporary road miles crossing unstable terrain. Alternative 2 proposes activity on 16.7 miles within dormant landslide terrain (51% of the total miles). Alternative 3 proposes activity on 4 miles within dormant landslide terrain (27%). There are 2.5 miles of road proposed for decommissioning under Alternative 2, 0.1 mile (4%) is within dormant landslide terrain. Under Alternative 3, there are 0.1 mile of road proposed for decommissioning, with 0.1 mile within dormant landslide terrain (100%). Following use under both alternatives, 1 mile of road in dormant landslide terrain will be closed for both alternatives.

For all the units in the action alternatives, primary concern from a mass wasting standpoint is for those units on dormant landslide terrain and underlain by mapped landslide debris. The Clarno Formation, John Day Formation and mapped landslide debris underlie the East Maury commercial units. Landslide terrain tends to develop unusual subsurface drainage patterns. The intensity and style of management activity on landslide terrain, in the vicinity of seeps and springs, could potentially change the drainage pattern, possibly increasing the risk for instability.

Table 3-35 New, Closed, Reconstructed, and Temporary Roads on Dormant Landslide Terrain

Road	Alternative 2		Alternative 3		Road Type
	On Dormant Landslide Terrain (miles)	Total Roads (miles)	On Dormant Landslide Terrain (miles)	Total Roads (miles)	
1600-170-264	0.1	0.1	0.1	0.1	New system
1600-190-279	0.3	0.3	--	--	New system
1600-400	1.0	1.0	1.0	1.0	Closed
1600-400-222	0.1	0.1	0.1	0.1	Temporary
1600-452	0.6	0.6	0.1	0.1	Reconstruction
1600-452-258	0.3	0.3	--		Temporary
1600-551	0.3	0.3	0.3	0.3	Reconstruction
1600-640-002	0.3	0.3	--		Temporary
1600-650	0.3	0.3	0.3	1.5	Reconstruction
1670-000-1	4.1	4.1	0.5	3.7	Reconstruction
1670-000-2	1.8	3.7	0.4	0.1	Reconstruction
1670-015	0.1	0.1	0.1		Decommission
1670-050-126	1.1	1.1	--	2.5	New System
1670-250	1.3	2.6	0.4	0.1	Reconstruction
1670-250-124	0.1	0.1	0.1		Temporary
1670-350-098	0.3	0.3	0.7	0.8	Temporary
1750-000-1	0.8	0.8	0.69		Reconstruction
1750-000-185	0.4	0.4	--		New system
1750-000-186	0.2	0.2	--		New system
1750-000-189	0.1	0.1	--		New system
1750-000-192	0.2	0.2	--		New system
1750-680-107	0.6	0.6	--		New system
1760-011-164	0.2	0.2	--		Temporary
Total	14.6	16.8	4.1	10.6	

The proposed harvest treatments do not generally alter groundwater movement measurably, except in the vicinity of seeps and springs. The treatments should not reduce the amount of water taken up by the trees through evapotranspiration substantially. Reducing the amount of evapotranspiration would leave more groundwater in the slope, which has the potential to decrease slope stability. The harvest sanitation proposed for Unit 244 in Alternative 2 and Alternative 3 is designed to reduce the dwarf mistletoe infestation. The unit is located on the hummocky bench of the large landslide feature, with slopes ranging from 21 to 35 percent in the steeper portions to 0 to 21 percent in the flatter areas. With the flatter ground, the treatment is unlikely to trigger slope movement.

Potential risk for an increase in sediment transport due to mass wasting is low to moderate for all the action alternatives. Alternative 2 proposes to commercially treat 64 percent (4,441 acres) and Alternative 3 proposes treatment of 37 percent (2,530 acres) of land underlain by dormant landslide. The actual acres at risk are less in Alternative 3.

The dormant landslide terrain acres by unit are listed for each action alternative in **Appendix D**. The seeps and springs in the units identified will be protected and any evidence of recent motion evaluated by the geologist. The skyline method used to harvest those units is less likely to compact the landslide debris as compared to tractor method. The units, generally located on the upper slopes, may have a slightly increased risk for indirectly destabilizing the lower slopes if there should be a continued weather pattern of higher precipitation.

Several units, based on slope and presence of landslide indicators, are more sensitive than others. The tractor and skyline units on steeper slopes, common with both action alternatives are: units 33, 93, 98, 99, 124, and 180. The units on steeper slopes in Alternative 2 are: units 20, 36, 84, 86.1, 86.2, 89, 107, 122, 126, 130, 132, 139, 144, 179, 185, 186, 189, 192, 215, and 242. If there is any evidence of recent slope movement, the geologist should be consulted.

The design elements to protect the streambanks, riparian corridors, seeps and springs will reduce the risk for increasing sediment production. The riparian vegetation will maintain the stability of the landslide debris toeslopes. Additional compaction of ground surrounding wet areas could alter the subsurface water flow, increasing the risk for reactivation of landslide debris, depending on the steepness of the slope.

Potential risk for an increase in sediment transport due to mass wasting is low to moderate for all the action alternatives. The Alternatives 2 and 3 are roughly equal in the percentage of acreage proposed for management within dormant landslide terrain. The slight difference lies in the prescription, method of harvest and total acres to be harvested. There are 6,915 acres of dormant landslide terrain in the project area. Alternative 2 proposes to commercially treat 64 percent (4,441 acres) and Alternative 3 proposes treatment of 37 percent (2,530 acres) on land underlain by dormant landslide terrain. Although Alternatives 2 and 3 treat roughly the same percentage of dormant landslide terrain, the actual acres at risk is less in Alternative 3.

Cumulative Effects - Geology

There are no past, ongoing, or reasonably foreseeable activities that would reduce slope stability or increase mass wasting.

Soap Material Source

Through development of the road system for timber and recreation access within the Maury Mountains, 31 mineral material sources have been opened over the past three decades and are likely sources to be used for road reconstruction and stream restoration activities. Within the East Maury project area, 12 acres are dedicated to mineral material sources. These sources vary in geochemical composition from rhyolite to basalt. The rock quality varies from marginal pit run to crushing quality. The status of the sources range from active to partially rehabilitated. Responsible management of the material sources includes meeting National Environmental Policy Act requirements, developing and maintaining a long term management plan which includes management of invasive species, completing reclamation and proper site closure. Short term management plans are developed for each entry.

Of the 31 mineral material sources in the project area, the Soap Material Source would be used for this project. Soap Material Source (3.2 acres) is located on Road 1670-015 in Unit 166 (T 18 S, R 20 E, Section 1). The inactive pit source is in ash flow tuff of the John Day Formation. Soap Material Source currently does not have enough reserves available for the proposed road work. The material source needs to be expanded by 4 acres to the southeast. According to existing drill logs, the pit run tuff extends to a depth of 15 feet. A rough estimate of 10,000 cubic yards of mineral material reserves would be available with this expansion.

Soils

Affected Environment

The Eastern Maury Mountains contains a variety of soils. Soils are categorized by landtype. The landtype is the basic unit of landscape stratification delineating unique characteristics features such as: soil mantle, bedrock, vegetation, climate, hydrology, and landform which are significant to management use and interpretation (Paulson, 1977). For more detailed discussion on soil resources and the potential impacts to soils, refer to the Soils Report. Relative soil erosion hazard areas are displayed on **Map 6 Slope Erosion Hazard**.

Based on the landtypes found in the Soil Resource Inventory (Paulson, 1977) approximately 41 percent (9,901 acres) of the project area has volcanic ash soils as a result of redistribution of the ash cap over time. The balance of the project area is largely residual soil with clay-loam or clay texture. Deeper ash soils generally are found on north and east slopes, swales and draws. Clayey soils are more common on south and west slopes and ridges. Ash soils are susceptible to compaction, displacement and puddling. While clay soils are compactable, their shrink swell properties reduce the duration of this damage. The December 20, 2007, Soils Report for this project more fully describes local landtypes and lists them by unit and can be found in the project record.

Most of the project area has slopes less than 35 percent. Approximately 90 percent of forest stands are suitable for ground-based logging systems. Ten percent would require skyline or other aerial systems due to steepness. Horse logging or cable logging is specified for sensitive areas such as RHCAs.

To maintain site productivity, the Forest Plan includes a standard for soil compaction and displacement. The Soils Report for this project more fully describes the soil standard. At a minimum, at least 80 percent of the activity area should be in a non-compacted/non-displaced condition within 1 year of any management activity. The standard is applied at an individual scale such as a unit of a timber sale. Detrimental soil conditions result from compaction, displacement, and charring. Compaction is the packing together of soil particles by exerting force at the soil surface and a resulting increase in soil density. Roads, log landings, and skid trails are typically areas that are detrimentally compacted during commercial timber harvest activities. Displacement is the movement or rearrangement of the soil so that normal processes are affected. Displaced soils are often loosened and are more susceptible to erosion. Soil charring can occur when concentrations of fuels are burned and the soil becomes superheated. This causes loss of organic matter and hydrophobic soil conditions can result from the cooked waxes and resins in the surface ash layer. Typically, charring occurs on landings where large

piles (concentrations) of slash are burned. Burning of hand and grapple piles does not typically result in enough charring to be classed as detrimental charring because of the small pile size.

Soils on scablands are largely very shallow. Soils in these areas are usually clayey and very rocky with greater resistance to detrimental compaction. However they are very susceptible to detrimental puddling and post-holing by equipment and large herbivores. Subsequently these soils are classified as sensitive soils for use and management (resistant to damage when dry, susceptible when saturated). There are 3,722 acres of scabland in the East Maury project area (15.4 percent of the project area). Scabland is located adjacent to units 13, 21, 29, 53, 61, 68, 71, 87, 88, 96, 111, 112, 151, 158, 161, 164, 200, 202, 220, 233, 238, 254, 258.2, 267, 269, and 281.

Environmental Consequences – Soils

Detailed information on the impacts of project activities on soils is contained in the Soils Report. Refer to that document for in-depth discussion on potential impacts of various treatments and associated actions on soil resources.

The existing condition of the soils resource was determined by the Forest soil scientist and other members of the interdisciplinary team. A combination of local knowledge, walk-through transecting, and aerial photo interpretation was used to determine existing soil disturbance for each unit. This unit-by-unit evaluation of existing soils condition was completed and is contained in **Appendix D**. This unit-by-unit evaluation includes an assessment of harvest units and grapple piling units. Other non-harvest activities were not included because they are not expected to cause detrimental soil disturbance. Existing disturbance was quantified as a percentage; estimates were made as to tilling potential based on soil type and slope, and unit-specific mitigations identified where needed to ensure compliance with the soil standard. Areas with high soil disturbance are displayed on **Map 6. Slope Erosion Hazard**.

Detrimental compaction is defined as a 15 percent increase in bulk density for residual soils and a 20 percent increase for ashy soils. Three to four passes with crawler tractors or rubber-tired skidders commonly produce this effect. The major effect is reduction in porosity resulting in reduced water and air availability to tree roots. There is also increased mechanical resistance to tree root growth. Mychorrhizal symbiosis has also been shown to be decreased.

Soil compaction has a negative effect on site productivity and resulting resources. The reduction in infiltration results in more overland flow and higher peak stream flows, which provides more energy for erosion and transport of sediment. Displaced soil has an altered hydrographic function and often does not allow normal growth to occur. Displaced soils are often channelized and loosened so than they are more susceptible to erosion.

Puddling results from the breakdown of soil structure under wet conditions. Logging operations, fuels treatment and recreational activities can all puddle soils causing channelization and loss of permeability.

Overland flow occurs when the infiltration rate or capacity of a soil has been exceeded by the amount of incoming precipitation or by the rate of snowmelt. Independent variables include all the soil and plant factors that influence infiltration rate, intensity and duration of precipitation, steepness of slope and whether or not the soil is frozen.

The volcanic ash soils of the Blue Mountains have several properties which can make erosion hazard assessment difficult. In an uncompacted state, these soils have infiltration rates often

exceeding 10 inches per hour. Permeability of applied water through the ash layers is also rapid. However, because of their lack of structural development (weak granular to singular grain), they are easily susceptible to erosion in situations where water is channeled on the soil surface such as skidroads, waterbar outlets, and near road drainage structures.

Soil Tillage Effects

Tillage is often used to decompact the soil improve infiltration, percolation, aeration and lessened bulk density. Resistance to root growth is lessened also. There are potential short term and long term effects of tillage. Short term effects may include increases in localized erosion potential before effective vegetative ground cover is established. This short term hazard can be reduced by the use of water bars and slash placement.

Tillage effectiveness varies widely with soil texture, rock content, depth, water content and type of tillage implement used. Research indicates that some mechanical method to consistently ameliorate the compacted condition is desirable and feasible especially on coarse textured soils such as ash capped soils (Geist and Froehlich, 1994). For landings constructed on coarse and medium textures soils, decompaction and decompaction plus topsoil recovery appear to be sufficient to restore productivity (Sanborn et al, 1999). Local monitoring in the past 15 years on tillage operations on the Ochoco National Forest has shown that for the average tillage implement, such as a forest cultivator or tractor mounted subsoiler, effectiveness is about 70 percent for a single pass.

About 20 percent of a harvest unit is composed of a dedicated framework of roads, landings and main skid trails. The area above this 20 percent is targeted for tillage treatment to mitigate for compacted soils. This project area has a large percentage of low tillage suitability due to slope, shallow soil, or too much rock.

Harvest Activities Effects

Ground based harvest systems have the highest potential for soil impacts and can result in exceeding soil protection standards if not carefully designed and actively monitored. Classic, rubber-tired skidders and skidding crawler-type tractors are used on an average 100-foot skid trail spacing to skid logs to the landings, which are accessed by roads. The main skid trails comprise the majority of the detrimental disturbance, which is largely compaction and displacement. The same applies to landings with the addition of more soil puddling and charring from landing piles. Skid trails on an average of 100-foot spacing contribute roughly 10 to 15 percent disturbance in an average unit with landings and roads making up an additional 5 and 2 percent, respectively. Overall, potential for detrimental soil conditions is 17 to 22 percent for a designated ground harvest system which includes landings, skid trails and roads. This does not include any mitigation or other measures to reduce potential impacts, nor does it include existing levels of detrimental disturbance. For instance, if the disturbance for the current entry is confined to existing skid trails, landings and roads then there would be no net increase in detrimental soil conditions.

Mechanized harvest systems using feller/buncher machinery travel over more ground but this movement is limited to one to two passes which has not been shown to create detrimental compaction on the additional area traveled. Based on site specific evaluations and implementation of project design elements (see Chapter 2), the overall percentage of net detrimental impacts would be kept to a minimum. Recent monitoring results show that

detrimental soil conditions can be kept within acceptable levels using ground-based equipment as the wide-tracked Timbco tracked feller buncher with an approximate 22-foot reach.

Additionally, if passes are kept to no more than two, then detrimental conditions will be less likely to result from this entry (on previously undisturbed ground). This requires that design criteria be carefully followed and that tillage opportunities are carefully evaluated.

Mechanized harvest systems increase landing size because bunched whole trees are yarded to the landing. Instead of the majority of slash being left on site, the majority of the needles and branches on harvested trees are taken to the landing. With the larger volumes of slash, landing piles are larger. With the whole tree being dragged along the skid trails there is some increase in detrimental displacement of topsoil on the edges of the skid trails due to additional tree length (versus log removal only) and additional width (the full width of the crown is being dragged). The sweeping action of the crowns being dragged create wider trails and resultant in a lack of roughness in the trails themselves (few branches left to protect surface of trail). On ash capped soils with heavy clay subsoils (such as occurs on much of the Maury Mountains), the clay is left exposed and puddled. This has the potential to direct runoff at an accelerated rate. The required waterbarring would reduce accelerated runoff by improving dispersion. Whole tree skidding eliminates the need for grapple piling after harvest and reduces incrementally the potential amount of soil disturbance when harvest and piling are considered together. Whole tree yarding is not allowed in some sensitive areas in order to maintain higher ground cover.

Skyline and mobile yard harvest would be used largely on steeper slopes where there is sufficient deflection for the use of cable operations. They are usually set up with an uphill access road at the top of the unit or drainage with landings along the road. The potential for detrimental disturbance is much lower than ground-based harvest. Overall potential for detrimental disturbance is 6 to 12 percent. Detrimental disturbance occurs primarily on landings, roads, and cable corridors. Mobile yarders don't have the reach that larger skyline machines have but are useful on shorter steep pitches often too steep for tractor operations. With the mobile yarders, complete suspension is often not attained but these yarders produce less ground disturbance than skidders.

On locally monitored animal logged units, soil disturbance was very minimal. A small drag trough was created by the mule skidding but was minimal compared to the impacts of the original tractor trail. Off trail disturbance was slight with an estimated 5 to 7 percent of the ground in an observable disturbed state. Detrimental displacement and compaction were low.

Precommercial thinning activities will be occurring both inside and outside of areas that are also being commercially harvested. The commercial harvest in RHCAs is primarily focused on removing encroaching conifers from aspen stands without the use of heavy machinery. No measureable detrimental effects to the soil resource are expected from pre-commercial thinning or commercial harvest in RHCAs. Soil disturbance that may occur is limited in scale, and of such a light intensity, that detrimental compaction or displacement is expected to be well below the Forest Plan standard of less than 10 percent detrimental soil disturbance.

Burning Effects

Prescribed burning removes some protective organic matter, volatilizes some elements, transforms elements to soluble forms, and alters the physical, chemical, and biological properties of soils (Wells and others 1978). Until effective ground cover is re-established there is a short term hazard of additional erosion by wind and water. Fires usually create a flush of nutrients

such as nitrogen, phosphorous and potassium. Some carbon is retained in the form of charcoal. This flush of nutrients provides nutrients to early successional species of grass, forbs and shrubs. It can also supply nutrients to noxious weeds and annual grass species. Fire changes the surface soil microclimate. There is additional surface heating with more convection (i.e., dust devils) which results in a drier surface condition which is often more susceptible to wind and water erosion.

Where there are large concentrations of fuel such as machine piles or large accumulations of down trees from insect or disease related tree mortality there can be detrimental soil charring. Detrimental charring has a negative effect on soil productivity. If soils are superheated under large concentrations of fuel they often develop a hydrophobic layer on the soil surface. In addition to the loss of the organic matter including the duff there may be a higher runoff rate resulting in higher sediment delivery to streams.

For units with grapple piling specified, only small (less than 12 inches) diameter material would be piled, and the piles would be small in size. These factors, combined with burning under cooler conditions would result in less intense/shorter residence fires. Such small area of soil charring would not be considered detrimental. For grapple piling, estimated piles per acre are 5 to 6 (with an average size of 10 feet by 10 feet or 100 square feet) which are largely piled and burned on existing skid trails and landings. Since only piles are burned, soil impacts are not continuous. Piling from existing skid trails would reduce additional soil disturbance.

Landing piles are seeded after burning with an appropriately competitive grass and/or forb seed mix to reduce the potential for noxious weed establishment. In addition, there is increasing potential for utilization of landing piles. This material may be removed to fuel biomass power plants in which case the piles would not be burned on site.

Underburning has fewer effects on soils due to shorter duration and less consumption of organic material and the dispersed nature of the burn itself. These types of burns most closely emulate natural processes as to nutrient volatilization and nutrient dispersal. Very little, if any, detrimental soil impacts are expected with this treatment.

No measurable detrimental effects to the soil resource are expected from the proposed fuels treatments. Grapple piling confined to existing disturbance as specified would result in no net contribution to detrimental soil conditions. The amount of soil disturbance that may occur is limited in scale or light in intensity so fuel treatments will comply with the soil standards.

Alternative 1

This alternative proposes no management actions which would affect the soil resource in the short term. Existing natural processes would continue. No soil restoration tillage would be performed. Recovery of existing soil (compaction) would occur through natural processes. These processes include frost heaving in the top 4 to 6 inches of soil and activity by organisms such as rodents, insects, arthropods and worms. These natural processes can take 10 to 50 years or more to fully restore damaged ash soils, while clayey residual soils may recover in 1 to 2 years due to shrinking and swelling actions of the smectitic clay.

Fuels reductions would not occur thereby increasing the risk severe fire. Higher fire intensities may result in increased oxidation and mineralization of nutrients such as nitrogen and potassium and ultimately may reduce site productivity (Harvey, 1991). In the short term this alternative would not result in disturbance to soils, but may lead to soil impacts in the long term if stands are

not thinned and heavy fuel accumulations are produced, then subsequently burned by wildfire, and then reburned (Shank, 2004).

Alternative 2

This alternative proposes the most harvest overall, as well as the most ground-based harvest. This alternative has the greatest potential to increase the amount of detrimental soil compaction, displacement, and charring. This alternative has unit specific design elements identified which will ensure that all activity units meet the soil standards (see **Appendix D**). **Table 3-36** shows a comparison of soil disturbing activities by alternative. This alternative creates approximately 17 acres of additional soil disturbance due to construction of 9.3 miles of new and temporary roads. Implementation of this alternative would result in approximately 100 to 140 acres of tillage to alleviate detrimental soil compaction. Decommissioning of 2.5 miles of road is being proposed under alternative 2. Short term erosion may increase depending on future storm events but long term erosion from the road surface and ditches would be reduced. Infiltration would be enhanced through tillage and runoff would be reduced. Trees and other vegetation would recolonize these sites. Implementation of this alternative would comply with the regional soil standards.

Some scablands function hydrologically as large "tin roofs" which shed runoff from rain and snowmelt very rapidly. Infiltration buffering is needed along the scab/forest interface to intercept runoff. Except for construction and use of a portion of road 1600-600-013, no other new roads would be located on scabland. Use of other existing roads occurring on scabland terrain would be allowed. Although some disturbance within this buffer is unavoidable it is recognized that there will be crossings and landings along this interface for practical logging operations to occur. Roads through scablands would be constructed with measures that allow water to flow off them without concentrating flows. Units 13, 87, 151, 164, 238 and 258 would be accessed by roads through scablands.

Table 3-36 Soil Disturbing Activities by Alternative

Soil Disturbing Activity	Alternative 2 (acres)	Alternative 3 (acres)
Commercial Harvest	6,928	5,119
Road Construction Area	17	<1
Ground-based Harvest	6,174	4,852
Restoration Soil Tillage	98 to 137	98 to 137

Restoration soil tillage acres identified in **Table 3-36** are approximate acres identified which will help to meet the soil standards on a unit-by-unit basis and reduce some of the legacy compaction in the project area (see Appendix D). Appendix D contains information which can be used to help identify specific areas within units that are suited for tillage. Additional restoration work will be accomplished through road decommissioning, and scarification of log landings performed for water quality concerns.

Alternative 3

This alternative proposes 25 percent less harvest, as well as 21 percent less ground-based harvest compared to Alternative 2. Refer to **Table 3-36** for a comparison of soil disturbing activities by alternative. This alternative has potential to cause an increase in the amount of detrimental soil compaction, displacement, and charring, but less than Alternative 2. This alternative has unit

specific mitigations and practices identified which would ensure that all activity units meet soil standards (see **Appendix D**). This alternative also creates approximately 0.7 of an acre of lost soil productivity due to construction of 0.4 miles of new and temporary road. Implementation of this alternative would result in approximately 100 to 140 acres of tillage to alleviate detrimental soil compaction. Obliteration of 0.8 miles of road is proposed under alternative 3. Short term erosion may increase depending on future storm events but long term erosion from the road surface and ditches would be reduced. Infiltration would be enhanced through tillage and runoff would be reduced. Trees and other vegetation would recolonize these sites. Implementation of this alternative would comply with the regional soil standards.

This alternative would have lower potential to disturb scabland soil than Alternative 2 because road 1600-500-013 would not be built.

Cumulative Effects - Soils

As a whole, total detrimental soil disturbance in the project area is at 12 to 15 percent. Existing detrimental soil conditions are primarily related to past harvest activities, associated fuel treatments and road building. Approximately 11,200 acres in the project area have had harvest and fuel treatments conducted with ground-base equipment since 1970. Logging on an additional 600 acres has been done by skyline system. It is estimated that detrimental soil disturbance ranges from 15 to 35 percent in stands treated since 1970. Additional disturbance occurred before 1970 but is not included in the above estimate. Soil compaction that occurred before 1970 has been partially restored (especially on thinner soils) through annual freeze/thaw cycles and natural soil processes. Soil disturbance resulting from past activities has been incorporated into the existing condition analysis of the soil resource discussed previously. Recent monitoring results in adjacent project areas show that detrimental soil conditions can be kept within Regional standards using ground-based equipment with the incorporated design elements and utilizing tillage opportunities.

Historic over-grazing by livestock resulted in impacts to effective ground cover, bank stability, infiltration resulting in high levels of sheet/rill erosion and channel erosion in some locations. As documented by Buckley, most of the impacts occurred in the 20 to 30 years before 1900 (Buckley 1992). Livestock grazing has contributed 1 to 3 percent of detrimental soil conditions. The main stems of Shotgun, Wildcat, Drake, Maury, Indian, Double Cabin, Wiley, Parrish, Cottonwood and Poison Creeks have been impacted also. Formerly hydric soils have been drained and the drainage has been channelized. Large amounts of sediment have moved and are moving from these areas, making these areas more vulnerable to soil impacts from project activities. Detrimental soil conditions occur in areas where livestock congregate, such as around water sources, bedding areas, salting areas, trails along fences, and at pasture corners. Soils in these areas are less productive because of detrimental compaction, displacement, post holing, bank sloughing and trampling.

Revised timing and rotation of grazing, a 10-year rest period in the East Maury Allotment and exclusion of grazing in Parrish Pasture will increase the recovery rate of soil productivity in these areas. Changes to be included in new allotment management plans are intended to improve livestock management and should improve upland range conditions and promote recovery of riparian vegetation. The 10-year rest period in East Maury Allotment should preclude livestock impacts on 9,444 acres during that time, and should result in better vigor and distribution of upland forage plants and riparian hardwoods in that area. These changes in vegetative cover should result in reduced surface erosion in the uplands and improved ability of riparian areas to

filter and store sediment. Refer to the Aquatics Species and Water Quality sections for more information on the interaction between soil erosion, turbidity and aquatic habitat.

Road development has added an estimated 1 percent to overall soil disturbance. Road Maintenance has short term effects to soils but helps prevent the magnitude of long term impacts.

American beavers historically helped maintain the functional nature of riparian systems by slowing the flow, increasing roughness, trapping sediment, storing water, providing pool habitat and maintaining riparian hardwood associations. They have been trapped for their fur and to drain the boggy areas. Their absence has allowed increased access to riparian areas by large ungulates, and has reduced extent of floodplains associated with riparian areas. There is currently a trapping moratorium on beavers on the Ochoco National Forest which has been in effect for more than a decade. This has helped populations re-establish in a few areas, but the limited abundance of riparian hardwoods in the area limits potential for population expansion.

Treatment of noxious weed populations helps reduce invasion and colonization of undesirable weed species, many of which limit the re-colonization of disturbed sites by desirable natives or native cultivars. Noxious weed control may help to reduce soil erosion, thus promoting recovery on sites that sustain soil disturbance as a result of project activities.

Numerous headcuts have been repaired with some short term increase in soil disturbance. Long term benefits far outweigh short term impacts by reducing long term bank erosion and reducing loss of site productivity.

Aquatic Species and Habitat

Riparian Habitat Conservation Areas

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

For streams, the width of an RCHA is determined by whether it is fish-bearing and whether it is perennial or intermittent. There are estimated to be 2182 acres of RHCAs in the project area. In addition to streams, RHCAs also occur around ponds, lakes, reservoirs, wetlands, landslides, and landslide-prone areas. RHCAs for these areas have not been mapped and are not included in the estimated acres of RHCAs in the project area. As noted in the design criteria in Chapter 2, seeps, springs, and landslide areas would have RHCAs around them with restrictions as described in INFISH.

Class I and II streams are fish-bearing and RHCAs extend 300 feet slope distance from the stream channel (600 feet wide), straddling both sides of the stream channel. There are approximately 19 miles of Class II streams in the East Maury project area. The RHCAs for these streams encompass 1431 acres.

Class III streams are perennial, non-fish bearing streams and RHCAs extend 150 feet slope distance from stream channels. Class III RHCAs are 300 feet wide including both sides of the stream channel. There are approximately 10 miles of Class III streams in the East Maury project area. The RHCAs for the streams encompass 341 acres.

Class IV streams are seasonally flowing or intermittent and RHCAs extend 50 feet slope distance for the stream channel. Class IV RHCAs are 100 feet wide including both sides of the channel.

There are approximately 35 miles of Class IV streams and Class IV RHCAs encompass approximately 410 acres in the East Maury project area.

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

INFISH establishes landscape-scale interim Riparian Management Objectives (TM1b INFISH p. A-7) that would be applied to watersheds with inland native fish. INFISH recognizes that in many cases interim Riparian Management Objectives would not be met instantaneously, but would be achieved over time (INFISH A-2). There are no Riparian Management Objectives that specifically address riparian vegetation; however, riparian vegetation does affect pool frequency, water temperature, large woody debris (LWD), width-to-depth ratios, and bank stability. All of the habitat features described in the interim Riparian Management Objectives are inter-related.

The interim Riparian Management Objectives that apply to the East Maury project include pool frequency, water temperature, LWD, width-to-depth ratio and temperature. The interim Riparian Management Objective for bank stability and lower bank angle only apply to non-forested systems; these objectives do not apply to harvest in the East Maury Project, as these treatments are in forested systems. Additional discussion is contained in the East Maury Resource Report and Biological Evaluation for Aquatic Species.

Affected Environment - RHCAs

Pool Frequency

The frequency and area of pools is dependent on stream gradient and drainage area, generally as stream size (order) increases, pools become larger but more infrequent. In smaller order channels, large wood in the stream channel increases pool frequency (Montgomery and Buffington 1993). Pool depth and complexity is also a function of the abundance of woody debris and sediment routing. Large pulses of sediment moving through a stream system can restrict pool depth and ultimately limit habitat capability. The bankfull width-to-depth ratio, a primary indicator of channel dimension, is also directly related to both pool quantity and quality. An inverse relationship between stream width and pool spacing has been well documented by Rosgen (1996). **Table 3-37** shows the interim Riparian Management Objectives for pool frequency in INFISH.

Table 3-37 Interim Objectives for Pool Frequency in INFISH

Pool frequency	Channel Type	Channel Slope (%)	Spacing Between Pools X Bankfull Widths (ft)
Spacing between pools by channel type (Rosgen 1996)	A	0.04 - 0.10	3.5 - 4.0
	A	0.10+	1.5 - 2.0
	B	0.02 - 0.04	4.0 - 6.0
	C	0.001 - 0.02	5.0 - 7.0
	E	<0.02	5.0 - 7.0

Surveys of selected streams in the project area indicate that the amount of pool habitat is less than recommended in INFISH in most streams. Pool frequency varies from none on several reaches to 3.5 pools per 100 feet on Pine Creek (east). Average pool frequency is approximately 1 pool per 100 feet.

Since the mid 1980's the Ochoco National Forest has implemented riparian protection for planned activities on the Forest, changing the previous management and protecting aquatic habitat. Because of protection of streams, meadows, seeps, springs, and riparian areas over the last 15-plus years, pools in some reaches have increased. For example, erosion control structures or woody debris have been placed in various reaches of principal streams including Double Cabin, Maury, Shotgun Wildcat, and Wiley Creeks on the National Forest during recent years (USDA 1991, 1993, 1995, 1998, 2000, 2003).

Water Temperature

Water temperature directly affects the amount of dissolved oxygen and other gasses in the water, along with the growth of algae and other taste, odor, and disease causing organisms. In turn, the temperature regulated biological activity of these organisms can alter the pH of the water and affect the volatilization or mobilization of chemicals in heavy metals either naturally present or introduced into the system.

Temperatures of 60°F are considered ideal for rapid growth of rainbow trout (*Oncorhynchus mykiss*) (Leitritz and Lewis 1980). For the East Maury project area, temperatures would likely be below 56°F for the fall, winter and spring months of October to March prior to spawning. Females are most productive when they are in water where temperatures do not exceed 56°F for six months before spawning (Leitritz and Lewis 1980). Water temperatures in the high 70's, except under otherwise ideal conditions, may cause stress, which predisposes disease or in some cases, death for all age classes. It is generally understood that inland rainbow (redband) trout are most successful in habitats with temperatures of 70°F or slightly lower, but can survive if there is cooler, well-oxygenated water into which they can retreat as the surface waters warm over 70°F.

Streamside vegetation provides shade in summer and insulation in winter and is critical to maintaining optimum stream temperatures and temperature-dependent processes. Contributing to the increased water temperature is the loss of shade and solar protection in the form of riparian vegetation such as willow, alder, and aspen. Loss of these important hard wood species also has negatively affected stream bank stability. Riparian shrub planting occurred in several stream systems in the project area between 1995 and 2005 including Drake, Double Cabin, Indian, Shotgun, and Wiley Creeks. Shrub survival has generally been good however growth and

development has been slowed in some areas by conifer cover, grazing by livestock and big game, and lack of water.

The number and size of pools has a direct effect on water temperature. In a channel with a low number of pools, the ratio of surface area to volume of water is high, and water in the channel tends to heat and cool rapidly. This causes variations in daily temperatures as much as 15 to 20°F. Pools increase the volume of water in the channel without markedly increasing the surface area, thus providing a buffer against wide swings in water temperatures.

Results of temperature monitoring are discussed in the Water Quality (Temperature) section. Water temperatures at monitoring stations in Double Cabin, Drake, Maury, Wildcat and Wiley Creeks have exceeded 7-day average daily maximum stream temperatures in various years since 1994 (see **Table 3-30**). **Table 3-30** also shows improved temperature readings at most stations since 2004.

Large Woody Debris

Large woody material in streams and the adjacent flood plain provides streambank stability, decreases flow velocities, increases storage time (decreases downstream flood risk), cools water temperature, and stores sediment. Large woody debris (i.e. down trees) also appears to reduce grazing and browsing impacts on bank stability by reducing accessibility to the riparian vegetation. Large wood helps to form pools in the stream channel. The deep water of the pools lowers water temperature. Fish use pools for hiding cover from predators, to seek refuge in cooler water during the summer months, and as resting areas while feeding.

Large woody material provides aquatic habitats and shade for streams. Redband trout, like many other salmonids, have evolved in stream systems in which large woody material helps retain organic and inorganic particulate matter that is important for channel stability, biological diversity, and productivity (Nakamura and Swanson 1993). Large wood influences habitat for fish and other aquatic organisms by serving as energy dissipaters, flow deflectors, and dams. Large trees are needed in RHCAs because they become large woody material when they fall. **Table 3-38** displays the desired amounts of LWD in forested systems. Desired amounts were determined from INFISH and a study of unmanaged, mixed conifer sites in Blue Mountain streams (Cordova 1995).

Table 3-38 Interim Objectives for LWD in INFISH

LWD (forested systems) ²	LWD Size	Channel Type A	Channel Type B	Channel Type C
	>21 in dbh, >35 feet long	0.4	0.6	0.8
	>12 in dbh, >35 feet long	1.5	1.3	1.7
	>6 in dbh, >35 feet long	3.4	3.4	4.5

Based on stream surveys, the project area is deficient in the amount of large woody material in streams. LWD ranges from no LWD in several reaches to 4.3 pieces per 100 feet in Drake Reach 3.

Width/depth ratio (all systems)

The width-to-depth ratio is often used as an index of cross-sectional shape, where both width and depth are usually measured at the bankfull level. Both depth and width can respond rapidly to changes in sediment load and/or discharge. Whether a stream erodes downward or outward is

influenced by both local shear stresses and whether the bed or banks are the most easily eroded. Bank vegetation increases the resistance to erosion through its binding effects on banks. Erosion decreases as the percentage of roots in the soil increases, such as in aspen stands with improving vigor, and this leads to narrower channels than would otherwise be expected. The effect of vegetation on channel shape is more pronounced in smaller streams (Gordon, et al. 1992).

Changes in width/depth ratios are a result of wood recruitment within RHCAs. Wood embedded in the stream channel and streambanks narrows the channel, slows velocity, catches sediment, and creates pools. Increasing large wood recruitment will result in improvement in width-to-depth ratios. Narrower, deeper stream channels result in cooler water temperatures improving habitat for fish. Generally, width-to-depth ratios are not being met on streams in the East Maury project area.

The interim RMOs for width-to-depth ratios are less than 10. Surveys indicate that there is a wide range of width-to-depth ratios for surveyed streams in the project. Width-to-depth ratios vary from 17.4 on reach 2 of Drake Creek to 5.8 on Shotgun Creek (reach 1).

Environmental Consequences - RHCAs

Alternative 1

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

Since the Forest Plan was signed in 1989 and again when INFISH was signed in 1995, the Ochoco National Forest has been managing riparian areas to maintain or improve riparian conditions. Because of protection of streams, meadows, seeps, springs, and riparian areas over the last 15+ years, pools have been improving. Large woody material increased as a result of budworm mortality in the late 1980's and early 1990's. Recruitment of large wood as a result of beetle-killed trees is also expected to improve pool numbers when dead trees inside RHCAs fall. Over time, pool numbers are expected to increase and width-to-depth ratios are expected to decrease, providing cooler water and cover. Large wood from logs would also catch sediment. Riparian vegetation that has been planted along streams would help stabilize pools, increase cover, decrease width-to-depth ratios, and reduce water temperatures. In some streams where shrubs have been planted expanding conifer cover will prevent growth and development of the shrubs. No treatments would occur in Alternative 1 in the East Maury project area. In areas adjacent to streams without a closed canopy, shade gradually would increase as a result of developing broadleaf shrub and tree cover as well as increased conifer growth. Increasing shade over streams contributes to reducing water temperature and acts as hiding cover for redband trout and Columbia spotted frogs.

Without proposed thinning and fuels treatment, there could be an increase in wildfire risks. Large trees standing and down large wood could be at risk. Potential future large wood from standing trees could be lost from wildfire. In the long term (could be a century), future large wood would be recruited after seed sources sprouted new trees; the open canopy from reduction in standing and down trees could promote expansion of woody species along the streams where replacement stand fire took place. Shade would be reduced in a stand replacement fire and would not improve for approximately 15-20 years until woody vegetation sprouted and grew

along streams enough to provide shade and hiding cover. Large wood recruitment could become stagnant in RHCAs; with crowding of trees, growth of trees would be inhibited. Wood would be available for future recruitment in the streams but would not be large in diameter category (>21 inches dbh, >35 feet long INFISH). Pools would develop when large wood falls into the stream.

Gravel embeddedness of less than 20% is essential to maintain healthy salmonid populations, especially in those areas identified as potential or existing spawning areas (Bjorn and Reiser 1991). If sediment exceeds 20%, the spaces between the rocks in the substrate are filled and oxygenation of eggs is reduced. Reduced oxygenation results in reduced success of fish and frog eggs surviving.

Alternatives 2 and 3

Activities have been proposed within RHCAs to increase the vigor of riparian vegetation and contribute to recruitment of future large woody material. Aspen is an important vegetation component that providing cover and bank stability when located in RHCAs and is the focus of harvest and associated treatments. **Table 3-39** summarizes proposed activities within RHCAs. **Tables 3-40** and **3-41** provide a breakdown of activities within RHCAs by stream, stream class, and alternative.

Table 3-39 Comparison of activities within RHCAs by alternative

	Harvest + PCT and/or Fire (Ac)	Noncommercial Thinning + Fire (Ac)	Prescribed Fire only (Ac)	Total Acres treated
Alt. 1	0	0	0	0
Alt. 2	210	751	224	1186
Alt. 3	166	783	214	1163

Harvest area in Alternative 2 is higher than Alternative 3. Alternative 3 was designed to minimize new road construction so the reduced acres are due to a lack of access. In Alternative 2 commercial harvest will occur in 15 separate units for a total of 210 acres within RHCAs and focus on thinning of conifers in and around aspen stands and areas where aspen occurred historically. There would be 166 acres of commercial harvest in 13 separate units within RHCAs in Alternative 3. A decrease in the acres of commercial harvest in Alternative 3 reduces the potential to improve the vigor of aspen proportionally. Commercial harvest is combined with precommercial thinning and underburning to promote attainment of RMOs for pool frequency, water temperature, large woody debris, and width-to-depth ratios. When combined with precommercial thinning, increased tree growth is expected and would increase future recruitment of large woody material. Commercial harvest and associated treatments would benefit other riparian-associated trees and shrubs such as alder and willow as well.

No heavy machinery or off road vehicles would be used in RHCAs for commercial harvest except to reuse existing roads and existing landings. No new landings would be constructed in RHCAs. To reduce ground disturbance within RHCAs and potential sediment delivery, harvest would be done by horse logging, skyline yarding or winchline pulling to equipment located outside of the RHCA. Reshin and others (2006) found that a 10-meter setback of felling and yarding activities prevented most sediment delivery to streams. Although conifer harvest would occur within 10 meters of stream channels within selected areas the linear extent of the removal

is limited and would be done without machinery use. Residual slash and the unharvested areas are expected to filter sediment before it reaches the streams.

Following treatment in both Alternatives 2 and 3, canopy cover in aspen stands would be reduced until the aspen and other broadleaf shrubs respond. Response time and amount would vary by current aspen condition and vigor, post treatment protection (fencing or debris) and intensity of treatment. Associated noncommercial thinning and aspen planting and protection would allow the aspen to remain on site and to increase in abundance. Commercial harvest and associated treatments would benefit other riparian-associated trees and shrubs such as alder and willow as well. A portion of conifers to be cut in Double Cabin and Wiley Creeks would be retained to provide LWD needs in these creeks.

Table 3-40 Harvest within RHCAs in Alternatives 2 and 3 by Stream

Stream Name	Alt 2 (acres)			Alt 3 (acres)		
	II	III	IV	II	III	IV
Double Cabin	28.9			28.9		
Drake Creek Tributary 2			0.2			0.1
Indian Tributary 2		13.3			13.3	
Indian Tributary 3	33.9			33.9		
Indian Tributary 4			4.3			4.3
Indian Tributary 5			0.1			0.1
Keeney			0.6			0.6
Keeney Tributary 2			4.9			0.1
Maury	8			8.3		
Maury Tributary 1			0.2			0.2
Parrish Creek			7.7			7.7
Shotgun	0.1			0.1		
Stewart	42.4					
Wildcat Tributary 1		8.3			8.3	
Wildcat Tributary 2			0.1			0.1
Wiley	34					
Wiley Tributary 1		24.8			24.8	

Proposed noncommercial thinning and fuels treatments in Alternatives 2 and 3 are similar varying by approximately 20 acres. The following effects discussion includes both Alternative 2 and 3. Noncommercial thinning outside of harvest units will occur on approximately 751 acres in 105 units within RHCAs. Understory conifer trees (typically less than 9 inches dbh) would be thinned to approximately 16 to 18 foot spacing. Precommercial thinning would occur to within 5 feet of stream channels. In order to maintain shade, the actual trees to be cut would depend on tree height, slope, aspect and distance to the stream. Only trees that do not provide shade would be removed so that the existing amount of stream shade is maintained. Removing these conifers would result in more sunlight available to deciduous vegetation which, in turn, would result in more vigorous deciduous vegetation. Thinning would reduce the competition between riparian-associated species and conifers resulting in more woody, shrubby species. Precommercial

thinning would result in increased growth rates for both conifers and riparian vegetation. Precommercial thinning would promote attainment of RMOs in RHCAs (Class I-IV). In the future, when large trees fall into streams they would increase pool numbers and help reduce stream temperatures. Increases in riparian vegetation would contribute to bank stability and capture sediments, contributing to narrower streams and decreased width-to-depth ratios. Precommercial thinning activities are not expected to result in sediment delivery to streams because this activity would not remove ground vegetation that filters sediment.

Prescribed underburning is proposed on a total of 793 acres including units with proposed harvest and noncommercial thinning and is the only treatment proposed on 225 acres within RHCAs. **Table 3-41** displays the area treated noncommercially (thinning, fire or both) outside of harvest units by drainage. Fuel loading objectives are higher within RHCAs than in area outside of RHCAs. Prescribed fire prescriptions would be designed to reduce smaller fuels within RHCAs, may be used to reduce stocking of conifer seedlings, and to rejuvenate grass and shrub cover. The prescribed fire application is intended to burn 10 to 50 percent of the RHCA in a mosaic pattern exposing less than 5 percent of the surface mineral soil. The majority of the burned area would be in the outer portions of the RHCA. Mineral soil exposure is expected to last less than one year. The above ground growth of grasses and shrubs in the burned areas would be killed but would respond with new growth within the first growing season after the burn. Observations of similar prescribed fire treatments show burned grasses begin to sprout with new growth within 1 to 3 months of the first growing season. Within the first year after burning, shrubs and grasses would be rejuvenated. The East Maury Project Fuels Report contains a discussion of fires effects specific to common shrubs in the project area. Ground cover including grasses and shrubs in the unburned portions of RHCAs would provide effective sediment filtering in the event of overland water flow. Prescribed fire and associated harvest and noncommercial thinning would reduce fire hazard and the potential for severe wildfire within the RHCA. Prescribed burning would be implemented over approximately 10 years and in different seasons resulting in reduced potential for sedimentation.

While some large wood may be consumed, fire is expected to kill some standing trees that over time would fall and become large woody debris. Reducing competition promotes the growth of residual trees that will be future large woody debris. See **Appendix B** for units proposed for fuels treatment by stream class.

Table 3-41 Noncommercial Thinning and Fuels Treatments in RHCAs

Alternative 2 Stream Name and Tributaries	RHCA (Stream) Class			Total Treatment	Total Area in RHCA
	2	3	4		
Cemetery Creek			20	20	26
Cottonwood Creek		6	31	37	44
Davis Creek			28	28	37
Double Cabin	87		6	93	160
Drake Creek	157	51	29	237	438
East Shotgun Creek	27			27	27
Indian Creek	61	14	4	79	127
Keeney Creek		18	10	28	74
Maury Creek	32	22	5	59	254

Alternative 2 Stream Name and Tributaries	RHCA (Stream) Class			Total Treatment	Total Area in RHCA
	2	3	4		
Parrish Creek	33		31	64	148
Pine Creek		2	13	15	44
Poison Creek			11	11	23
Rimrock Creek			28	28	63
Shotgun Creek	115	8	2	125	155
Stewart Creek	43		7	50	51
Tom Vawn Creek	29			29	82
Wildcat Creek	122	8	8	138	189
Wiley Creek	122	57	1	180	222
Totals	830	189	238	1,248	2,164

Proposed new and temporary roads proposed in Alternatives 2 and 3 are described in Chapter 2, **Table 2-2 and Table 2-3**. Appendix B **Table B-2** contains a comprehensive list of road use, reconstruction and new road development by alternative. The transportation plan for the East Maury project was developed through a roads analysis and is contained in the East Maury Roads Analysis Report, (2007). Road work, including constructing, reconstructing, closing, and decommissioning, affects sediment delivery to streams. The construction of new roads within RHCAs would increase the potential for sediment delivery to streams. New roads would provide additional soil disturbance and potential for sediment transport. The primary sediment delivery sites will be at road/stream crossings. Based on monitoring of sediment delivery during a culvert installation project on Badger Creek, a Class II stream, only small amounts of sediment are expected and sediment is expected to settle out within 200 feet of the area of disturbance. This monitoring indicated that sediment levels returned to background levels in less than 24 hours. Monitoring of stream structure work on McKay Creek also resulted in increased sediment within 200 feet of the area of disturbance; sediment also settled out or was dispersed within a few hours of the activity.

No new road crossings are proposed on fish bearing streams in either Alternative 2 or 3 and no new stream crossing are proposed in Alternative 3. For Alternative 2 **only**, proposed new roads would cross the following streams:

- Keeney Creek tributary 2 (Class IV), Road 1600-640-003 would cross a drainage below a spring. The crossing would need to maintain subsurface flow or a culvert for surface flow.
- Stewart Creek tributary 1 (Class IV), Road 1600-289 the spring area would be avoided and the road would be closed after use.
- Poison Creek (Class IV), road 1670-215. An armored crossing would be installed. This crossing would be closed after harvest is completed.

Reconstruction of roads within RHCAs would improve drainage and reduce sedimentation from the existing condition. Road reconstruction would occur at stream crossings at the following locations:

- Drake Creek tributary 1 (Class III), Road 1600-650, an armored drain dip would be installed. This stream becomes subsurface below this existing crossing.

- Parrish Creek tributary 6 (Class IV), roads 1670-080, an armored drain dip would be installed.
- Tom Vawn Creek (Class II), Road 1600-640; a temporary bridge would be installed; or alternately, the crossing would be from the 1600-640-018 road in the Class IV area. **This crossing applies only to Alternative 2 and would not occur in Alternative 3.**
- Wildcat Creek (Class II): road 1680-050 has been a chronic source of sediment. For use in this project the road surface leading to the crossing would be armored. The culvert would be removed after activities are completed. Additional work would include floodplain restoration and construction of grade control structures in area of culvert removal.
- Wiley Creek tributary 1 (Class II), Road 1600-452, a temporary bridge would be installed. **This crossing applies only to Alternative 2 and would not occur in Alternative 3.**

Closing and decommissioning roads within RHCAs would reduce compaction, increase infiltration, and improve road drainage which would reduce concentrated flows and sediment transport. Reconstruction of roads within RHCAs would improve drainage and reduce sedimentation from the existing condition. Reconstruction of roads outside of RHCAs also includes drainage improvement, additional surface rock and would reduce sediment.

Road work would occur during low stream flow after fish have spawned and eggs are hatched (during the inwater work period). Precipitation is low during the summer months in the project area. Small pulses of sediment may occur during implementation if a rain event immediately followed road improvement. During activity, fish can move to other parts of the stream. The rain event would increase flow in the streams allowing for faster dispersal of sediment through out the system.

Most roads identified for closure or decommissioning are located within or cross RHCAs. Alternative 2 would close 2 miles and decommission 2.5 miles of road. Alternative 3 would also close 2 miles but decommission only 0.8 mile of existing road. Roads to be closed and decommissioned are listed in Appendix B, **Table B-2**. The net result is that Alternatives 2 and 3 would result in a reduction of open roads in RHCAs and an improvement over current conditions by reducing compaction, improving road drainage, and reducing the amount of sediment produced by roads.

Pools: Proposed harvest and associated road use, noncommercial thinning and fuels treatments in both action alternatives could affect pool size and frequency in the short-term by increasing sediment delivery as previously discussed in the Soils and Water Quality sections. As discussed in the section on Water Quality (Sediment and Turbidity), application of design elements and BMPs to reduce disturbance and to maintain filtration integrity in the RHCAs should ensure that state water quality turbidity standards are met. Road reconstruction, closures and decommissioning would reduce long-term sediment sources. Locations of project activities which have the highest potential to generate sediment are outlined in the Water Quality discussion and displayed in **Tables 3-31** and **3-32**. Over time, pool frequency would be improved as aspen, shrub and grass vegetation develop along stream channels. Improved streamside vegetation would strengthen streambanks, narrow channels and provide better

sediment filtration. Long-term growth and development of large trees would also indirectly affect pools by increasing the potential for large woody debris.

Water Temperature: As discussed in the Water Quality (Temperature) section the proposed actions in Alternatives 2 and 3 are not expected to increase water temperature although there would be short-term shade reduction in selected aspen stands. Harvest and associated treatments are meant to improve aspen vigor, cover and allow aspen clones to expand in size. Shade will improve as aspen stands develop. Other proposed treatments in RHCAs are designed to maintain current shade levels. Canopy develop would continue in untreated portions of RHCAs.

Large Woody Debris: Proposed activities in Alternatives 2 and 3 would not alter the existing amount or arrangement of LWD except in aspen treatment units in Double Cabin and Wiley Creeks. In these streams, a portion of the commercial-sized conifers would be retained to augment existing low LWD levels. In addition, increased growth of remaining trees would provide large diameter trees for future large wood recruitment.

Width/Depth Ratio: Width depth ratios are expected to improve as a result of the proposed activities. Increases in riparian vegetation would contribute to bank stability and capture sediments, contributing to narrower streams and decreased width-to-depth ratios.

Table 3-59 in the National Forest Management Act section contains applicable Forest standards as amended by INFISH and summarizes proposed activities and measures included to meet INFISH standards. None of the proposed treatment in Alternatives 2 or 3 would be great enough to jeopardize attainment of the Riparian Management Objectives in the short term. As a result of the proposed project, overall fish habitat would improve as: (a) pools increase from wood that becomes lodged in the stream channels; (b) stream temperature would be reduced in the formation of the pools; (c) large woody material recruitment would increase from thinning in RHCAs; and (d) width/depth would improve as a result of increased large woody material lodging within the stream channel collecting other wood moving downstream during high flows and expanding long rooted riparian species from the aspen thinning. INFISH standards for pools, large woody debris, temperature, and width/depth ratio would be met for Alternatives 2 and 3.

Cumulative Effects - RHCAs

The cumulative effect of past, present, and reasonably foreseeable actions is expected to be improved RHCA function and condition. RHCAs in which the proposed activities overlap with past, present, or reasonably foreseeable actions include Double Cabin, and Wildcat Creeks. Activities that have occurred in these RHCAs include culvert removal and headcut stabilization. Riparian planting has occurred on Double Cabin, Indian, Wiley and Shotgun Creeks. Commercial harvest, precommercial thinning, prescribed burning, hardwood thinning, and road work along these streams would also contribute toward the attainment of RMOs for pool frequency, water temperature, large woody debris, and width-to-depth ratios.

Livestock grazing will continue although grazing extent and intensiveness will change with implementation of the Maury Mountain Allotment Management Plan EIS. Approximately 50 percent of the project area has been rested for several years and will continue to be rested for another 10 years (with grazing eliminated altogether from one pasture). The rested area is located on the east side of the project area from Stewart Creek and includes most of the Maury Creek drainage. Grazing rest has resulted in a positive response in development of ground vegetation including grass and shrub cover in areas without high levels of conifer canopy.

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

Measures in the Maury Allotment Management Plan EIS are designed to improve channel condition. They include moving water troughs out of riparian zones, fencing or enlarging enclosures at spring source areas at water developments, developing more water sources in the uplands, earlier season of use, and resting pastures. Livestock have a primary influence on stream bank condition, trampling banks and removal of riparian vegetation, which is one of the factors that determine what the channel response will be to changes in flow. Upward trends in riparian condition are expected to continue due to changes in the range utilization standards in the Grazing Implementation Monitoring Module (IIT, 2000). These utilization standards are used to determine when livestock are to be removed from pastures. Based on stream surveys, bank conditions where cattle have been concentrating are not stable. By treating uplands and reducing canopy closure in forested stands, sunlight reaching the forest floor would result in a subsequent increase in forage in upland areas. In the burned areas, the newly sprouted vegetation would increase in forage palatability and in nutrients for the first 3 years that would make it easier to attract cattle away from riparian areas to uplands. This would alleviate grazing pressure and trampling in RHCAs. The previously burned vegetation would then return to normal level of nutrients as it became part of the landscape and providing increased riparian plant growth and bank stability.

Harvest and other management history on National Forest lands are summarized on pages 3-2 to 3-3 and are also discussed in more detail in the Aquatic Species Report. The treatment history has affected the ability of watersheds in the project area to provide vigorous and stable riparian habitat.

The proposed treatments in Alternatives 2 and 3 are designed to not retard the attainment of the Riparian Management Objectives and would not slow the rate of recovery below the near natural rate of recovery. Long-term riparian management objectives would be enhanced by performing vegetation management (both commercial harvest and noncommercial thinning) within RHCAs. Activities in RHCAs are designed to maintain or improve shade conditions, to promote development of large-size trees, and to enhance long-term recruitment of large wood within riparian areas. These activities would contribute to meeting Riparian Management Objectives in INFISH.

Aquatic Species

Affected Environment

Management Indicator Species

Fish species identified as management indicator species are listed in the Forest Plan include rainbow trout (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*). In the past, these fish have been stocked by the Oregon Department of Fish and Wildlife (ODFW). They are no longer stocked in the streams in the East Maury project area but naturally reproduce in many streams (Class II). Redband trout serve as a surrogate for brook trout and rainbow trout in this analysis as they have similar habitat requirements. For purposes of this analysis, effects to redband trout are described in the Threatened, Endangered, and Sensitive Species section and will act as a surrogate for MIS fish species effects analysis. No further evaluation for MIS will be discussed.

Essential Fish Habitat

The Pacific Fishery Management Council designated Essential Fish Habitat for chinook salmon on September 27, 2000. This designation included current and some historic habitat in the Deschutes Basin. Historical habitat above Pelton Round Butte Dam was included. For the Ochoco National Forest, Essential Fish Habitat is not included above Bowman Dam (1961) that is a channel barrier. The East Maury project area is located upstream of Bowman Dam on Prineville Reservoir. This project will not have an effect on Essential Fish Habitat.

Threatened, Endangered Species and Sensitive Aquatic Species

The Biological Evaluation for aquatic species prepared for the project documents possible effects of proposed activities on threatened, endangered and sensitive species in the project area. Refer to the Biological Evaluation for more detailed discussion of these species. The Effect/Impact determinations from the Biological Evaluations are displayed in **Appendix C**. There are no endangered species known or suspected to occur on the Ochoco National Forest. Two aquatic species that are federally listed as threatened and known to occur on the Ochoco National Forest and Crooked River National Grassland are bull trout (*Salvelinus confluentus*) and Mid-Columbia River steelhead trout (*Oncorhynchus mykiss* ssp.). These species do not occur in the project area. There would be no effect to bull trout or mid-Columbia River steelhead trout from any alternative. Consultation with the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration is not applicable for the East Maury project area. Therefore, these species will not be further discussed in this document.

The Malheur mottled sculpin (*Cottus bairdi*), west-slope cutthroat trout (*Oncorhynchus clarki lewisii*) and Mid-Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*) are identified as sensitive species by the Regional Forester. The East Maury project is not expected to impact these species because there are no known populations or habitat in the project area. Therefore, these species will not be further discussed in this document. Two sensitive species, the redband trout and Columbia spotted frog do have habitat and are known to be present in the project area, and potential impacts to these species are described below.

Redband Trout

Redband trout (*Oncorhynchus mykiss*) is the only salmonid species known to occur within the East Maury project area. Modification to fish habitat as well as loss of fish habitat have had an effect on redband trout density and condition within the project area.

The population numbers of redband trout have decreased over time and non-native fish species have been introduced. Lower numbers of redband have resulted from the loss of riparian vegetation, particularly hardwood trees and shrubs, bank erosion, entrenched streams, loss of beaver and woody debris, modified stream channels from narrow and deep to steeper slopes. Straighter channels due to degradation are accompanied by increased bank erosion, increased sediment transport, increased sediment deposition in depositional areas, and loss of floodplains (USDA 2000). Fish habitat has improved (ODFW 1979, 1991; USDA 1888-2005) over time.

With the change in grazing allotment management plans in the Maury Mountains (USDA 2006), riparian shrubs and grasses are expected to be in an upward trend. Headcuts and road closures across the Maury Mountains have arrested areas that were providing continuous sedimentation to streams.

A healthy stand of deciduous vegetation would provide structure for increased diversity and populations of terrestrial and aquatic insects which are important food items for redband trout (Chapman and Demory 1963) and amphibians. In addition, the leaf drop of deciduous trees will provide increased quantities of organic material and nutrients which will be available for aquatic insects and invertebrates (Cummins 1974). The increase in riparian vegetation and large woody material is expected to help stabilize stream banks, reduce erosion and lead to the development of undercut banks. It will also trap sediment from upstream sources (Platts 1991).

Environmental Consequences – Aquatic Species

Redband Trout

Alternative 1

There would be no impact to redband trout habitat because there are no treatments proposed in this alternative. The existing condition of the streams would continue to inhibit the success of redband trout populations and fitness.

On-going uses in the project area, such as road maintenance, noxious weed treatments, livestock grazing, and recreation use would continue. Restoration projects, such as riparian planting and headcut repair authorized in other documents, would be implemented. Fish population distribution throughout the project area would still be limited by: (1) stream flow; (2) both man-made and natural barriers; (3) stream gradient; and (4) rearing and spawning habitat quality and quantity. The primary reason for the decline in production of salmonids throughout the project area has been the loss of instream habitats and declining water quality. Populations of existing salmonids (redband trout) would not begin to increase until the channel structure improves and water temperatures decrease. It is estimated that most of the sediment in the streams in the East Maury project area is coming from in-channel erosion such as bank erosion, head cuts, and channel scour.

Although the alternative does not harvest timber, there is some risk that insect and disease mortality may reduce stream shading. If this mortality is light to moderate, it may be beneficial (i.e., natural thinning). Dead trees which fall into or adjacent to the channel, would add to the channel stability, catch sediment, and provide cover and structure to the channel. This would help to provide cool clean water, provide structure to develop pools, increase the amount of cover for fish, and help retain water for late season flows. However, large amounts of dead and dying trees from insect and disease in the riparian areas could also burn at high intensity and

reduce stream shading, increase water temperature, and decrease potential for large wood recruitment.

Because of the existing impacts of sediment, the No Action Alternative would move towards attainment of Riparian Management Objectives at a slower rate than the action alternatives for aquatic species and their habitat because no vegetation management would be done to improve riparian habitat conditions. Attainment of improved aquatic and riparian habitat and fish populations where streams are degraded may not improve over time without treatment.

Watersheds with previous harvest would continue to recover. Due to past harvest practices such as skid trails through RHCAs, fire suppression, and current conifer stocking, many of these conifer stands would not improve without treatment. In RHCAs, individual tree growth would not increase to promote the development of large trees and LWD recruitment to the stream channel within the timeframe as in Alternatives 2 or 3. Large wood develops pools, traps sediment, decreases water temperatures, and provides cover for fish.

The effects of past management practices such as logging and skidding in riparian areas, effects of the land use generated sediment, channel widening and aggradation, and channel stability loss, could persist for at least several decades. From Hagans' (et al. 1986) prediction in another study area, it could be more than a century for recovery from past management practices, even if no further disturbance occurred in the area.

Without fuels treatment, there could be an increase in wildfire risks. Large trees standing and downed large wood could be at risk. Potential future large wood from standing trees could be lost from wildfire. In the long term (could be a century), future large wood would be recruited after seed sources sprouted new trees; the open canopy from reduction in standing and down trees could promote expansion of woody species along the streams where stand replacement fire took place. Shade would be reduced in a stand replacement fire and not improve for approximately 15 to 20 years until woody vegetation sprouted and grew along streams enough to provide shade and hiding cover. Large wood recruitment could become stagnant in RHCAs; with crowding of trees, growth of trees would be inhibited. Wood would be available for future recruitment in the streams but would not be large in diameter category (>21 inches dbh and >35 feet long, INFISH).

Gravel embeddedness of less than 20 percent is essential to maintain a healthy salmonid population, especially in those areas identified as potential or existing spawning areas (Bjorn and Reiser 1991). If sediment exceeds 20 percent, the spaces between the rocks in the substrate are filled and oxygenation of eggs is reduced. Reduced oxygenation results in reduced success of fish and frog eggs surviving. Gravel embeddedness generally exceeds 20 percent in the Class II streams in the East Maury project area. Without proposed treatments such as removal of conifers in aspen areas, aspen sites will be overstocked with conifers reducing aspen populations. Aspen are riparian species benefiting stream channel stability reducing sediment entering streams.

Existing road crossings are not providing for the 100-year flood or for fish passage. Crossings that are not sized properly for flow back up water during high water events. Backing up water creates eddys (swirling water) at the inlets causing streambank erosion. Sediment then increases in the streams and settles in the gravels. A shotgun effect (water exits the culvert causing erosion at the outlet) is created reducing the ability of fish to migrate upstream.

In the event of a wildfire, there would be varied intensities of fire depending on the varied amounts of fuel loading. In RHCAs, large wood is below INFISH standards. The upper steeper draws (Class IV) would likely have a high-intensity fire. There would be a loss of future LWD recruitment until after new seedlings become established and grow into mature trees, which could take decades. In the lower parts of the drainages, there would be immediate large wood recruitment as the dead and dying trees in the moderate and low intensity burn fall into the streams. There would be an increase of sediment as a result of losing vegetation along the RHCAs and uplands, likely in a mosaic pattern. Shade would be reduced and water temperatures increased. Pools would form from the sediment being trapped in the fallen wood. In the unstable stream reaches, down cutting would continue where large wood is deficient.

The resulting open canopy would increase growth of woody riparian vegetation. As the cover over streams increased, temperatures would decrease and seedlings would reestablish. In Alternative 1, post wildfire, large wood would be available in the RHCAs quicker than in Alternatives 2 and 3 with vegetation and fuels treatments. It would take longer in Alternative 1 to recruit the next generation of large wood until seedlings reestablished and grew into large wood and fell into the streams.

Livestock grazing continues to impact streams by trampling and by consuming riparian (woody) streamside vegetation such as willows. Grazing woody vegetation along streams reduces shade, increases temperature, increases compaction due to trampling, reduces pools, and causes stream bank cutting.

Bank conditions where cattle have been concentrating are not stable. Without treatment to open the canopy in the uplands, sunlight would not reach the forest floor and would result in a subsequent decrease in forage in upland areas. Livestock would continue to concentrate in the RHCAs.

Degraded channel conditions in the headwaters of many streams and in spring areas in the project area have resulted from livestock concentration. Livestock grazing has changed as a result of the new AMP (2006). It is reasonably foreseeable that there will be an improvement in riparian condition due to changes in the range standards in the Grazing Implementation Monitoring Module (IIT 2000). Studies in the intermountain region (Clary 1999) indicate that the height of grasses and forbs that are to be left in key riparian areas indicate a level of grazing that allows a corresponding recovery of palatable woody vegetation. Bank stability and channel geometry interact with vegetation but may respond differently, depending on the extent of continued disturbance in the channel and the current channel condition.

Due to past harvest practices, fire suppression, and current conifer stocking, many of these conifer stands would benefit from thinning (commercial and noncommercial thinning) and activity fuels under burning. Without treatment, it could take more than a century to begin to move the vegetation towards historical conditions (Hagans et al. 1986).

The private land within and adjacent to the project area have had previous selective harvest but are predominately scattered overstory ponderosa pine with medium to high densities of understory trees. Current uses appear to be for dispersed recreation and possibly cattle grazing. Activities for the future are likely to remain similar to those ongoing today.

Alternatives 2 and 3

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

Management related impacts to LWD, stream shade provided by vegetation, and sediment delivery resulting from the proposed activities were evaluated to determine the degree to effects to redband trout. Evaluation of these variables indicates the effects to the Riparian Management Objectives describing good fish habitat, including pool frequency, temperature, LWD, and width/depth ratio. The proposed treatments are designed to enhance recruitment of LWD. Large woody material in streams and the adjacent floodplain provides stream bank stability, decreases flow velocities, increases storage time (decreases downstream flood risk), provides cover for fish and stores sediment. An indirect effect of the proposed treatments and recruitment of large wood for streams includes development of deeper and narrower streams, reduced temperatures, and trapped sediment within the wood structures. Streams would increase in numbers of pools formed by downed wood and improve the width/depth ratio by making the streams narrow and deeper. Pools increase the volume of water in the channel without markedly increasing the surface area; thus, providing a buffer against wide swings in water temperatures. Neither of the action alternatives would adversely affect pools in the short or long term.

The proposed treatments would reduce temperature over time by forming pools from large woody debris recruitment and the resultant deeper and narrower stream channels. Pools increase the volume of water in the channel without markedly increasing the surface area; thus, providing a buffer against wide swings in water temperatures. In the long term, approximately 40 years, pools would be expected to develop as the trees grow larger in the riparian areas, die, and eventually fall and become part of the streams structure. (Refer to Purpose and Need in Chapter 1 and the discussion on LOS in Chapter 3). Riparian vegetation would also be improved over time. As riparian vegetation increases, the amount of stream shading would also increase and reduce water temperatures. In the long term after the large wood becomes part of the stream structure and pools develop, water temperature would be reduced quickly as the pool fills. Neither of the action alternatives would increase stream temperatures in the short term or long term.

Long-term as a result of large wood becoming part of the stream structure, width-to-depth ratios would improve from the proposed treatments. Recruitment of large woody debris in streams would increase numbers and quality of pools by making the streams narrower and deeper. This would reduce width-to-depth ratios and increase the ability of a stream to reach the floodplain and reduce shear stress on stream banks (reducing cut banks). The appropriate width-to-depth ratios result in improved fish habitat and water quality. The two action alternatives would not adversely affect width-to-depth ratios.

Proposed underburning is designed to burn in a mosaic pattern and to preserve existing large woody material in riparian areas. Fire would be used in RHCAs to promote the growth of riparian vegetation by reducing conifer density. Fire would also be used in RHCAs to reduce the risk of high intensity fire by reducing small diameter surface fuels (less than 3 inch diameter) and ladder fuels (trees less than 1 inch dbh). Prescribed fire usually burns the litter layer and upper part of the duff layer over 10-50% of the surface area within a RHCA with less than 5% mineral

soil exposure, usually where an old punky log is completely consumed. The two action alternatives would not adversely affect large woody debris.

Both depth and width can respond rapidly to changes in sediment load and/or discharge. Whether a stream erodes downwards or outwards is influenced by both local shear stresses and whether the stream bed or banks are the most easily eroded. Prescribed fire has been designed in each alternative to minimize the potential effects of fire in RHCAs. Treatments in RHCAs are designed to rejuvenate riparian plant species composition. This would accelerate the improvement of riparian plants more closely to the natural rate of recovery. In the short term immediately after treatment, sediment would be filtered by the grasses left as a result of a mosaic burn and shrubs along the streams. Some sediment may enter the stream immediately after burning if there is a rain event. However, in the long term, approximately 1 month after the burn, vegetation will be reestablished and filter sediment from over land flow. These fuel projects would not have more of an effect on fish or fish habitat than a naturally-occurring, low-intensity fire. Water quality would not be adversely affected by sedimentation (refer to the Water Quality section).

Alternatives 2 and 3 do not differ substantially in effects to fisheries and aquatics except in the amount of road construction. The total amount of treatment area is approximately the same number of acres in each action alternative. The proposed activities are discussed in RHCAs above. Several units in each action alternative commercially treat vegetation within RHCAs, the units in Alternative 2 total 210 acres, and the units in Alternative 3 total 166 acres. However, only the portions of the area within each unit that is within 50' of aspen trees or sprouts will be commercially treated. Treatment is designed to maintain or improve existing shade conditions by thinning conifers to promote deciduous trees and shrubs, to promote development of large-size trees by reducing competition, and to enhance long-term recruitment of large wood within riparian areas. These activities would contribute to meeting Riparian Management Objectives in INFISH for LWD recruitment and shade. No ground-based heavy equipment would be utilized to remove commercial trees within the RHCA unless on existing roads; wood would be removed with the use of a mobile yarder or a tractor mounted winch from the existing roads.

Noncommercial thinning in RHCAs varies with 981 acres occurring in Alternative 2 and 967 acres occurring in Alternative 3. All alternatives contain specifications for treatment to protect riparian dependent resources and the effects are similar between the alternatives relative to threatened and endangered, sensitive, and management indicator species. Specifics of treatment impacts by RHCA class, watersheds, and subwatersheds may be found in the February 2008 Resource Report and Biological Evaluation for Aquatic Species. Noncommercial thinning and natural fuels burning would occur within RHCAs. These activities are designed to maintain or improve existing shade conditions, to promote development of large-size trees, and to enhance long-term recruitment of large woody debris within riparian areas. These activities would contribute to meeting Riparian Management Objectives. In addition to decreases in stream temperature, increased vegetation would lead to changes in fish and amphibian cover and their prey base. Fish and amphibian cover within the lower portions of all the major drainages would change from one dominated by substrate to one dominated by LWD and vegetation. Trout production should increase as the quantity and quality of cover improves (Wesche 1974, Binns and Eisermann 1979). This would allow use of portions of the stream not used currently because of lack of cover. A healthy stand of deciduous vegetation would provide structure for increased diversity and populations of terrestrial and aquatic insects which are important food items for redband trout (Chapman and Demory 1963) and amphibians. In addition, the leaf drop of

deciduous trees will provide increased quantities of organic material and nutrients which will be available for aquatic insects and invertebrates (Cummins 1974). The increase in riparian vegetation and large woody material is expected to help stabilize stream banks, reduce erosion and lead to the development of undercut banks. It will also trap sediment from upstream sources (Platts 1991).

In addition to decreases in stream temperature, increased vegetation would lead to changes in fish and amphibian cover and their prey base. Fish and amphibian cover within the lower portions of all the major drainages would change from one dominated by substrate to one dominated by LWD and vegetation. Trout production should increase as the quantity and quality of cover improves (Wesche 1974, Binns and Eisermann 1979). This would allow use of portions of the stream not used currently because of lack of cover. A healthy stand of deciduous vegetation would provide structure for increased diversity and populations of terrestrial and aquatic insects which are important food items for redband trout (Chapman and Demory 1963) and amphibians. In addition, the leaf drop of deciduous trees will provide increased quantities of organic material and nutrients which will be available for aquatic insects and invertebrates (Cummins 1974). The increase in riparian vegetation and large woody material is expected to help stabilize stream banks, reduce erosion and lead to the development of undercut banks. It will also trap sediment from upstream sources (Platts 1991).

In noncommercial thinning units, the trees are too small to be sold as conventional mill products; these trees would be left on site after cutting and would be available for firewood, posts and poles, or other uses. Noncommercial thinning projects include both cutting dense understory trees, and cutting juniper to restore upland grass and shrub communities. Prescribed fire or grapple piling would be used to reduce fuels created by thinning. Treatment units contain riparian habitat that would be lightly thinned to develop and maintain a high forest canopy for shade or to promote development of broadleaf shrub and tree cover.

Thinning is expected to increase individual tree growth and promote the development of large trees and LWD recruitment to the stream channel. Fish habitat would improve due to increased cover and pool formation with LWD input (Bjorn and Reiser 1991). Increased LWD will also slow hydraulic gradients, reducing potential erosion during high flow events, help to develop narrower and deeper channels, catch and retain sediment and organic matter, and would allow fish colonization of previously unused habitat.

Natural fuels and activity fuels underburning would avoid burning large wood in RHCAs. There would be no hand fire lines within 20 feet of Class II and III RHCAs and within 10 feet of Class IV RHCAs. Fire may be purposely ignited within RHCAs to protect structures, create fuel breaks, and to thin seedlings with fire. Fire may also creep into RHCAs, but has been designed to retain large wood and riparian vegetation. Prescribed fire has been designed in each alternative to minimize the potential effects of fire in RHCAs. Treatment in RHCAs would rejuvenate riparian plant species composition. This would accelerate the improvement of riparian plant species more closely to the natural rate of recovery. These underburning activities would not have more of an effect on fish habitat or fish than a naturally-occurring, low-intensity fire. Naturally-occurring fire would move in and out of the riparian areas, removing vegetation in a mosaic pattern. Large down wood in RHCAs would be minimally impacted from the underburning activities. The proposed prescribed fire includes underburning some forest stands after thinning, and underburning some unthinned stands to maintain the existing low fuel levels. Prescribed fire reduces surface fuels, which reduces the potential intensity and resistance to

control of future wildfires. Prescribed fire would also be used to reduce seedling and sapling density; regenerate grass, forbs, and shrubs; and reduce the encroachment of western juniper into pine stands.

Burning would be conducted for approximately a 10-year period and scattered throughout the East Maury area to meet the disturbance regime. In the short term, there would be a slight increase in the potential for sedimentation if a rain event occurred immediately after the treatment before vegetation is reestablished. Acreages of prescribed fire treatments would be similar in Alternative 2 (741 acres) and Alternative 3 (793 acres).

Fire objectives (FM-1, FM-2) in INFISH would be met in each alternative. Fire is designed to enhance Riparian Management Objectives by treating fuels to reduce the risk of high-intensity wildfire and minimize disturbance of riparian ground cover and vegetation. Strategies 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. These actions such as fire retardant, incident bases, camps, helibases, staging areas, and helispots are not planned to be used to carry out prescribed fire objectives and operations.

With treatment by fire and noncommercial thinning within RHCAs, there would be an increase in large wood recruitment for future decades as trees increased in size, died, and fell into the RHCA. Since shade would not be reduced riparian woody vegetation would not increase as quickly as in the case of a wildfire where the canopy in RHCAs becomes open with sunlight reaching the vegetation.

A roads analysis (East Maury Roads Analysis) was completed prior to analysis of the proposed alternatives to determine the influence of each road on riparian areas and to identify roads no longer needed for access. Road construction and use may impact water quality and timing by increasing sediment delivery, reducing infiltration, and increasing the rate of water delivery to streams. Most sediment production outside stream channels in the project area results directly or indirectly from roads. Roads within RHCAs disturb overland and groundwater flow, can reduce shading, displace deciduous vegetation and reduce potential for large woody debris recruitment. Road crossing of streams can impede natural flow (USDA 2003). **Appendix B** identifies road activities proposed under each alternative

To avoid opening a section of Road 1600-500 that closely parallels Tom Vawn Creek, access to the east side of Tom Vawn Creek will be provided by reconstructing a crossing lower in the drainage on road 1600-640 or alternately on 1600-640-018. The crossing on 1600-640 would be on a temporary bridge. A 0.25 mile section of Road 1600-500 will be decommissioned. A temporary bridge would be installed on Wiley Creek tributary 1 (Road 1600-452). Temporary crossings would be in for about one year, and removed at the completion of harvest activities. After removal of the temporary crossing, shrub planting would occur at each crossing to restore vegetation cover.

Road 1680-050 at Wildcat Creek is a high sediment source to the creek because of lack of drainage and hardened road surface. The road has areas where the surface is failing and washing down into the stream. The culvert is undersized for the 100-year flood and for continuous fish passage. The road surface leading into the drainage needs to be reconstructed and the culvert replaced. Currently high spring flows exceed the capacity of the culvert and run over the road creating a chronic sediment problem to the stream for water quality and fish habitat. High velocity through the undersized culvert scours the stream channel and outlet feeding more

sediment into the stream. Excessive sediment into the stream reduces the quality of food (macroinvertebrates) available to fish. The current culvert has a jump at the outlet and does not accommodate fish passage. Using this road as it is would increase the damage to the surface of the road and cause increasing sedimentation over existing condition. Deterioration of the road would continue from use by log trucks. The existing culvert would be used and removed. Then the channel would be restored. Restoration includes headcut repair, re-establishing channel grade, restore floodplain, restoring fish passage, shrub planting. Fish habitat would be restored in the area of the culvert and sediment reduced over existing condition. Removing the culvert and restoring the stream channel would improve the habitat conditions and provide fish passage for redband trout and Columbia spotted frogs.

In the letter dated September 22, 1995, Implementation of the Inland Native Fish Strategy, p. A-3, question 13 concerning road management projects, the letter states:

While short-term effects must not be great enough to jeopardize the Riparian Management Objectives, avoidance of all short-term effects should not be allowed to preclude management changes or restoration actions necessary for the long-term recovery of habitats and/or populations.

Sedimentation to streams is discussed in the Water Quality section. Road decommissioning and inactivation within the RHCAs would likely reduce bank erosion at stream crossings and sediment from road surfaces and allow for stream channels to maintain function.

Alternatives 2 and 3 may impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species for redband trout or habitat. The action alternatives were designed to enhance or improve dimension, pattern, and profile to streams. There would be no adverse physiological changes or adverse biological changes as a result of any of the action alternatives as defined by INFISH. Chapter 2 includes Design Criteria and Resource Protection measures that were developed by the interdisciplinary team to comply with standards and guidelines in INFISH.

Short-term sedimentation from project implementation would not be measurable and project activities would not harass fish or frogs. Fish may be displaced for a short period of time during the activity but fish would have refuge in other areas of the stream away from project activities. Fish and frogs would not be annoyed or tormented repeatedly and persistently by the proposed activities such that a decline or diminishment of the habitat necessary for the survival of native inland fish or frogs would be caused.

Cumulative Effects – Redband Trout

Harvest and other management history on National Forest lands are summarized on pages 3-2 to 3-3 and are also discussed in more detail in the Aquatic Species Report. The treatment history has affected the ability of watersheds in the project area to provide habitat for redband trout. Past timber harvest has reduced shade on some stream reaches. Proposed timber harvest and precommercial thinning in approximately 34 percent of the planning area (plus juniper thinning in an additional 13 percent) in the action alternatives, combined with past vegetative treatments, can reduce interception and evapotranspiration, increase snow accumulation, and change snow melt rate and timing, which could increase stream flow and the potentially the magnitude of peak flows. Increased stream flows could expand the distribution of fish in some streams, and could also provide deeper pools for fish to occupy. On the other hand increased peak flows could alter sediment delivery and stream substrates, which can impact spawning habitat and fry. Due to past

harvest practices, fire suppression, and current conifer stocking, many of these conifer stands would benefit from thinning (commercial and noncommercial thinning) and activity fuels under burning. Without treatment, it could take more than a century to begin to move the vegetation towards historical conditions (Hagans et al. 1986). Conifer thinning is expected to increase individual tree growth and promote the development of large trees and LWD recruitment to the stream channel. Fish and amphibian habitat would improve slightly due to increased cover and pool formation with LWD input (summary by Bjorn and Reiser 1991). Increased LWD will also slow hydraulic gradients, reducing potential erosion during high flow events, help to develop narrower and deeper channels, catch and retain sediment and organic matter, and may allow fish colonization of previously unused habitat. Neither action alternative is expected to have effects that combine with the effects of past, present or reasonably foreseeable actions to produce measurable increases in the maximum water temperature. Potential short term changes in shading as a result of aspen treatments is not expected to result in any measurable increase in water temperature, due to the small size of area treated much of which would be too far from streams to influence shading. All alternatives would meet state water quality temperature standards and INFISH riparian management objectives (RMOs). Refer to the Water Quality section for more detailed discussion of potential effects to water yield, temperature and turbidity.

Implementation of the Maury Mountain AMP EIS should promote recovery of streamside vegetation. It is reasonably foreseeable that there will be an improvement in riparian condition due to changes in the range utilization standards in the Grazing Implementation Monitoring Module (IIT, 2000) and the 2006 Maury Mountains Allotment Management Plan. Having more cover by riparian plants should promote stream channel stability, shade and improved ability of streams to carry peak flows, and to capture and store sediment. In the long term this should lead to improvement in fish habitat compared to existing conditions. The effects of the proposed activities should contribute to this upward trend by increasing forage on the uplands so that there is less pressure to graze the riparian zones.

Harvest treatments on private land below the forest boundary have been similar to those on the Forest. There is currently no logging on private land adjacent to the project area. Based on species composition and past harvest activities, any future logging on private would probably be selective harvest. Commercial forest land is limited adjacent to the project boundary and is confined to several small stands totaling approximately 440 acres. The largest area is in the Indian Creek subwatershed in the southwest corner of the project area.

Columbia Spotted Frog

Columbia spotted frogs inhabit a variety of vegetation communities, including coniferous or mixed forests, grasslands, and riparian areas of sage-juniper brush lands. Frogs have also been associated with vegetation indicating permanent water sources (i.e., willows and submerged aquatic plants rather than with emergent vegetation such as sedges) and vegetation providing hiding and thermal cover (e.g., willows). Spotted frogs are located in similar habitats in the East Maury project area. Three main components must meet necessary criteria for adequate breeding and larval habitat: water bodies, vegetation, and temperature.

Alternative 1

There are no activities proposed in Alternative 1 that would directly alter spotted frog habitat. Solar exposure of potential habitat would not be increased. In open canopy areas where woody vegetation is present along streambanks, shade would increase. Increasing shade over streams

contributes to reducing water temperature and moderation of climatic extremes, and acts as hiding cover for Columbia spotted frogs. This alternative would have no impact to Columbia spotted frog in the short term. However, over time fuel loading would continue the progression toward a higher risk of high intensity fire. In the long term there is potential for indirect effects associated with fuel loading that would carry a high intensity wildfire, potentially over a large area. If a large scale high intensity fire was to occur, increased solar input to streams would result from decreased shade. Increases in water temperature and drying of the riparian zone would be proportional to the amount of canopy lost and the aspect. It is difficult to predict the time, or the scale and intensity at which event(s) might occur, but it is expected that future fires would be larger and more intense than what happened historically due to increased ladder fuels and higher fuel loadings.

Alternatives 2 and 3

The Project Design Criteria contained in the *Aquatic and Terrestrial Programmatic Biological Assessment for Federal Lands Within the Deschutes and John Day River Basin's Administered By The Deschutes and Ochoco National Forests* (USDA/USDI, 2006) were designed to protect and maintain ponds, lakes, sloughs, wet meadows, and other wetlands, high channel complexity and stability, abundance and diversity of side channel habitats, water quality, low levels of fine sediment, in-stream wood, and wood recruitment. The criteria are also designed to protect and maintain hydraulic regimes and temperatures that are consistent with unaltered basins, and maintain, restore, and open connective corridors to spotted frog suitable habitat.

Fuels treatments would occur in the spring and fall. Hand piles would be burned later in the year after the first snow. Egg deposition occurs for frogs soon after snowmelt. Eggs are normally deposited in water at temperatures of approximately 57.2 degrees F. Fire does not creep through seeps, bogs, springs, meadows, and any other wet area. Hand fireline would be avoided through these areas. Foraging areas that take place in the summer would not be affected by fuels treatments that take place in the spring and fall.

Restoring existing roads within RHCAs reduces sedimentation from existing condition by improving road surfaces and drainage. Activities would occur when the flows of streams are low and eggs produced during spawning have hatched. Precipitation is low during the summer months in the project area. Frogs make use of summer foraging in small wet or damp areas in forest and meadows, including water-filled tracks, stream edges, and marshes. Frogs that use water-filled tracks from vehicles may be affected by restoration of existing roads in RHCAs by heavy equipment. Current visitor traffic that impact frogs using water-filled tracks would no longer impact these frog sites as roads are improved or closed. Treatments would occur after eggs have hatched.

During project implementation, ponds, seeps and wet areas that could be used by frogs would not have harvest activities. Vegetation for summer and winter habitat would be improved by implementing hardwood treatments. Increased riparian vegetation increases cover and closed areas for increased humidity needed for frogs.

Harvesting trees outside of RHCAs would not contribute to changes in frog habitat. Ponds, seeps, and wet areas that could be used by frogs would be protected.

When trees fall in the RHCA, many of them move into the stream channel over time with spring flows. The wood becomes lodged in the stream channel trapping small wood, creating log dams, side pools, and side channels. Pools develop from the wood backing up water. Pools are deeper

than the riffles and have cooler water temperatures because of the depth. Hiding cover is created from the wood in the stream and formation of the pool. Sediment is trapped within the wood structure. These areas are used by frogs. Foraging, breeding and over-wintering sites would be improved. Pools and cooler temperatures are needed by frogs for survival. Humidity maintained by cover and the increase in pools from large wood improve likelihood of frog survival.

Project Design Criteria for Columbia spotted frogs (USDI USDA Programmatic BA 2006-2009) would be met for Alternatives 2 and 3. The determination for Columbia spotted frogs would be “may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species” for Alternative 2. Treatments would occur outside of the breeding season that reduces vulnerability of frogs during activities.

In Alternative 3, there would be no new road building or crossings on Tom Vawn Creek, Stewart Creek tributary 1, Poison Creek, and Wiley Creek tributary 1 (1600-452) as proposed in Alternative 2. Project Design Criteria for Columbia spotted frogs (USDI USDA Programmatic BA 2006-2009) would be met for Alternative 3. The determination for Columbia spotted frogs would be, “may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species” for Alternative 3. Treatments would occur outside of the breeding season that reduces vulnerability of frogs during activities.

Cumulative Effects - Columbia Spotted Frog

Harvest and other management history on National Forest lands are summarized on pages 3-2 to 3-3 and are also discussed in more detail in the Aquatic Species Report. The treatment history has affected the ability of watersheds in the project area to provide habitat for redband trout.

Cumulative effects from past, present and reasonably foreseeable actions combined with effects from the proposed actions are the same as described above for redband trout. Refer to the Aquatic Species Report for additional detail on impacts to spotted frogs.

Sensitive, Threatened and Endangered Plant Species

Affected Environment

The Biological Evaluation for botanical species prepared for the project documents potential effects of proposed activities on sensitive, threatened and endangered species in the project area. There are no federally listed threatened or endangered plant species or habitat or proposed species known or suspected to occur on the Ochoco National Forest. There would be no effect to proposed, threatened or endangered plant species. Refer to the Biological Evaluation for more detailed information on the analysis of impacts to threatened, endangered and sensitive plant species. A table which displays a summary of the impacts to these species is provided in **Appendix C**.

Pre-field reviews and plant surveys conducted between 1990 and 2005 determined that 14 sensitive species are known to occur in the project area or have potential habitat. These species have been grouped where they occupy similar habitats and where the anticipated effects of alternatives are similar. The habitat groups include riparian, moist forest, and non-forest scabland. Sensitive species under each of these groups are listed below.

Riparian Species

ascending moonwort (*Botrychium ascendens*)

crenulate moonwort (*Botrychium crenulatum*)

Mingan's moonwort (*Botrychium minganense*)
mountain moonwort (*Botrychium montanum*)
twin-spike moonwort (*Botrychium paradoxum*)
pinnate moonwort (*Botrychium pinnatum*)
Peck's mariposa lily (*Calochortus longebarbatus* .var. *peckii*)
porcupine sedge (*Carex hystericina*)
interior sedge (*Carex interior*)
silverskin lichen (*Dermatocarpon luridum*)
margined streamside moss (*Scouleria marginata*)

Moist Forest Species

Back's sedge (*Carex backii*)

Scabland Species

Henderson's needlegrass (*Achnatherum hendersoni*)
Wallowa needlegrass (*Achnatherum wallowaensis*)

Riparian Species (Including Wet Meadows, Seeps and Springs)

Peck's Mariposa Lily

Peck's mariposa lily is a local endemic, known only from the Ochoco Mountains of Eastern/Central Oregon. Most populations occur along drainages associated with Big Summit Prairie and Little Summit Prairie, with other populations recorded on McKay Creek, Marks Creek, and the drainages of the Maury Mountains and Snow Mountain.

The majority of Peck's mariposa lily populations were documented in the early 1990's. In 2003, additional populations were documented just outside the East Maury area, in areas acquired in a land exchange. Compared with other portions of the Ochoco National Forest, the East Maury project area contains a low amount of potential habitat, with documented populations near Wildcat Creek and Shotgun Creek. Potential suitable habitat occurs in units 29, 58, 124, 222, 249, 264, 267, 269 and 276.

Human impacts have resulted in reductions of both individual plants and habitat. Road construction and timber harvest with heavy machinery resulted in soil disturbance that impacted individual plants because of their shallow root system. Soil compaction and erosion have reduced potential future recruitment by changing hydrological patterns in Peck's mariposa lily habitat. Other activities, such as slash piling and burning, resulted in scorched soils, damaging plants and their habitat, increasing risk for introduction and spread of non-native invasive plants that could displace Peck's mariposa lily.

Non-native plants have also likely contributed to a decline in Peck's mariposa lily. Sensitive plant site records indicate non-native grasses such as timothy (*Phleum pratensis*) and Kentucky bluegrass (*Poa pratensis*) are ubiquitous in Peck's mariposa lily sites. These non-native grasses have been present for several decades, and do not appear to threaten viability. However, teasel (*Dipsacus sylvestris*) and Canada thistle (*Cirsium arvense*) are beginning to dominate some areas of suitable habitat for this sensitive species, including one historic Peck's mariposa lily sub-population (in another portion of the Ochoco National Forest). It appears teasel invasion into Peck's mariposa lily habitat has resulted in extirpation of this sub-population.

Moonworts

Several species of *Botrychium* are on the Regional Forester's Sensitive Species List (USDA Forest Service 2004a). The six species of sensitive moonwort known to occur on the Ochoco National Forest occupy similar riparian habitats, and are discussed here as one group. The six moonwort species are considered rare and local species, meaning the few, known populations are usually small.

These are small, primitive plants closely related to ferns. Habitat for the six moonwort species is primarily moist ground sedge/forb communities associated with seeps, drainages, and the edges of wet meadows at relatively high elevations, generally over 5,000 feet. Moonwort sites also are more commonly found within or adjacent to coniferous forest, especially grand fir communities. Though several surveys have been completed, none of these species have been documented in the East Maury area (Veverka 2003). However, these small plants are easily overlooked, except during very intensive surveys.

Known sites occupied by populations of moonwort in other portions of the Ochoco National Forest are partially shaded to fully open at the edges of clearcuts. However, more individuals have been found at intact sites versus altered sites. At least one population is in a natural wet meadow. Habitat and populations appear to be stable (Lesko, personal observation).

It has been suggested that moonwort are dependent on some level of disturbance, and the ensuing lack of competition from other plant species for reproduction. However, this disturbance has often been observed to be natural, such as flooding or other natural processes that occasionally create small openings for spores to become established. Human impacts have resulted in reductions of both individual plants and habitat (Lesko, personal observation). Road construction and use of timber harvest machinery resulted in soil disturbance, compaction and erosion has reduced potential future recruitment by changing hydrological patterns in moonwort habitat. Other activities, such as slash piling and burning, resulted in scorched soils, damaging plants and their habitat, increasing risk for introduction and spread of non-native invasive plants that could displace moonwort plants.

Porcupine Sedge and Interior Sedge

On the Ochoco National Forest, porcupine sedge has been found only along Black Canyon Creek and other creeks on the Paulina Ranger District. It also occurs in the Bridge Creek watershed on public lands administered by the BLM. Though surveys of potential habitat have been completed, this species has not been documented in the project area. It also appears to be more often associated with non-forested lower elevations, and therefore may not occur in the East Maury area.

Interior sedge has been documented on the Ochoco National Forest, including the Maury Mountains but outside the East Maury area. Both species appear to be tolerant of moderate grazing disturbance (Lesko, personal observation). In Oregon, habitat for these species appears stable (Lesko, personal observation, Yates, personal communication, Halvorson, personal communication). Few areas of potential habitat in the project area presently appear to be threatened by non-native invasive plants.

Silverskin Lichen and Margined Streamside Moss

This lichen has been documented in a variety of aquatic habitats in Washington, Oregon, and California. Because perennial streams occur in the project area, habitat is presumed present. Habitat does not appear to be threatened by invasive species. Livestock use that results in

physical damage by hooves could impact this species, but maintaining habitat for this species appears to be more related to maintaining water quality.

This moss species is endemic to the Pacific Northwest, found in southern British Columbia, Washington, Idaho, western Oregon, and northern California (Harpel, 2005). Surveys have occurred on other portions of the Ochoco National Forest, and this species was not found. However, because perennial streams occur in the project area, habitat is presumed present. Habitat does not appear to be threatened by invasive species. One threat appears to be livestock use that results in physical damage to plants by hooves. However, closely-related species appear to occupy rocky, steep stream habitats that are not usually associated with high livestock use. Other activities, such as road construction and timber sales, and in-stream work such as culvert replacement or channel modifications, can impact water quality and affect this species.

Moist Forest Species

Back's Sedge

Back's sedge occurs across much of the western United States and Canada, though it is less common in the Pacific Northwest (Wood 2002). In Central Oregon, this species was last documented in 1916 on private land at "Cabin Station Pasture," adjacent to the Ochoco National Forest along Ochoco Creek.

Though surveys have been completed on a variety of sites throughout the Ochoco National Forest, including the East Maury project area, this species has not been recently documented on the Forest or in Central Oregon. These and earlier surveys indicate this species is likely not present in the East Maury project area, and appears likely to have been extirpated from Central Oregon. Closest known populations presently known are approximately 100 miles east of the East Maury project area.

Non-forest Scabland Habitats

Henderson's Needlegrass and Wallowa Needlegrass

These perennial grasses are regional endemic species. Closest documented populations are on land managed by the BLM within the North Fork Crooked River watershed. None have been documented within the project area, though few areas of suitable habitat have been surveyed. Proposed treatment units adjacent to potential suitable habitat include 13, 21, 53, 61, 68, 71, 87, 88, 96, 111, 151, 158, 161, 164, 200, 202, 220, 233, 238, 267, and 269. Additionally, new road construction needed to access units 13, and 258.2, would cross potential habitat for these plants.

Studies indicate that where scabland soils occur on slopes exceeding 15%, measurable erosion has occurred over the last 100 years. As a result of these changes, productivity and plant community composition has also likely changed due to the loss of surface soil, grazing, and invasion by exotic species. Monitoring indicates the majority of this change occurred several decades ago. Though this species occurs on these altered sites, it is difficult to estimate effects of these changes on needlegrass populations.

Where scablands occur on flatter slopes, less erosion has occurred, indicating little change in productivity and plant communities (David, 2001). Scabland habitat associated with this species presently appears to be stable, and, except for road construction and some damage by OHV traffic, has changed little over the last few decades. Because scabland habitat does not recover from disturbance, protection is emphasized under direction of the Forest Plan and Crooked River

National Grassland Land and Resource Management Plan. Long term effects of exotic grasses on this species are unknown, but if associated soils remain undisturbed, effects of exotics are less apparent. On the Ochoco National Forest, the majority of this habitat appears to be stable, and is expected to remain suitable for these species.

Environmental Consequences – Sensitive Plants

Alternative 1

This alternative includes no disturbance, such as road construction, timber harvest, burning or other activities that could affect viability of these species. Habitat would be maintained. Monitoring indicates habitats for all 14 species are currently stable, and would be maintained. Therefore, no impact to Peck's mariposa lily, the six moonwort species, porcupine sedge, interior sedge, silverskin lichen, and margined streamside moss would occur under this alternative. Since Peck's mariposa lily appears to decline if competition is not set back due to fire or other disturbance, the continued policy of wildfire suppression and lack of management practices, such as tree thinning and prescribed burning, may lead to a long-term (>10 years) decline of Peck's mariposa lily (Kagan 1996, Halvorson 2003).

Alternative 1 avoids ground-disturbing activities on scablands that provide the primary habitat for Henderson's needlegrass and Wallowa needlegrass. Therefore this alternative is expected to result in no impact to these species.

Alternatives 2 and 3

Riparian Species

Effects to sensitive plants from alternatives 2 and 3 are expected to be the same. Soil disturbance from heavy machinery can directly impact individual plants. Soil compaction or erosion can impact future recruitment by changing hydrological patterns in riparian habitat. Heavy thinning slash can bury plants, and burning these higher fuel loads can scorch soils, damaging plants and their habitat, and increasing risk for introduction and spread of non-native invasive plants that could displace sensitive plants. **Appendix B** displays potential sensitive species habitat with each of the proposed East Maury project units.

In the long term (>10 years), management activities such as thinning and burning may improve habitat for Peck's mariposa lily by reducing competition from conifers and other competing vegetation (Kagan 1996).

All of the action alternatives avoid mechanical disturbance of known populations and high probability habitat for Peck's mariposa lily, the six moonwort species, porcupine sedge, interior sedge, silverskin lichen, and margined streamside moss. Except for existing roads and selected crossings, no ground-based equipment would be used in any RHCA's or other areas identified as habitat for these species.

If available, native grass and forb seed would be used for rehabilitation of roads, primary skid trails, and log landings, including those in riparian areas, to reduce potential for erosion and introduction and spread of noxious weeds. Additional seeded grasses and forbs could move into Peck's mariposa lily habitat. Populations of native and non-native grasses and non-invasive forbs appear to have shared this habitat with Peck's mariposa lily for decades. Therefore, seeding is not expected to increase risk to Peck's mariposa lily. On highly disturbed sites such as roads, seeded grass and forbs can colonize these sites and reduce risk of some noxious weeds,

such as teasel, which appears to be a greater threat to Peck's mariposa lily. Habitat for moonworts, interior sedge, and porcupine sedge is very moist. These areas would be avoided.

Actions including road maintenance, reconstruction and decommissioning, non-commercial thinning, and fuels treatments that would occur within the RHCAs may damage some individual plants or their habitats. However, these activities would: (1) only affect the periphery of such habitat (e.g. thinning along a meadow edge); (2) not burn with high intensity; (3) affect areas already heavily disturbed (e.g. road decommissioning); or (4) otherwise occur primarily in marginal habitat or other areas unlikely to affect viability of populations. Therefore, anticipated short-term effects (<10 years) would be that some individuals or habitat may be affected, but would not be likely to contribute to a trend towards federal listing or a loss of viability to sensitive plant species associated with riparian areas, wet meadows, or seeps and springs.

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

Activities that maintain, enhance, or degrade water quality are expected to have similar effects to habitat for silverskin lichen and margined streamside moss.

Moist Forest Species

Most of the suitable habitat for this species is associated with upland portions within RHCAs. Though surveys indicate Back's sedge is not likely to occur in the project area, and may no longer occur in Central Oregon, potential habitat does exist. With the exception of areas such as existing roads and crossings, timber harvest and fuels treatments in RHCAs would be completed without the use of ground-disturbing machinery. Where vegetation management prescriptions in these areas are proposed, they are modified to limit equipment use and maintain large wood within RHCAs.

Weather and fuels moisture conditions associated with prescribed burning generally result in little to no fuels consumption in the moist forest habitats associated with this species. Therefore, this activity is not expected to affect viability of Back's sedge.

Seeding of upland grasses and forbs would occur on portions of decommissioned roads, log landings, and skid trails, including those in habitats associated with Back's sedge, to stabilize soils and reduce potential for noxious weed introduction or spread. These grasses are already present in many areas of the Ochoco National Forest, and primarily occur on heavily disturbed areas such as road shoulders and log landings. In general, they do not appear to be aggressive in displacing existing native vegetation; they are not expected to colonize undisturbed areas and affect the viability of Back's sedge.

Activities such as road maintenance and road decommissioning may in the short-term affect some habitat, but are expected to result in long-term enhancement of associated habitat by reducing impacts from vehicles. Non-commercial thinning and aspen treatments would include cutting conifers and burning slash that could impact habitat, but this activity would not use ground-based equipment. Therefore, some individuals or habitat may be impacted by

implementation of these alternatives, but is not expected to lead to a trend towards federal listing or affect viability of Back's sedge.

Non-Forest Scabland Habitat Species

Actions including road maintenance, reconstruction and decommission, non-commercial thinning, and fuels treatments may damage some individual plants or their habitats. These activities are expected to only affect the periphery of such habitat (e.g. thinning along a scabland edge), areas already heavily disturbed (e.g. road decommissioning), marginal habitat, or other areas unlikely to affect viability of populations. Units adjacent to scabland and could impact these species include: 13, 21, 29, 53, 61, 68, 71, 87, 88, 96, 111, 112, 151, 158, 161, 164, 200, 202, 220, 233, 238, 254, 258.2, 267, 269, and 281. New road construction on scabland in Unit 13, Road 1600-500-013, could also impact these species.

Henderson's needlegrass and Wallowa needlegrass occur on areas with relatively low fuel density, these sites can only burn during extreme conditions, such as during high winds on hot summer days. Because prescribed burning occurs during spring and fall, it is not expected to affect scabland habitat. Therefore, the anticipated effects would be that some individuals or habitat may be affected, but would not be likely to contribute to a trend towards federal listing or a loss of viability to sensitive plant species associated with scabland habitats.

Cumulative Effects – Sensitive Plants

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

Though habitat quality has declined since pre-settlement, on the Ochoco National Forest, observations and monitoring over the last decade indicate habitats for Forest sensitive species are generally stable, despite continuing influences from livestock, noxious weeds, recreation use, etc. Sensitive species associated with scablands, or non-forest balds, have changed little in the last few decades, and are expected to remain in their current condition. In some areas, riparian improvement projects, such as planting, headcut repair, and development of riparian pastures appear to have enhanced or expanded habitat for sensitive species associated with riparian areas. Where conifer thinning (and follow-up burning) has occurred, forest stands have moved towards conditions more closely approximating pre-settlement. This is expected to benefit sensitive plant species that favor open conditions. An example is where thinning and prescribed burning occurred along a forest/meadow interface where fire suppression has resulted in conifer expansion into meadow habitat (Arno 2000). Meadow habitat associated with Peck's mariposa lily has increased, reversing the trend of "shrinking meadows."

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

On upland forest sites, prescribed burning has resulted in increased exposed soils, which have increased susceptibility to noxious weed introduction and spread. This risk increases when prescribed fire exceeds normal intensities, such as occurs during unanticipated weather changes during burning activity. Burning has improved forage production and palatability, and in some

areas resulted in increased livestock use. Where these areas burned too hot, or where livestock grazing occurred before sufficient recovery of vegetation and the soil organic layer, grazing has impacted these areas by compacting and displacing soil, and increase risk of erosion, riparian degradation and served as vectors for introduction and spread of noxious weeds (DeClerk 1997, DiTomaso 1997, Miller and Rose 1999, Arno 2000, Asher and others 2001, Zimmerman and others 2002). This could affect long-term (>10 years) viability of sensitive plants and habitat. However, large-scale burning can also help distribute livestock, and its impacts, over a wider area. Grazing has occurred on what is now the Ochoco National Forest for over a century. There is also a twenty-year history of prescribed burning and successive livestock use. Sensitive plant populations presently appear stable following these activities.

With the current vegetation and fuels conditions in the East Maury project area, wildfire is foreseeable and could affect native plant communities and associated sensitive plants directly (Owen 2003). The sensitive plant species associated with riparian areas, are not expected to be affected by wildfire. These species occur in areas that are generally moist year round, or in the case of Peck's mariposa lily, are dormant during wildfire season and also in areas with generally light fuel loads, and therefore are not expected to burn with high intensity. Peck's mariposa lily is generally recognized as dependent on disturbances such as wildfire (Kagan 1996, Kaye and others 1990, 1994).

Species associated with scabland occur on areas with relatively low fuel density. However, these habitats are known to burn during wildfire events (Johnson 1998). Therefore, these species are likely to be adapted to, and remain viable with periodic wildfire.

Back's sedge has been documented in riparian areas, which are generally moist year-round. It may also be associated with upland conifers, indicating it is adapted to periodic fire. Therefore, wildfire is not expected to affect viability of this species.

Wildfire could also affect native plant communities and associated sensitive plants indirectly by increasing susceptibility to noxious weeds (Asher et al 2001). In general, thinning and fuels reduction treatments that move conditions towards the historical range would reduce potential adverse effects due to wildfire.

Existing untreated infestations of non-native invasive plants are expected to spread, and threaten plant communities by directly displacing native vegetation, including sensitive plant species. Though teasel appears to have impacted at least one sensitive plant sub-population, and Canada thistle also occurs in sensitive plant habitats, they currently do not appear to have a measurable effect on the overall viability of sensitive plant populations. Though Canada thistle is expected to expand, impacts to viability of sensitive plants are presently not foreseen. Introductions or spread of biological control agents on the Ochoco National Forest may ultimately result in a decline of Canada thistle. Assuming noxious weed control continues, weeds are less likely to affect sensitive plant habitats. Therefore, no cumulative effects are expected on sensitive plant species that would change the direct and indirect effects described in the previous section.

In view of the past and continuing activities, assessment of future activities, expansion of noxious weeds, and assessment of general wildfire effects on sensitive plant species, cumulative effects are expected to not change the findings determined in the direct and indirect effects.

Non-native Invasive Plants (Noxious Weeds)

Affected Environment

Non-native invasive plants are aggressive plants capable of degrading environmental quality or causing economic harm. Noxious weeds are a subset of these plants, and designated “noxious” by the Secretary of Agriculture or state agencies (U.S. Congress 1974, U.S. President 1999, USDA 1999, ODA 2001). In this EIS, both “noxious weed” and “non-native invasive” are used to describe plants considered “non-native invasive” on the Ochoco National Forest. The Ochoco National Forest is currently managing noxious weeds under the 1998 Integrated Weed Management Plan and Environmental Assessment/Decision Notice (USDA 1998), and the Forest Plan, as amended July 25, 1995, to implement noxious weed management. Weed management includes a variety of strategies, depending on the species, size of infestation, and location. Monitoring of treated infestations has shown that weed control has been effective, and herbicide use has declined where treatment has occurred. However, new infestations of all invasive plants are occurring, and are likely to continue. For more detailed information on the noxious weeds, including the noxious weed risk assessment refer to the Botany Report.

Over 80 noxious weed infestations have been documented within the East Maury project area. Most of the existing weed species have been present in the area for at least a decade. Weed inventories indicate most infestations begin on disturbed areas, such as road shoulders, old log landings, and recreation sites. With most infestations along roads, primary introduction of noxious weeds appears to be through vehicles. Other vectors include water (e.g. streams), wind, livestock, wildlife, and mineral material and heavy equipment used for road maintenance and construction projects.

In 2003, pre-project surveys were completed along both open and closed roads within the project area, where weeds most commonly occur. Additional weed surveys occurred in 2007. Common weed species, such as teasel and Canada thistle, have not been completely documented, especially where scattered individual plants occur along road shoulders. The following lists non-native invasive plants in the East Maury project area:

- spotted knapweed (*Centaurea maculosa/C. biebersteinii*)
- diffuse knapweed (*C. diffusa*)
- Dalmatian toadflax (*Linaria dalmatica.*)
- white top (*Cardaria draba*)
- Scotch thistle (*Onopordum acanthium*)
- sulfur cinquefoil (*Potentilla recta*)
- Canada thistle (*Cirsium arvense*)
- bull thistle (*Cirsium vulgare*)

Canada thistle may be the most common noxious weed in the East Maury project area. It can be found on a variety of sites, including rock pits, roadsides, dispersed camping areas, meadows, old harvest units, and others. In susceptible areas, numerous, small infestations of this plant are often followed by rapid expansion (Sheley 2004). This perennial plant has an especially deep root system, making hand-pulling infeasible. Because Canada thistle is so common, management has focused on release of biological controls, where they have established in some areas of the Ochoco National Forest. However, within the East Maury project area,

establishment has been limited, and Canada thistle infestations continue to expand. Although releases are expected to continue, the long term effectiveness of biological controls is unknown.

Another widespread species, bull thistle, is not receiving herbicide or mechanical treatments. Though bull thistle quickly establishes the first few years following burning or timber harvest, its density decreases over time as other vegetation becomes re-established.

New infestations of a variety of species have been documented within the project area, which were not included for chemical control in the 1998 *Noxious Weed Environmental Assessment*. Currently, treatment of new infestations is largely limited to hand-pulling. Individual noxious weed plants are occasionally found by field-going personnel outside these documented infestations and are hand pulled and removed when encountered.

Natural controls do exist in the form of dense forest cover and the soil organic layer. This forested condition helps to keep most weed infestations restricted to roadsides and other disturbed areas such as landings.

Proposed logging activities would remove vegetation and disturb the soil organic layer, increasing potential for introduction and spread of noxious weeds. Although prescribed burning is normally low-intensity, burning slash piles or intense burning that results in scorched soils can exacerbate risk of weed infestations, by increasing time for establishment of vegetation and the soil organic layer.

Two types of analyses are included in the risk assessment. The first compares the amount of exposed soils for alternatives, and the other uses a checklist of risk factors, such as burning adjacent to infestations, etc. The risk assessment comparison of disturbed acres only includes direct and indirect effects of the alternatives. The risk factors assessment includes these effects, as well as the cumulative effects of recreation use, etc.

Environmental Consequences - Weeds

Alternative 1

Alternative 1 includes no road construction, timber harvest, slash piling or burning that would result in ground disturbance. Because no ground disturbance would occur, risk for introduction and spread of noxious weeds would not increase. The present level of risk would continue from existing infestations. Compared with ground disturbance associated with other alternatives, Alternative 1 offers the least amount of risk.

Treatment strategies are already implemented in the area due to existing weed infestations. Since 1996, targeted infestations of specific weeds have been treated with herbicide and manual controls. Monitoring indicates that in most areas where treatment has occurred, density of noxious weeds is decreasing. This is most apparent in those areas receiving herbicide treatments. Weed treatments are expected to continue under the existing weed management plan, until a new management plan is adopted.

Alternative 1 creates no additional ground disturbance, and is the baseline for comparison. Therefore, this alternative would have no potential for increasing the risk for introduction and spread of noxious weeds. However, new weed infestations are still likely to establish within the analysis area as a result of present and reasonably foreseeable activities, such as vehicle use by the public, grazing, etc.

Alternatives 2 and 3

Table 3-42 lists the non-native invasive plants infestations documented in the East Maury project units. Additional weed infestations occur along roads throughout the project area.

Table 3-42 Non-native Invasive Plant Populations in East Maury Project Units

Unit	Weed
32	Canada thistle present
93	Knapweed present
97	White top present
111	Canada thistle present
112	Canada thistle present
113	Canada thistle present
153	Canada thistle, white top present
164	Canada thistle present
166	Canada thistle, white top present
200	White top present
233	Canada thistle, knapweed present
243	Canada thistle, knapweed present
265	Canada thistle, knapweed present
276	Canada thistle, knapweed present

The introduction and spread of noxious weeds can reduce the diversity and abundance of native vegetation, forage, diversity and quality of wildlife habitat, increase erosion, and decrease water quality. They have developed many characteristics, such as rapid growth rates, high seed production, and extended growing periods that give them advantages over native plants (Sheley and Larson 1994a, DeClerck 1997, Shelly et al 1999b, Scott and Pratini 1995, Roche and Roche 1998, USDA/USDI 2000, USDA 2002a). Factors contributing to weed risk include:

- Most non-native invasive plants are shade intolerant, and therefore have greater potential for invasion forest sites that have been disturbed. Existing conditions favor establishment and spread of noxious weeds. Many areas have had road construction and timber harvest. Proposed activities would create additional disturbance by removing vegetation and exposing soils, creating an ideal seedbed for noxious weeds (Borman et al 1991, Alexanian 2000).
- New road construction would create new disturbed areas and pathways into weed-free areas. Roads can lead to increased use of recreational vehicles (especially off-road vehicles). Weed seed can be introduced from weed-infested areas through soils attached to vehicles and road maintenance or other equipment. A corridor of habitat can allow for expansion of weeds into weed-free areas even if future vehicle traffic is eliminated.
- Road inactivation (closed but available for future use) and de-commissioning (closed with no anticipated future use) activities can reduce noxious weed risk because introduction vectors (vehicles) would be reduced.
- Non-native plants are often difficult to replace with native species. On many sites,

especially where roads or log landings have been constructed, soil disturbance, notably loss of soil, has resulted in sites not capable of returning to native plant communities for many years, perhaps several decades. Weeds (and some non-native grasses) often out-compete native species on altered sites (Hall 1996).

- The potential for introduction of noxious weeds due to logging activity is much greater than other activities because of soil disturbance and removal of vegetation by log skidding and road and landing construction activity. Logging equipment (skidders, cats, feller-bunchers, etc.) is much more likely to bring in noxious weed seed or plant material because equipment may be transported from site to site with soil and weed seed or plant parts attached.
- Project activities would reduce tree density and result in more ground vegetation, potentially resulting in greater distribution of livestock that can serve as vectors for weed introduction and spread.
- Burning natural and activity fuels (logging and thinning slash) would increase susceptibility to some degree. In general, compared with wildfire, underburning occurs in spring and fall, with generally low intensity, and so vegetation recovers much more quickly (often with greater vigor than before burning). The majority of the soil organic layer is also retained. Conversely, burning grapple or hand piles results in fuel levels that result in soil scorching that removes the soil organic layer and increases weed susceptibility. Maintaining vegetation and the soil organic layer results in less susceptibility to noxious weed introduction and spread.
- Aspen treatments would involve conifer cutting and slash treatments. Because sites associated with aspen are productive sites, they are expected to re-vegetate quickly. Therefore, these activities are expected to have minimal effect on weed risk.
- Present and reasonably foreseeable recreation use, road maintenance, riparian work such as planting and stream headcut repair would all contribute to weed risk.

The Forest Service Manual (FSM 2081.2) lists weed prevention as the first priority, followed by early treatment and containment and control of existing infestations. The Forest Plan and *Pacific Northwest Regional Office Final Environmental Impact Statement and Record of Decision for The Pacific Northwest Invasive Plant Program, Preventing and Managing Noxious Weeds* (USDA 2005) also direct the Forest Service to control noxious weeds and implement prevention measures.

The recommended noxious weed strategy for East Maury project is prevention. Design elements for preventing introduction and spread have been incorporated in all action alternatives (see Chapter 2). Natural controls are available through existing vegetation and soil organic layer. In both alternatives 2 and 3, prescribed burning near infestations are expected to be of low intensity that will retain most of the soil organic layer, reducing opportunities for weed establishment and spread. Prescribed burning also generally avoids construction of fire lines, using instead natural fuel breaks such as ridge tops, or human-created breaks, such as roads. Where firelines would be needed, to facilitate prescribed burning, firelines would be constructed by hand rather than with equipment use. This is expected to minimize the time for the vegetation to recover.

The prevention strategy is designed to limit the expansion of current populations and to reduce risk of new infestations. If prevention measures are not adequate to prevent the introduction and

spread of noxious weeds, early treatment would be implemented under existing or future noxious weed management plans.

On portions of roads not expected to re-vegetate as quickly, seeding native or non-native grasses and forbs would occur to occupy the site and reduce potential for noxious weed introduction or spread. Costs of prevention associated with cleaning equipment and other measures are estimated at \$3,000-\$5,000 over the duration of project activities. Even with the proposed design criteria and prevention strategy, there is a continued risk to spread non-native invasive weeds.

The Soap Mineral Source does not have noxious weeds according to an inspection done June 26, 2007. To ensure the source remains clean, project design measures will be implemented to control the spread of non-native invasive species.

Vehicles use also contributes to weed risk. Vehicle use and other activities will continue in the East Maury, regardless of the alternative chosen, including no action. There is an inherent risk of new infestations from sources outside the East Maury projects (e.g. wildlife, windblown seed) in all alternatives.

Projecting the long-term potential effects related to the risk of introduction and spread of weeds is speculative due to many unknown variables, including funding and availability of herbicides for future weed management.

As part of the Ochoco National Forest Integrated Weed Management Plan, activity areas would be surveyed for noxious weeds. Weed monitoring is recommended for the sale area improvement plan, and a priority for post-project funding.

Cumulative Effects - Weeds

The cumulative effects of present and reasonably foreseeable activities indicate a high risk for introduction and spread of noxious weeds. Weeds will continue to be introduced and spread by vehicles, livestock, fence maintenance, the recreating public (horseback riders, hikers, and campers), water, windborne seed, wildlife and other sources. Harvest and other management history are summarized on pages 3-2 to 3-3. Both action alternatives include ground disturbance, burning, and other activities that increase risk of noxious weed introduction and spread. Alternative 2 would result in the most exposed soils and having the most risk factors rated HIGH. Alternative 3 would create less ground disturbance, but still has the same number of HIGH risk factors as Alternative 2. All alternatives include the HIGH risk factors of reasonably foreseeable livestock grazing activity near infestations. See the Botany Report for the complete description of the noxious weed risk assessments, including HIGH risk factors. **Table 3-43** summarizes the weed risk assessments, by alternative.

Table 3-43 Noxious Weed Risk by Alternative

	Alternative 1	Alternative 2	Alternative 3
Total Area of Disturbed Soils (acres)	0	2,277	2,247
Number of HIGH Risk Factors	1	4	4
Risk Factors Assessment	High	High	High

The exact source of non-native invasive plant infestations is unknown, but they are expected to have originated from several areas. The location pattern shows concentrated sites along primary travel corridors. Other infestations are associated with recreation sites and mineral material sites, indicating the primary vector for noxious weeds appears to be vehicles. Vehicle use and other activities will continue in the East Maury, regardless of the alternative chosen, including no action. Additional introduction and spread of noxious weeds, especially hound's-tongue, appears to be through livestock and wildlife (DeClerck 1997).

In addition, new weed infestations have been documented in the area on sites that have had relatively little disturbance. There is an inherent risk of new infestations (such as from windblown seed) in all alternatives, regardless of other activities.

Present and reasonably foreseeable recreation use, road maintenance, riparian work such as planting and stream headcut repair would all contribute to weed risk. Human use of the National Forest is increasing and is expected to increase in the future as populations in nearby towns continue to grow. Increased human use and expanding non-native noxious weed infestations outside the East Maury area will likely increase potential for new noxious plant infestations.

Livestock grazing can delay recovery of desirable vegetation, resulting in increased potential for introduction and spread by selective grazing of more palatable native and desirable non-native species (Callihan and Evans 1991, Olson 1999, Belsky 2000).

Wildfire and fire suppression can result in introduction or spread of weeds by equipment brought in from different areas that may contain weed seed or plant parts. Due to the emergency nature of wildfire, prevention measures including equipment cleaning are not always implemented or feasible. Dozer lines, hand lines, drop points, safety zones, staging areas, etc. all create bare ground with heavy travel and disturbance. Motor vehicle traffic during and after suppression activity can introduce weeds to highly susceptible soils. Therefore introduction and spread from wildfire suppression activities is possible. Use of fire control lines that avoid line construction with equipment, instead using natural breaks such as rocky ridges or existing roads, can reduce risk. Fire rehabilitation efforts are normally implemented that can mitigate many of the negative effects by fireline rehabilitation, area vehicle closures, and post-wildfire weed control and monitoring (surveys).

Wildfire and suppression effects could exceed action alternatives in degree of exposed soils and reductions of shade, creating conditions highly susceptible to weeds. Completing a more specific analysis of potential wildfire effects, and weed risk, is not possible due to the number of unknown variables, such as fuels conditions during a wildfire event, weather, suppression forces available, and other factors that determine the size and intensity of wildfire, as well as suppression effects such as the extent of construction of dozer line and safety zones.

Prevention techniques for weed risk associated with reasonably foreseeable activities, such as clean equipment requirements for road maintenance are expected to be effective in reducing weed risk. The majority of other activities, including legal recreational driving and illegal off-road vehicle use, are more difficult to control. Wet season illegal off-road use and legal road use can be conducive to weed spread due to mud clinging to tires. Prevention measures as design elements, listed in Appendix D, have been incorporated into the alternatives and the current weed treatment program would help reduce the cumulative effects related to weed risk.

Not all noxious weeds can be effectively controlled by herbicides or other measures. Current weed management limits herbicide use to knapweed and a few other species on specific sites. Few controls are available for some species in certain locations, such as teasel in riparian zones. Prevention measures that limit the potential for introduction and spread of these species are essential in maintaining existing desirable vegetation.

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

The Deschutes and Ochoco National Forests are currently completing an EIS for site-specific management of noxious weed infestations. This is expected to result in additional treatment areas on the Ochoco National Forest for integrated noxious weed management. Implementation of additional weed management is expected to have little short-term effect on native plant species, and may have long-term beneficial effects. Decisions and implementation based on this EIS is expected in 2007 and 2008.

The degree of environmental impact due to noxious weeds, in the short term, is relative to the acres infested. Collectively they occupy less than 1% of the analysis area, and therefore, environmental effects due to noxious weeds are considered low. Assuming noxious weed control continues, anticipated effects of all alternatives related to introduction and spread of noxious weeds is expected to remain relatively low.

Projecting the long-term potential effects related to the risk of introduction and spread of weeds is speculative due to many unknown variables, including weather patterns, funding, and especially the completion date and decisions related to the current EIS process for managing non-native invasive plants. For example, if future noxious weed management is limited to measures other than herbicide treatments, and funding for control declines, spread of and establishment of new infestations is more likely than a continuation of current management.

Wildlife

The habitat within the project area varies across the landscape. The current mosaic of habitat conditions is a reflection of geologic and hydrologic features, aspect and elevation, precipitation zones, natural disturbance processes, management history and on-going uses. Habitat types in the project area range from relatively high-elevation mixed-conifer forests to low elevation shrub/steppe and juniper woodlands. Site classes range from rock outcrops with no soil development to meadow, wetland and streamside habitats with deep soils resulting from deposition or historic landslides. Forested areas include a range from dry grand fir (more moist) to dry ponderosa pine (more dry). Inclusions of special habitats are scattered across the project area, a reflection of soil or moisture features, often associated with the underlying geologic history. These special habitats include rimrock and talus slopes, meadows and wetlands, seeps and springs, xeric scrublands (mountain mahogany, bitterbrush, ceanothus, etc.), riparian hardwoods (aspen, birch, willow, red-osier dogwood, alder, black cottonwood, etc.) dry washes and scab flats (rocky, shallow soil areas, often on ridges, that support low or rigid sage, grasses

and forbs). There are numerous species of birds and mammals, several species of reptiles and a few species of amphibians that use habitat in the Maury Mountains.

The Forest Plan identifies Management Indicator Species (MIS) for wildlife across the Forest, these include the pileated woodpecker and primary cavity excavators (PCE). The FEIS for the Forest Plan also identifies the northern flicker as a MIS for old growth juniper on Ochoco National Forest. The Forest Plan also includes Forest-wide Standards and Guidelines for golden and bald eagles, prairie falcon, raptors (hawks and owls), Rocky Mountain elk and mule deer, antelope (pronghorn), and species associated with dead and down logs, various plant communities and successional stages, and species associated with springs, bogs and other unique habitat. Other species have been identified in amendments, policy or strategies that have been adopted subsequent to the Forest Plan. These species include northern goshawk (a species included in the 1995 Regional Forester's Plan Amendment 2); a group of focal bird species (identified in the *Conservation Strategy For Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington*, 2000); sage-grouse (Greater Sage-grouse Conservation Assessment and Strategy for Oregon, 2005) and the Regional Foresters Sensitive Species List, as updated in 2004. The diversity of habitat needs represented by this suite of species and species groups should be representative of the many wildlife species likely to use habitat within the project area. Indicator and focal species were selected to serve as indicators of habitat conditions for a variety of species that utilize the same types of habitat. The effects discussions represent effects anticipated for members of the wildlife community most likely to be affected by this project. Some wildlife species are habitat generalists and may not be affected by proposed activities as much as species with a more narrow range of habitat preferences. Species with a narrow range of habitat preferences are discussed in the effects analysis, or their habitat needs are represented by an indicator, sensitive or focal species. The effects of proposed alternatives on terrestrial wildlife and their habitats are discussed in more detail in the Wildlife Report, which is incorporated by reference in this document. **Table 3-59** in the National Forest Management Act section lists applicable Forest guidelines concerning wildlife as amended by the Eastside Screens and summarizes proposed activities and measures included to meet standards.

Goshawk

Affected Environment

Goshawks use mixed coniferous forest stands with relatively high canopy closure for nesting. They often forage in forests with fairly open understory conditions within stands with moderate to high canopy closure. Patchy crown density and horizontal diversity of forest conditions are important components of habitat for goshawks (Reynolds, et al. 1990). Stands characterized by a sparse overstory of young to mature pine, with some Douglas-fir may not contain sufficient canopy closure to provide preferred nesting habitat.

There are 14,096 acres of goshawk primary nesting habitat, based on area dominated by trees larger than 9 inches dbh (structural/seral conditions dominated by size class 4 or 5 trees) and species composition including ponderosa pine and Douglas-fir. Refer to the discussion on the viable ecosystem seral/structural matrix in the Late and Old Structure Forest (LOS) section of this Chapter (page 3-1 to 3-5). Historically, between 8,385 and 18,304 acres of primary nesting habitat would have been present within the project area. The amount of suitable habitat is currently within the historic range of variability (HRV).

Nest cores and post fledging areas (PFA) have been mapped around or adjacent to known goshawk nesting sites. There are currently 5,101 acres mapped in 12 post-fledgling areas and their associated nest cores in the project area. Of these nesting territories, 11 had confirmed nesting records from 2004 to 2007, and one was recorded as an active nest prior to 1998. Two of these territories have two nest cores mapped, and 10 have multiple nest trees recorded within a single mapped nest core area. Additional nest cores may be mapped as new nesting sites are determined. **Table 3-44** is a summary of goshawk territory reproductive history. One of these post fledging areas (5088) has 289 acres inside the project area, and 120 acres plus a 31-acre nest core outside of the project area. Impacts to this post fledging area outside of the project area are described in the cumulative effects section.

Table 3-44 Goshawk Reproductive History in the East Maury Project Area

Post Fledgling Area	Year of last confirmed nesting	Year of first nesting record	Number of documented nest trees	Number of documented nest cores	Number of nest attempts with young confirmed, other comments
0886 Wiley Flat	2007	1989	3	1	4 years (89, 90, 03, 07) birds seen in 5 of the 6 yrs surveyed between 1989 and 2007.
0946 Double Cabin	2007	1998	6	1	2 years (98, 07) birds seen in 6 of the 7 years surveyed between 1977 and 2007.
0949 Arrowwood Gorge	2007	1998	3	2	5 years (98, 03, 04, 05, 07) birds seen in 6 of the 6 years surveyed between 1989 and 2007.
0950 Poison Spring Cr.	2005	1977	2	1	No confirmed young, birds seen in 1 of the 4 years surveyed between 1977 and 2007.
0951 Grassy Ridge	2005	1977	2	1	No confirmed young, birds seen in 2 of the 4 years surveyed between 1990 and 2007.
5080 Wildcat Cr.	2007	1998	2	2	4 years (99, 03, 04, 07), birds seen in 6 of the 6 years surveyed between 1998 and 2007.
5083 Maury Cr.	2005	1998	2	1	1 year (04), birds seen in 4 of the 6 years surveyed between 1990 and 2007.
5085 Rimrock Cr.	2007	2003	2	1	2 years (03, 07), birds seen in 5 of the 5 years surveyed between 1998 and 2007.
5087 Drake Spr.	unknown	1998	2	1	No confirmed young, birds seen in 4 of the 5 years surveyed between 1990 and 2007.
5088 West Shotgun Spr	2007	2007	1	1	1 year (07), birds have been seen in territory in 2 of the 4 years surveyed between 1998 and 2007.

Post Fledgling Area	Year of last confirmed nesting	Year of first nesting record	Number of documented nest trees	Number of documented nest cores	Number of nest attempts with young confirmed, other comments
5110 Tom Vawn/Stewart	2004	2004	2	1	No confirmed young, PFA includes #0948 (Stewart Cr.), combined birds seen in 4 of the 6 yrs surveyed between 1977 and 2007.
5111 North Tower Pt.	2007	2007	1	1	1 year (07), birds seen in 2 of the 2 years surveyed between 2005 and 2007.

Alternative 1 - Goshawk

This alternative would not treat forest stands within post-fledgling areas, core nest areas or suitable goshawk habitat outside of post-fledgling areas. This action will maintain the existing acres of mixed conifers and canopy closure, at least in the short term. Lack of treatment of the mid-story trees in these stands would perpetuate development of the codominant canopy layer of fir with a positive effect on canopy closure and interlocking crown structure, at least in the short term. These features are important components of nesting habitat. On the other hand, existing canopy gaps and patches of open forest would become reduced as understory conifers fill in. The continuation of over-stocking in the understory of these stands may render them less suitable for goshawk foraging due to dense understory canopies, and could impact the longevity of overstory trees. Shrub and herbaceous understory important to some prey species may be lost as the understory conifer density increases. These features contribute to foraging habitat by providing nesting and food for prey species. No treatment in overstocked stands will likely slow the advancement of some stands that are dominated by small to medium sized trees toward LOS and nesting habitat conditions. Ultimately, high stand densities may lead to mortality of overstory trees due to insects, disease or high intensity fire. The effect of such disturbances on crown closure in the long term is dependent on the type, severity and extent of the event(s).

This alternative would maintain the suitability of all existing habitat for goshawks within the post fledgling area and would not result in displacement of goshawks from any existing occupied territories. This alternative would not reduce suitability of existing habitat, nor would it increase the rate of development of suitable conditions in stands that are not currently suitable as primary nesting habitat. Existing primary reproductive habitat would remain at 13,987 acres within the project area.

Alternative 2 - Goshawk

This alternative would treat timber stands within post fledgling areas with a harvest prescription designed to reduce basal area to promote growth of residual trees and to reduce the risk of loss to insects or high intensity fire. Harvested areas would be thinned from below to improve the health of retained trees. Dominant and co-dominant overstory trees would be retained; however, mid-story and understory cover would be substantially reduced. This thinning is intended to improve longevity of dominant and co-dominant trees, and would have the added benefit of creating more open space for flight below the overstory canopy, which can be desirable in foraging habitat for goshawks. However, these treatments would concurrently reduce the abundance of dense patches which are characteristic of nesting habitat. Thus suitability as nesting habitat will be reduced or eliminated within commercially treated stands. As shown on **Table 3-45**, this alternative would alter stand densities within post fledgling areas for goshawks

on 2,472 acres. This represents approximately 19 percent of the current primary reproductive habitat and 53 percent of habitat within post fledging areas in the project area (4,672 acres). Timber harvest within post fledging areas would be designed to meet long term restoration of HRV for LOS seral/structural stages rather than nesting or post fledging habitat objectives. Although the intent of the treatment is to facilitate the development of LOS, this alternative would reduce the suitability of habitat for nesting on 1,806 acres where stands are commercially treated within the post fledging areas. However, nesting habitat at 11,624 acres remains within the HRV of 8,385 to 18,304 acres.

Table 3-45 Alternative 2 Treatments within Goshawk Post Fledging Areas

Post Fledgling Area	Existing Post Fledgling Area Acres	Harvest Treatment Acres	% Harvest	Total Area Treated both commercial and non-commercial	
				Acres	Percent
0886	399	189	47%	200	50%
0946	393	177	45%	226	58%
0949	384	183	48%	242	63%
0950	395	199	50%	207	52%
0951	403	208	52%	212	53%
5080	395	127	32%	233	59%
5083	405	175	43%	189	47%
5085	389	181	46%	190	49%
5087	401	0	0%	85	21%
5088 ¹	289 (409)	45	16% (11%)	134	46% (33%)
5110	417	235	56%	261	63%
5111	400	87	22%	292	73%
Totals	4,672	1,806	39%	2,472	53%

¹ Post-fledgling area (5088) has 289 acres inside the project area, and 120 acres plus a 31-acre nest core outside of the project area. Numbers shown in parenthesis include area outside of the project boundary but within the PFA.

Noncommercial thinning outside of harvest units will generally result in more retention of moderate to high crown density than is expected to result within commercially treated units. As a result the impact of pre-commercial thinning on nesting habitat is expected to be a short-term reduction in high density patches. Understory thinning may improve prey availability and promote maintenance or development of future nesting habitat on grand fir, Douglas-fir and moist pine sites, but may have negligible effects to goshawk habitat on dry pine and juniper sites. Prescribed fire can have similar effects on goshawk habitat as non-commercial thinning relative to stocking density and stand development. Prescribed burning outside of harvest units within post fledging areas would be designed to protect overstory trees. Burning has the potential to remove large snags and down logs where they are present prior to treatment. This should be partially offset by the creation of snags and down wood due to fire-killed trees. Fire is likely to increase the relative abundance of smaller snags (at least in the short term) that result from effects of the fire, and subsequently recruitment of small logs as these snags fall. The effect of fire on snag retention would likely result in a higher number of hard and small diameter snags, with a concurrent reduction in large, soft snags and hollow tree habitat. Prescribed burning should also stimulate production of herbaceous vegetation for several years after the fire, and

shrubby vegetation three to 15 years after treatment. These changes in conditions would likely provide foraging habitat for some species that would be prey for goshawk, while potentially altering nesting habitat for some prey species, especially cavity nesting birds. Prescribed fire can affect stocking density and stand development and can result in reduction of canopy layering and dense patches. These impacts can lead to changes in prey abundance and suitability as nesting habitat. The outcome of prescribed fire relative to goshawk habitat is dependent on fuel and weather conditions during the operation and the frequency of maintenance underburning.

Interim Management Direction (Eastside Screens) specified in the Regional Forester's Plan Amendment 2 states: that nest sites will be protected from disturbance (seasonal restrictions on activities near nest sites); that 30 acre nest areas will be deferred from harvest; and that harvest activities within PFAs must "retain LOS stands and enhance younger stands toward LOS". Harvest and other treatments will not be implemented within mapped 30 acre goshawk nest cores. Some nest cores may have prescribed fire creeping through them from adjacent treatment units. There would not be direct ignition in the nest cores and pre-treatment would be done as needed to minimize impact to nesting habitat within mapped nest cores from effects of prescribed fire. Harvest activities within PFAs will not remove late and old structure trees or snags, except those deemed to be a safety concern. This alternative has potential to disturb nesting goshawks in occupied territories. Design elements are included in this project to reduce disturbance to nesting goshawks. Site specific information is included in the Design Elements discussion on page 2-13, in Appendix B, and in the Wildlife Report. Appendix B provides unit by unit details. In summary, seasonal restrictions would be employed for disturbance activities from March 1 to August 31 of each year (within ½ mile nest site for habitat modifying activities, or ¼ mile for disturbance only activities). The goshawk nesting seasonal restriction applies to approximately 1,597 acres of commercial harvest, 1,953 acres of non-commercial thinning (outside of harvest units) and 1,239 acres of prescribed fire (outside of cutting units). For these reasons, this project is expected to be consistent with the LRMP as amended by the Regional Forester's Plan Amendment 2.

Harvest and other treatments will not be implemented within mapped 30 acre goshawk nest cores. Prescribed fire from adjacent units may creep into nest cores, but they will not be purposefully ignited, and pre-treatment would be done as needed to minimize impact to nesting habitat within mapped nest cores from effects of prescribed fire.

Commercial harvest exceeding 50 percent of any individual post fledging area may remove dense patches and canopy closure enough to result in displacement of birds in existing territories or reduction in reproductive success. This occurs in 2 post fledging areas (0951 and 5110) under this alternative. However in each of these PFAs a substantial amount of area is included within harvest unit boundaries where actual implementation will result in less commercial harvest. For example Unit 61 in PFA 5110 is an aspen restoration unit and will only have commercial treatment within 100 feet of aspen trees or sprouts. The remainder of the unit will only receive non-commercial treatments. In the other PFA, Unit 87 has inclusions that would likely not be harvested due to of steep ground, marginal timber value or a combination thereof. As a result, it is expected that the actual harvest within each of these PFAs would be less than 50% of the PFA area. At a landscape scale the amount of primary nesting habitat available within the project area would increase slightly to 14,209 acres, primarily as a result of treatments that move stands from smaller to larger size class categories.

Alternative 3 - Goshawk

This alternative would treat timber stands within PFAs with a harvest prescription designed to reduce basal area to promote growth of residual trees and to reduce the risk of loss to insects or high intensity fire. Harvested areas would be thinned from below to improve the health of retained trees. Dominant and co-dominant overstory trees would be retained as no trees 21" dbh or larger would be harvested. However, mid story and understory cover would be reduced. This thinning is intended to improve longevity of dominant and co-dominant trees, and would have the added benefit of creating more open space for flight below the overstory canopy, which is desirable in foraging habitat for goshawks. However, these treatments would concurrently reduce the abundance of dense patches which are characteristic of nesting habitat. Thus suitability as nesting habitat will be reduced or eliminated within commercially treated stands. Noncommercial thinning outside of harvest units will generally result in more retention of moderate to high crown density than is expected to result within commercially treated units. As a result, the impact of noncommercial thinning on nesting habitat is expected to be a short-term reduction in high density patches. Understory thinning may improve prey availability and promote maintenance or development of future nesting habitat on grand fir, Douglas-fir and moist pine sites, but may have negligible effects to goshawk habitat on dry pine and juniper sites. Prescribed fire can have similar effects on goshawk habitat as non-commercial thinning relative to stocking density and stand development. However prescribed fire tends to reduce the abundance of down wood and large snags, and can result in reduction of canopy layering and dense patches. These impacts can lead to reduced prey abundance and suitability as nesting habitat. As shown on **Table 3-46**, this alternative would alter stand densities within post fledging areas for goshawks on 2,320 acres. This represents approximately 18 percent of suitable goshawk habitat and 50 percent of post-fledgling area habitat in the project area. Although timber harvest objectives are to facilitate the development of LOS, stands that receive commercial harvest treatments would become less suitable for nesting on 1,116 acres within PFAs.

Interim Management Direction (Eastside Screens) specified in the Regional Forester's Plan Amendment 2 states: that nest sites will be protected from disturbance (seasonal restrictions on activities near nest sites); that 30 acre nest areas will be deferred from harvest; and that harvest activities within PFAs must "retain LOS stands and enhance younger stands toward LOS". Harvest and other treatments will not be implemented within mapped 30 acre goshawk nest cores. Some nest cores may have prescribed fire creeping through them from adjacent treatment units. There would not be direct ignition in the nest cores and pre-treatment would be done as needed to minimize impact to nesting habitat within mapped nest cores from effects of prescribed fire. Harvest activities within PFAs will not remove late and old structure trees or snags, except those deemed to be a safety concern. This alternative has potential to disturb nesting goshawks in occupied territories. Design elements are included in this project to reduce disturbance to nesting goshawks. Site specific information is included in the Design Elements discussion on page 2-13, in Appendix B, and in the Wildlife Report. Appendix B provides unit by unit details. In summary, seasonal restrictions would be employed for disturbance activities from March 1 to August 31 of each year (within ½ mile nest site for habitat modifying activities, or ¼ mile for disturbance only activities). The goshawk nesting seasonal restriction applies to approximately 1,235 acres of commercial harvest, 2,313 acres of non-commercial thinning (outside of harvest units) and 1,136 acres of prescribed fire (outside of cutting units). For these

reasons, this project is expected to be consistent with the LRMP as amended by the Regional Forester’s Plan Amendment 2.

Harvest and other treatments will not be implemented within mapped 30 acre goshawk nest cores. Prescribed fire from adjacent units may creep into nest cores, but they will not be purposefully ignited, and pre-treatment would be done as needed to minimize impact to nesting habitat within mapped nest cores from effects of prescribed fire.

This alternative does not propose commercial harvest on more than 50 percent, or total treatment of more than 75 percent in any individual post fledging areas. At a landscape scale the amount of primary nesting habitat available within the project area would increase to 14,242 acres, primarily as a result of treatments that move stands from smaller to larger size class categories.

Table 3-46 Alternative 3 Treatments within Goshawk Post Fledging Areas

Post Fledging Area	Existing Post Fledging Area Acres	Harvest Treatment Acres	% Harvest	Total Treated Area	
				Acres	Percent
0886	399	167	42%	201	50%
0946	393	81	21%	226	58%
0949	384	183	48%	242	63%
0950	395	187	47%	208	53%
0951	403	0	0%	212	53%
5080	395	127	32%	233	59%
5083	405	171	42%	188	46%
5085	389	174	45%	194	50%
5087	401	0	0%	85	22%
5088 ¹	289 (409)	45	16% (11%)	134	46% (33%)
5110	417	19	5%	237	57%
5111	400	87	22%	285	71%
Total	4,672	1,116	24%	2320	50%

¹ Post-fledging area (5088) has 289 acres inside the project area, and 120 acres plus a 31-acre nest core outside of the project area. Numbers shown in parenthesis include area outside of the project area within the PFA.

Cumulative Effects - Goshawk

Past harvest activities have affected the current distribution of seral structural stages, and thus the amount and distribution of goshawk habitat across the project area. Harvest and other management history are summarized on pages 3-2 to 3-3, and are also discussed in detail in the Wildlife Report. Past management activities have affected the current condition of seral/structural stages, and thus have altered the amount, quality and distribution of suitable goshawk habitat on the landscape. Generally goshawk post fledging areas have been mapped outside of intensively harvested areas. As a result they occur in irregular patches rather than as a contiguous block of forested habitat. Areas that were harvested with prescriptions that included overstory retention provide greater opportunities to recruit larger and more contiguous patches of suitable habitat in the future than previously harvested areas without overstory retention. Some post fledging areas do include previously thinned or selectively harvested areas where such stands are the best available habitat in the vicinity of the known nest cores.

Past harvest prescriptions which removed most or all of the overstory trees would have also removed goshawk habitat suitability until new stands develop. Prescriptions that retained four to six live overstory trees would provide for some future large snag and log habitat as the younger stand develops into a mature stand in the long term, but would have largely eliminated goshawk habitat in the short term after treatment. Commercial thinning and uneven-aged selection areas may retain enough overstory trees to provide goshawk foraging habitat, but the abundance of dense canopy patches and the occurrence of interlocking crown structure is usually greatly reduced in thinned stands. Therefore, commercially thinned and uneven-aged management stands are expected to have lower nesting habitat quality compared with untreated stands. Such stands do retain structure that could contribute to both the overstory and the snag and down wood components in the future as the stands develop. These stands have good potential as goshawk nesting habitat in the future, but would likely be limited to foraging habitat in the short term. Of particular relevance to this analysis, are the treatments that are occurring in PFA 5088 under the West Maury Fuels and Vegetation Management Project. The cumulative impact of these actions, when combined with the impacts of the proposed action result in approximately 38 percent of this post fledging area being commercially treated and approximately 46 percent of this post fledging area having any treatment (including non-commercial).

Adjacent to Forest Service managed lands there are 440 acres of privately owned timberland. On these lands, past timber management has reduced the abundance of large overstory trees, snags and large down logs. These actions may have limited the suitability of these timberlands for occupancy by nesting goshawk. However, due to the proximity of goshawks nesting on public lands, it is expected that goshawks forage within these privately owned forests where they retain enough forest canopy to remain attractive for use by this species. Because the suitability of these privately owned forest areas cannot be assured into the future, goshawk post fledging area have only been mapped within the Forest boundary. For this reason, some of the areas are less contiguous and less concentric around the nest stand than they might be if they were not adjacent to private land boundaries. Within subwatersheds that overlap the project boundary there are 79,142 acres that are outside of the Forest Boundary (outside of the project area). The majority of these lower elevation sites do not provide preferred nesting or foraging habitat for goshawks as most of these acres have low site potential and do not support forest stands. Some of these acres provide suitable winter foraging habitat for goshawks where woodland habitats are present. The grassland and open shrubland habitat that is common on the lower slopes and valley bottoms is expected to be unsuitable for goshawks (or perhaps marginal for winter foraging).

The Davis Creek prescribed burn (primarily within adjacent BLM land) is scheduled to be implemented within the next five years. That prescribed burn covers approximately 1,344 acres outside of the Forest boundary in the Davis Creek drainage, and is adjacent to goshawk post fledging area 0949. The Davis Creek prescribed burn project should promote productivity of shrub and herbaceous vegetation in treated areas after a brief recovery period, improving habitat for many prey species (birds and small mammals). The proposed burn could create canopy gaps which may serve as flyways that goshawks may use while hunting and traveling through the canopy. However, the project may also remove dense patches that contribute to suitable nesting and post-fledging habitat within the PFA and its two associated nest cores. The cumulative impact of the Davis Creek burn and this proposed action is expected to result in a reduction in goshawk nesting habitat, while at the same time potentially improving winter foraging habitat, depending on burn intensity and patchiness.

Other Raptors

Affected Environment

Eleven raptor nests (other than goshawk) have been identified within the area of influence for this project area. They include two red-tailed hawk, two Cooper's hawk, one bald eagle, four osprey and two golden eagle nest sites. Refer to the Sensitive, Threatened, and Endangered Species Section for a discussion on northern bald eagles. No prairie falcon nests are known to occur within this project area.

Another raptor species, the great horned owl, has been recorded in the project area but nest sites have not been located. The great horned owl is common on relatively low elevation and relatively dry forest types and is expected to be distributed across the Maury Mountains. The great gray owl, on the other hand, has not been recorded in the Maury Mountains. Great gray owls are more likely to occur in high elevation true fir forest and meadow complexes in the Ochoco Mountains and are not as likely to occur in the relatively drier and lower elevation forest types typical of the Maury Mountains.

Environmental Consequences - Raptors

Alternative 1

This alternative would not treat forest stands and thus the current trends in forest development would continue to occur. This alternative would maintain the existing acres of fir-dominated understories and the trend toward fir-dominated habitats. This would tend to favor the forest dwelling accipiters (Coopers hawk) and the small forest dwelling owls (pygmy owls, saw whet-owls). These dense, fir-dominated understory conditions would result in a continued loss of herbaceous and shrubby vegetation in the understory. As a result, shrub and ground nesting bird populations (prey) would remain depressed, and the ability of open forest avian predators to effectively hunt ground dwelling small mammals would continue to be limited. There would be a continued decline in habitat for species which prefer grassland/shrub steppe, open forest and edge habitats (ferruginous hawks, harriers, red-tailed hawks, kestrels, flammulated owls, barn owls and great horned owls). Tree mortality due to stand densities being above sustainable levels would result in recruitment of snag and down log habitat over time. This would likely trigger an increase in the woodpecker population in the short term, which are also prey for avian predator species. Concurrently, the build up of fuels and canopy conditions that favor crown fires and high fire intensity may ultimately facilitate a stand replacing disturbance event. Such events would provide foraging opportunities for species that prefer to hunt open country, but would result in limited nesting habitat for species that nest in green forests with moderate or high canopy closure.

Habitat for species that select edge habitats (such as the great gray owl) nest in forested stands but forage in open country. Under Alternative 1, open habitat would become less abundant over time due to encroachment of conifer trees, until fuel and weather conditions facilitate a stand replacement fire. If such disturbance events occur, the amount of habitat available to edge species will depend on the extent and intensity of the event(s). A fire that burns in a mosaic with unburned or low intensity fire intermixed with patches of moderate to high intensity fire would promote habitat for edge species, while an extensive high intensity fire would reduce edge habitat. Under Alternative 1 the potential for fuels to accumulate in a continuous pattern is

higher than under the action alternatives. Continuous accumulations of high fuel loading can sustain extensive high intensity wildfire and thus contribute to loss of edge habitat.

Alternative 2

Canopy closure would be reduced to less than 60% crown closure in treated stands. Retained trees would expand their crowns in diameter and depth in response to the release from competition that results from the thinning. Thinning of mid-story trees would promote the development of large structure trees, large snags and down logs. Reducing competition from below is also likely to improve the longevity of existing large trees in the overstory. Thus, treatments may reduce suitability, in the short term, for the forest dwelling accipiters and the small forest dwelling owls. However, over time, the treatments may maintain overstory canopy by improving health and vigor of retained trees in the stands. The development of herbaceous and shrubby vegetation in the understory that results from reducing conifer density, should also improve habitat for many species of shrub and ground nesting birds, and the ability of open forest avian predators (such as great horned owl and red tailed hawk) to effectively hunt ground dwelling small mammals would also be improved. Large raptors that nest on large trees or snags in relatively open forests, such as osprey, red-tailed hawks, bald and golden eagles would benefit in the long run from thinning treatments that promote the development of large trees and snags. This type of treatment would occur on the 2,233 acres under this alternative.

Prescribed fire can reduce the abundance of soft snags, as they are prone to ignition. The loss of soft snags can reduce potential nesting sites for species that select for very soft snag conditions, such as the great gray owl. However, the project area is not known to be occupied by great gray owls and is expected to have low potential as great gray owl habitat due to the relatively dry and low elevation forest types typical of the Maury Mountains. Prescribed burning is proposed on up to 11,616 acres in Alternative 2

This alternative would maintain the suitability of habitat for raptors that select for open forest environments within treated stands and for other species in untreated stands. This alternative has potential to disturb nesting raptors in occupied territories. Design elements are included in this project to reduce disturbance to nesting raptors. Site specific information is included in the Design Elements discussion on page 2-14, in Appendix B, and in the Wildlife Report. Appendix B provides unit by unit details. In summary, seasonal restrictions would be employed for disturbance activities from March 1 to August 1 of each year within 660 feet of hawk or owl nests or ¼ mile for osprey, and March 1 to August 15 within ½ mile of golden eagle nests). The raptor (other than bald eagles and goshawk) nesting seasonal restrictions apply to approximately 396 acres of commercial harvest, 105 acres of non-commercial thinning (outside of harvest units) and 240 acres of prescribed fire (outside of cutting units). See the Goshawk section for information on goshawk restrictions and the Threatened, Endangered and Sensitive Species section for information on bald eagles. For these reasons, this project is expected to be consistent with the LRMP Standards and Guidelines for nesting raptors.

Alternative 3

Habitat impacts and improvements described under Alternative 2 would also occur under alternative 3, but to a slightly lesser extent. Thus, the reduction in suitable habitat for dense forest dwelling species, and improvement in habitat conditions for open forest dwelling species under this alternative would be slightly less than described for Alternatives 2. Large raptors that nest on large trees or snags in relatively open forests, such as osprey, red-tailed hawks, bald and

golden eagles would benefit in the long run from thinning treatments that promote the development of large trees and snags. This type of treatment would occur on the 2,085 acres under this alternative.

As described above, prescribed burning can reduce the abundance of soft snags and thus potential nesting sites for species that select for soft snags, such as the great gray owl. The Maury Mountains have low potential to support nesting great gray owls. Prescribed burning is proposed on up to 11,149 acres in Alternative 3.

This alternative would maintain the suitability of habitat for raptors that select for open forest environments within treated stands (but on fewer acres than in Alternative 2) and for other species in untreated stands. This alternative has potential to disturb nesting raptors in occupied territories. Design elements are included in this project to reduce disturbance to nesting raptors. Site specific information is included in the Design Elements discussion on page 2-14, in Appendix B, and in the Wildlife Report. Appendix B provides unit by unit details. In summary, seasonal restrictions would be employed for disturbance activities from March 1 to August 1 of each year within 660 feet of hawk or owl nests or ¼ mile for osprey, and March 1 to August 15 within ½ mile of golden eagle nests). The raptor (other than bald eagles and goshawk) nesting seasonal restrictions apply to approximately 232 acres of commercial harvest, 269 acres of non-commercial thinning (outside of harvest units) and 240 acres of prescribed fire (outside of cutting units). See the Goshawk section for information on goshawk restrictions and the Threatened, Endangered and Sensitive Species section for information on bald eagles. For these reasons, this project is expected to be consistent with the LRMP Standards and Guidelines for nesting raptors.

Cumulative Effects - Raptors

Past harvest and other management activities have affected the current distribution of seral structural stages, and thus habitat for various raptors. Harvest and other management history are summarized on pages 3-2 to 3-3, and are also discussed in detail in the Wildlife Report. Harvest prescriptions that removed most or all of the overstory trees and snag habitat would have limited nesting habitat for some raptor species. Some species of hawks nest in large trees, and most owls nest in cavities in snags or hollow trees or in abandoned stick nests in trees. Where these structures have been removed, potential nesting habitat has been eliminated. However, these open areas do provide foraging opportunities for many species that forage over open ground, such as northern harriers, red-tailed hawks, kestrels, long-eared owls, great horned owls and great gray owls. Red-tailed hawks and pygmy owls select trees along or near the edges of forest openings for nesting.

Prescriptions that retain approximately four to six live overstory trees provide some nesting structure for species that like to nest in very open stands. As with the other intensive harvest treatments, foraging habitat would also be available in these sites for species that hunt in open areas. Although some future large snag and log habitat would be provided by such prescriptions as these stands develop into a mature stands, such treatments would have eliminated suitable nesting habitat for some forest dwelling hawks and owls at least in the short term. Commercial thinning may provide nesting habitat for some species of hawks and some owls. Red-tailed hawks, kestrels, sharp-shinned hawks, great horned owls and long-eared owls are known to prefer relatively open forests. While flammulated owls prefer forests with relatively open overstory with dense patches of developing understory. Thinned stands would likely be too open for other forest dwelling owls and accipiters, such as goshawks.

Adjacent to Forest Service managed lands within watersheds that overlap the project area and the Forest boundary there are 204 acres of privately owned timberland. On these lands, past timber management has reduced the abundance of overstory trees and snags. These actions may have limited the suitability of these timberlands for occupancy by some species of forest dwelling raptors. However, retention of scattered large trees and snags on private land, especially near ponds and reservoirs, is currently providing nest and roost sites for species that enjoy having an open view of foraging areas. Some species are likely to nest in timbered areas on National Forest land and forage over privately owned habitat (for example, red-tailed hawks, osprey and bald eagles). There are 79,142 acres within subwatersheds that overlap the project, that are not managed by the Forest Service. These lands provide a variety of foraging opportunities for raptors as well as wintering habitat for some species. Activities on these lands that alter prey abundance or habitat could combine with effects resulting from this project. For example, snag reduction on private land combined with effects of prescribed fire on public land could limit nesting sites for cavity nesting raptors such as kestrel, screech owls or saw whet owls. On the other hand range management activities on private land such as controlled burns or juniper cutting could combine with effects of proposed treatments on public lands to provide complementary benefits to open country species such as northern harriers, Swainson's hawks and ferruginous hawks.

Grazing by livestock and big game will continue to occur on both privately owned and federally managed lands in and adjacent to the project area. This activity can result in changes to herbaceous and sometimes shrubby vegetation. Grazing of grasses and forbs can alter the height of these plants and the amount of ground cover. This can impact the quality of nesting and brood rearing habitat for ground nesting birds and small mammals, which may serve as prey to raptors. However, removal of coarse vegetation by large ungulates can also improve the palatability and nutritional value of this forage for prey species that consume vegetation, and can improve foraging opportunities for species that feed on insects and other invertebrates, by making these food resources more visible. Browsing of palatable species of shrubs can reduce their size, height and density. This can alter the quality of nesting habitat for shrub nesting birds that may serve as prey to raptor species. Raptors which forage on ground dwelling animals such as insects, amphibians, reptiles and small mammals often take advantage of open areas with reduced ground cover as foraging sites. Grazing management changes resulting from the recent Maury Mountain Allotment Management Plan are expected to improve upland and riparian conditions in the long term, which should support a wide variety of species that may serve a prey for birds of prey.

Pileated Woodpecker

Affected Environment

The pileated woodpecker prefers closed canopy, late to old-growth fir-dominated habitat. The best pileated woodpecker habitat is within stands dominated by large (>20" dbh) true fir. Pileated woodpecker habitat in the Maury Mountains is expected to occur primarily on north and east facing slopes, not on south and west facing juniper or dry pine sites. On grand fir sites (which have better potential to provide pileated woodpecker habitat than pine sites) current abundance of pileated woodpecker nesting habitat is limited by closed-canopy late seral stands with large tree size (L4 and L5) being below the HRV, but improved by mid seral stands (M4a and M5a) being within HRV. At the same time Douglas-fir site late seral stands (L4a and L5a) are well

above the HRV, bringing current amount of pileated woodpecker nesting habitat above the HRV as shown in Table 4. The existing condition (2851 acres of primary nesting habitat for pileated woodpeckers) is currently above the range predicted to be in the watershed historically (1183 acres low end, 2479 acres high end).

Within this project area sub-watersheds include grand fir and Douglas fir as follows:

- Drake Creek is 61 percent grand fir and 9 percent Douglas-fir;
- Stewart/Tom Vawn Drainage is 58 percent grand fir and 11 percent Douglas-fir;
- Indian Creek is 11 percent grand fir and 17 percent Douglas-fir;
- Lower Camp Creek is 8 percent grand fir and 31 percent Douglas-fir; and
- Maury Creek is 24 percent grand fir and 51 percent Douglas-fir.

Sub-watersheds where grand fir and Douglas-fir make up the majority of the area within the project boundary (Drake Creek (70 percent), Tom/Vawn Drainages (69 percent), and Maury Creek (75 percent) have the highest potential to provide habitat for pileated woodpeckers. Pileated woodpeckers are less likely to occur where grand fir and Douglas-fir plant association groups are of limited extent such as in Lower Camp Creek (39 percent) and Indian Creek (27 percent) subwatersheds.

Pileated woodpecker reproductive areas are designated as Old Growth Management Areas (MA-F6) and associated feeding habitat (PFH) have been mapped outside of designated old growth as required by the Forest Plan. There are 2 Old Growth Management Areas in the East Maury project area: one near Drake Butte (OG-D3-02) is 324 acres and 99% dry grand fir plant association group; and the other at Rimrock Creek (OG-D3-07) is 309 acres and 91% Douglas-fir plant association group. Both of these Old Growth Management Areas contain sufficient abundance of plant association groups capable of providing reproductive habitat for pileated woodpeckers. It would be reasonable to expect them to support a nesting pair of pileated woodpeckers.

Each of the Old Growth Management Areas have pileated woodpecker feeding habitat (PFH) designated around them. Within the project area there are 563 acres of mapped feeding area. The pileated woodpeckers prefer closed canopy, late to old growth fir-dominated habitat. They prefer stands with old growth, grand fir, abundant snags and down logs and with canopy closure of at least 60%. The abundance of snags greater than 20 inches in diameter is a good predictor of pileated woodpecker habitat. Within the project area records of use by pileated woodpeckers is limited. Pileated woodpeckers in the Maury Mountains are expected to occur primarily on north and east facing aspects on grand fir or Douglas-fir sites.

Alternative 1 – Pileated Woodpecker

This alternative would not treat forest stands within designated feeding habitat or Old Growth Management Areas. This action will maintain the existing acres of fir-dominated understories and canopy closure, at least in the short term. Lack of treatment of the understory in these stands would perpetuate development of fir understory conditions with a positive effect on the pileated woodpecker habitat abundance and quality in the short term. Large woody debris would be retained at the current levels. Over time, high stand densities may lead to declining stand health due to insects and disease, although this may also benefit the pileated woodpecker by increasing its forage base. Extensive mortality due to insects, disease could also increase the risk high intensity fire in the future. The effect of such disturbances on pileated woodpecker habitat in the long term is dependent on the type, severity, frequency and extent of such event(s).

This alternative would maintain the suitability of all existing habitat for pileated woodpeckers in the short term. Over time the suitability for nesting may decline on sites that cannot sustain high densities of conifers. As trees on such sites succumb to insect invasion they would provide a foraging substrate for a variety of woodpeckers, including the pileated. If the mortality becomes extensive and live canopy closure is lost in areas with severe insect infestations, then affected areas would become less suitable for this species as potential nesting habitat. At the landscape scale 2,851 acres of primary reproductive habitat for pileated woodpeckers would remain in project area. The amount of primary nesting habitat would remain slightly above the HRV (1,183 to 2,479 acres).

Alternative 2 – Pileated Woodpecker

This alternative proposes harvest (with associated pre-commercial thinning and fuels treatment) on 48 acres (9 percent) of designated feeding habitat (10 acres near OG-D3-02 and 38 acres near OG-D3-07) in units: 68, 88, 96, 164.3 and 189.

The harvest prescription calls for preferential retention of ponderosa pine and larch, but grand fir and Douglas-fir will also be retained as individuals or clumps within these stands. As the canopy may be reduced to less than 60 percent crown closure after treatment, this alternative would reduce the suitability of these stands as nesting or foraging habitat for pileated woodpeckers. Canopy closure is expected to recover partially, as the retained trees expand their crowns in diameter and depth in response to the release from competition that results from the thinning, especially on more mesic sites such a grand fir or Douglas-fir plant associations. However, full recovery of canopy closure to the current level may not occur. Thinning of mid-story trees would promote the development of large structure trees over time, ultimately providing a source of recruitment for large snags and down logs. Reducing competition from below is also likely to improve the longevity of existing large trees in the overstory. Thus, this treatment could facilitate the development of potential pileated woodpecker habitat in the long term, but the current habitat suitability (quality) for pileated woodpeckers would be reduced in treated areas in the short term.

This alternative also proposes to pre-commercially thin (and associated fuels treatment) an additional 5 acres (<1 percent) in designated feeding habitat. Pre-commercial thinning outside of harvest areas but within designated feeding areas would occur on less than 1 acre in units 47, 51, 64, 65, 73, 75, and 289. Noncommercial thinning would have a negligible effect by reducing the density of suppressed trees in the mid and understory. This would slightly reduce susceptibility to invasion by insects, and thus foraging substrate for woodpeckers. Thinning of these small trees would have a slight positive effect on the development of larger trees in the stand. Though the treatment would result in a negligible reduction of the quality of habitat for pileated woodpeckers in the treated stands, they would remain suitable as foraging habitat. The prescription calls for preferential retention of ponderosa pine and larch. Grand fir and Douglas-fir would be retained as individuals or clumps scattered within these stands.

There would also be 71 acres (13 percent) of fuel treatment outside of thinning units within designated feeding habitat near OG-D3-02 in units 78, 95, 104, 120 and 174. Only units 95 and 104 contain more than 1 acre of treatment in designated feeding habitat. This activity could impact the suitability of these stands as reproductive habitat for pileated woodpeckers by reducing canopy closure, reducing the grand fir and Douglas-fir component, consuming snags and down wood, and burning the base of hollow trees, causing them to fall.

No changes to Old Growth Management Areas would occur under this alternative. This alternative would maintain suitable habitat for pileated woodpeckers in untreated stands on 439 acres (78 percent) of designated feeding habitat. Habitat suitability for this species would be reduced on 124 acres of mapped designated feeding habitat. At the landscape scale (including habitat outside of OGMA and mapped PFH) 1,612 acres of primary reproductive habitat for pileated woodpeckers would be present in project area post treatment. This would bring the amount of primary nesting habitat to within HRV (1,183 to 2,479 acres).

Alternative 3 – Pileated Woodpecker

Habitat impacts and improvements described under Alternative 2 would also occur under alternative 3, but to a slightly lesser extent. This alternative proposes harvest (with associated pre-commercial thinning and fuels treatment) on 3 acres (1 percent) of designated feeding habitat (2 acres near OG-D3-02 and 1 near OG-D3-07) in units 88, 96, 164.3. Only Unit 164.3 treats more than one acre of designated feeding habitat.

This alternative also proposes to pre-commercially thin (and associated fuels treatment) an additional 49 acres (9 percent) in the designated feeding habitat. There would be additional fuel treatment outside of thinning units on 71 acres (13 percent) of designated feeding habitat in units 78, 95, 104, 120, and 174.

No changes would occur to Old Growth Management Areas under this alternative. This alternative would maintain the suitable habitat for pileated woodpeckers in untreated stands on 440 acres (78 percent) of designated feeding habitat. Suitable habitat would be reduced, at least in the short term, on 123 acres (22 percent) within designated feeding habitat. At the landscape scale (including habitat outside of OGMA and mapped PFH) 2,008 acres of primary reproductive habitat for pileated woodpeckers would be present in project area post treatment. This would bring the amount of primary nesting habitat to within HRV (1,183 to 2,479 acres).

Cumulative Effects – Pileated Woodpecker

Past harvest and other management activities have affected the current distribution of seral structural stages, and thus pileated woodpecker habitat. Harvest and other management history are summarized on pages 3-2 to 3-3, and are also discussed in detail in the Wildlife Report. Stands previously treated with regeneration harvests would generally be represented as structure classes 1 to 3 in the existing structural/seral stages. At the same time that pileated woodpecker habitat was being reduced within timber harvest units, fire suppression was being implemented across all plant associations. As a result of this fire suppression, grand fir was allowed to develop in the understory of many stands that were previously dominated by Douglas-fir, ponderosa pine and larch. In these stands, pileated woodpecker habitat has increased.

Stands that currently are suitable as primary reproductive habitat for pileated woodpeckers would generally be represented as seral/structural stages M4a, M5a, L4a and L5a in the grand fir and Douglas-fir plant association groups. Secondary reproductive habitat would include the E4, E5 and other M4, M5, L4 and L5 seral/structural stages. Refer to the Late and Old Structure Stands section for more detailed information on LOS seral/structural stages (page 3-2 to 3-11).

Harvest prescriptions which removed most or all of the overstory trees rendered these areas unsuitable for pileated woodpeckers if they were suitable prior to harvest. Prescriptions that retained approximately four to six live overstory trees would provide for some future large snag and log habitat as the younger stands develop into a mature stands, but would have removed pileated woodpecker habitat post harvest. Commercial thinning may retain enough overstory trees

to provide pileated woodpecker habitat, but the quality of the habitat for this species would have been lessened due to canopy reduction. Such stands do retain structure that could contribute to both the overstory and the snag and down wood components in the future as these stands develop. Refer to the section on primary cavity excavators for further discussion on cumulative effects to snag abundance. Pileated woodpeckers have been found to occur in higher densities where snags and down wood are abundant.

Adjacent to Forest Service managed lands within the project area, there are 204 acres of privately owned timberland. On these lands, past timber management has reduced the abundance of overstory trees, snags and large down logs. These actions have limited the suitability of these timberlands for occupancy by pileated woodpeckers.

Primary Cavity Excavators, Snag and Down Log Habitat

Affected Environment

The existing and predicted condition for primary excavators is addressed by focusing on two species of habitat specialists, white-headed and pileated woodpeckers. The effects of the proposed alternatives on pileated woodpeckers are described in detail in the section above. Pileated woodpeckers tend to utilize dense stands on relatively moist sites. The high density of trees characteristic of pileated woodpecker habitat is often associated with moderate to high levels of tree mortality, which can result in attractive habitat for black-backed woodpeckers. Therefore the discussion of effects for pileated woodpeckers is an indicator for black-backed woodpeckers in their use of live mixed conifer stands with an abundance of dead or dying trees. Black-backed woodpeckers are also commonly associated with recently burned forests across a range of forest types. Thus they are also included in the discussion below for white-headed woodpeckers in ponderosa pine dominated environments. The northern flicker is listed as a Management Indicator Species in the FEIS for the Forest Plan. This species was identified as an indicator for old-growth juniper on Crooked River National Grasslands. The flicker is a habitat generalist and can be found nesting in a wide variety of habitat types, so long as snags or hollow trees of the appropriate dimensions are present. However, this species can excavate nests in old growth juniper, where other species of woodpeckers do not serve as primary cavity excavators. Northern flickers are expected to utilize relatively open stands, especially at lower elevations. The other species of primary cavity excavators that would be present in the project area are represented by either the pileated woodpecker or the white-headed woodpecker as described below.

The white-headed woodpeckers prefer ponderosa pine habitat that has more open overstory with large live pine for foraging and snags for nesting habitat. Its habitat associates are generally called the pine birds, including the pygmy and white-breasted nuthatches and the flammulated owl. This habitat is used by all of the local primary excavators with the exception of the pileated woodpecker, which prefers a fir component for foraging substrate and roost structure. Open forest conditions are preferred by Lewis' woodpecker, northern flicker, Williamson's sapsucker, pygmy and white-breasted nuthatch. The Lewis woodpecker is also addressed as a focal species below, due to its strong association with riparian hardwoods (specifically old cottonwood) in the Blue Mountains of Oregon. Current conditions in the Maury Mountains are limiting for white-headed woodpeckers, and associated species, since open-canopy stands with large tree size are below the HRV in the grand fir, Douglas-fir, and ponderosa pine plant association groups. The existing condition (5,864 acres of primary nesting habitat for white-headed woodpeckers) is currently

deficient in habitat within the watershed, as compared to the HRV (8,766 acres low end, 16,320 high end).

With the use of Decayed Wood Advisor (DecAID) it is possible to relate the abundance of dead wood habitat, both snags and logs, to the frequency of occurrence of various wildlife species that require dead wood habitat for some part of their life cycle. The data displayed in DecAID is merely a summary of the conditions present in research plots that have been studied and is dependent on available research data. DecAID predicts the following species will use snags among live eastside mixed conifer vegetation: American (pine) marten, long-legged myotis, pileated woodpecker, silver-haired bat, and white-headed woodpecker. DecAID also predicts that the following species will use snags in ponderosa pine/Douglas-fir large tree vegetation type: black-backed woodpecker, flammulated owl, northern flicker, white-headed woodpecker, pileated woodpecker, pygmy nuthatch, red-naped sapsucker, and Williamson's sapsucker. Species used small and large snags in different abundances. In most cases, wildlife usage is more common when snag density is higher.

DecAID predicts that black bear may use down logs in live eastside mixed conifer forests in open condition. Eastside mixed conifer stands with small to medium sized trees will have down wood use by three-toed, black-backed woodpecker and pileated woodpeckers, as well as by carpenter and formica ants, deer mice, American marten and black bear. Down logs in eastside mixed conifer stands with large sized trees would be used by the same species, as well as by small ants. DecAID has no data on species use of down logs in live ponderosa pine/Douglas-fir forests with open conditions, but does predict use in ponderosa pine/Douglas-fir with small to medium sized trees and with large trees as follows: various woodpeckers, small ants, carpenter and formica ants. American (pine) marten are known to use areas with an abundance of down wood in high elevation forest types where lodgepole pine is common. On the Ochoco National Forest pine marten are more likely to be found in mixed conifer forests with subalpine fir and lodgepole pine, such as those on the north and north east facing slopes of the Ochoco Mountains. The relatively low elevation and drier climatic regime found in the Maury Mountains is less likely to support a population of pine marten. If they were to occur there they would be associated with hollow trees and snags and down wood. Black bear and various species of woodpeckers and ants are expected to occur and to utilize down logs in the Maury Mountains.

Environmental Consequences

Alternative 1 – Primary Cavity Excavators, Snags and Logs

This alternative would not treat forest stands and thus the current trends in snag and large wood abundance would continue to occur. Mortality due to stand densities being above sustainable levels would result in recruitment of snag and down log habitat. The large pine trees in the overstory are particularly vulnerable to competitive stress from an overly dense understory. Many of overstory pine that are currently alive would succumb to this stress and become large snags. The development of hollow snags would be less common than would occur under a natural fire regime, as heart rots spreads through the bole of large live trees very slowly. Trees that are killed rapidly by the combination of competitive stress and insects are less likely to develop sufficient heart rot to create hollow tree habitat than trees that remain defective but alive for years. Hollow trees that die as a result of competitive stress are not likely to remain standing as long as hollow trees that remain alive for a longer period of time. This alternative could result in less habitat in the long run for Vaux's swift, black bear, American (pine) marten, bats, and other species that utilize large hollow snags, trees and logs.

High stand densities would result in increasingly high levels of insect activity. These insects, primarily bark beetles and western spruce budworms would provide a food resource for woodpeckers for a period of time (most foraging for beetles occurs within 3 years after the death of a tree). Concurrently, the build up of fuels and canopy conditions that favor crown fires and high fire intensity may ultimately facilitate a stand replacing disturbance event. Such events yield an abundance of snags in the short term (preferred habitat for black-backed woodpeckers), but may result in large areas with low density of snags in 50 to 100 years after the event. Large snag recruitment would begin again after the new stand matures enough to provide such structure. This may take 150 years or more. Large scale insect outbreaks and high intensity fires also reduce foraging opportunities for cavity nesters that include food resources from live forests in their diet (seed eaters, sapsuckers and gleaners). For example, white-headed woodpeckers glean insects from bark crevices of live ponderosa pine and consume pine nuts.

This alternative would maintain the existing acres of fir-dominated understories and the trend toward fir-dominated habitats. The no action alternative will favor the species that utilize dense, fir-dominated habitats, in the short term. There would be a continued decline in suitability of existing white-headed woodpecker habitat which prefers open, pine dominated stands. However, because large size class trees are the limiting factor on this landscape, potential white-headed woodpecker habitat will increase over time as mid-size pine trees become larger. This alternative would not promote development of potential habitat for the white-headed woodpecker and its associates, as rapidly as the action alternatives which promote more rapid development of large size ponderosa pine and open stand conditions. White-headed woodpecker primary nesting habitat would remain at 5,864 acres which is below HRV as shown in **Table 3-47**. Projections indicate that primary nesting habitat for white-headed woodpecker would drop to 5,135 acres after 50 years if stands continue to develop without disturbance. Overstory development may provide potential habitat, but thick understory conditions may prevent use by nesting white-headed woodpeckers.

Table 3-47 White-Headed Woodpecker Primary Nesting Habitat (in acres)

Alternative	HRV low	HRV high	Acres Post Treatment	Acres Year 50	HRV Year 1	HRV Year 50
Alt. 1	8,766	16,320	5,864	5,135	below	below
Alt. 2	8,766	16,320	8,943	6,571	within	below
Alt. 3	8,766	16,320	8,182	6,034	within	below

Effects Common to Alternatives 2 and 3 – Primary Cavity Excavators, Snags and Logs

In both action alternatives, all existing snags would be left that are not deemed to be a safety hazard. Reduction of understory tree density within treated areas would reduce the abundance of dense fir-dominated understory conditions, and increase the abundance of more open stand structure with ponderosa pine contributing a relatively larger percentage of the species composition. This should result in reduced abundance of habitat for species that select for dense multi-layered forests, such as the pileated woodpecker and red breasted nuthatch, while providing an increased abundance of habitat for species that prefer more open pine dominated stands, such as the white-headed woodpecker, Lewis’s woodpecker, pygmy nuthatch, and white-breasted nuthatch. Snags and down wood may be consumed by prescribed fire. This should be

partially offset by the creation of snags and down wood due to fire-killed trees. The effect of fire on snag retention would likely result in a higher number of hard snags, with a concurrent reduction in soft snag habitat. Because of anticipated low fire intensity, it is also likely that while large existing snags may be consumed by fire, the snags created by fire would tend to be in smaller size classes due to the vulnerability to fire mortality of smaller, thin barked trees. Generally prescribed burning should reduce small logs more than large logs, especially with spring burns. However when large logs are well decayed and dry, they are likely to be consumed in prescribed burns. Loss of large soft snags can reduce potential nest sites for great grey owls and loss of down wood can reduce habitat for American (pine) marten.

This project does not propose to harvest snags, so the amount of snags present within the project area should not be substantially altered by thinning implemented under this project. Prescribed burning may alter snag abundance as described above, but fire effects are not expected to alter snag densities enough to affect the likelihood for species evaluated under DecAID to use the project area. Snag habitat for any species for which such habitat is currently being provided is expected to be retained over the majority of the project area due to use of project design criteria intended to minimize loss of snags during burning operations. The distribution and abundance of snags will remain on untreated areas. Some snag habitat will be reduced incidentally in order to construct roads or landings, or to reduce work area hazards. The number of snags felled as hazard trees and to clear right-of-way and landing areas is incidental to this project and is not expected to occur on more than 5 percent of the treated area. Removal of defective trees may also reduce the incidence of heart rot and thus the development of hollow trees. However, some fire scars may result from prescribed burning, which could promote a few hollow trees in treated areas. Treatments that promote the development of large trees would promote the development of large snags and logs in the long term, while reducing the recruitment of small and medium size snags and logs in the near and mid term (less stand mortality results in lower rate of snag and down log recruitment). In harvest areas large woody debris would be retained at levels consistent with Viable Ecosystems or Eastside Screens (which ever is more restrictive) as follows: Dry grand fir, 100 to 257 lineal feet per acre; Douglas-fir, 100 to 233 lineal feet per acre; moist ponderosa pine, 55 to 167 lineal feet per acre; and Dry Douglas-fir 20 to 55 lineal feet per acre.

Alternative 2 – Primary Cavity Excavators, Snags and Logs

This alternative would help restore white-headed woodpecker and Lewis's woodpecker habitat on most of the commercial harvest area. Where pre-commercial thinning occurs in two-storied stands with a component of large live ponderosa pine and suitable snags for nesting, this treatment would also serve to help restore white-headed woodpecker habitat. This alternative is expected to restore white-headed woodpecker and Lewis's woodpecker habitat on 3,079 acres post harvest, bringing the amount of primary nesting habitat to 8,943 acres. This alternative would reduce the understory fir component on acres dominated by ponderosa pine and western larch which would have potential for creating habitat for the white-headed woodpecker and its habitat associates. White-headed woodpecker habitat would be brought within HRV post treatment. After 50 years of stand development white-headed woodpecker habitat (5, 571 acres) is predicted to be 1,436 acres higher as a result of treatments in this alternative compared to no action, but still would fall below HRV without follow-up treatments. The amount of habitat available in the future could be maintained at or above the post-treatment abundance if periodic maintenance underburning is implemented. The values in **Table 3-47** represent stand development without future maintenance activities.

Existing large down logs would be retained during harvest operations. Harvest and non-commercial thinning is not expected to substantially alter large down wood directly, but may affect future recruitment of down logs by stimulating development of larger trees and by reducing the number of trees in the future. There may be less small logs accumulating in treated stands, but large logs may make up a larger proportion of the down wood in thinned stands in the future. Some down logs may be lost and others created during burning operations as described above. Thus treated stands may have altered down log abundance and distribution, while untreated stands will retain existing down wood and continue on the current trend in down wood accumulation. The abundance and distribution of large down wood is expected to be reduced to some degree post-treatment on up to 11,527 acres in prescribed burning units. Current accumulations and trends will continue to be present on approximately 10,000 acres that are not treated under this alternative.

Alternative 3 – Primary Cavity Excavators, Snags and Logs

This alternative is expected to restore white-headed woodpecker habitat on 2,318 acres, bringing the amount of primary nesting habitat to 8,182 in the project area. The effects of this alternative would reduce acres of overstocked stands by thinning understory trees, but less than Alternative 2. White-headed woodpecker habitat would be brought toward HRV (nearly within) post-treatment. After 50 years of stand development white-headed woodpecker habitat is predicted to be 899 acres higher as a result of treatments in this alternative compared to no action. However, the amount of primary habitat in 50 years (6,034 acres) would still fall below HRV without follow-up treatments. The amount of habitat available in the future could be maintained at or above the post-treatment abundance if periodic maintenance underburning is implemented. The values in **Table 3-47** represent stand development without future maintenance activities.

Existing large down logs would be retained during harvest operations and thinning (both commercial and non-commercial) is not expected to substantially alter large down wood directly. Thinning may affect future recruitment of down logs by reducing the number of trees, but increasing the diameter of trees in the future. There may be less, but larger logs in the future. Some down logs may be lost and others created during burning operations affecting down log abundance and distribution, while untreated stands will retain existing down wood and continue current trends in down wood accumulation. The abundance and distribution of large down wood is expected to be reduced to some degree post-treatment on up to 10,061 acres in prescribed burning units. Current accumulations and trends will continue to be present on approximately 10,300 acres in the project area that are not treated under this alternative.

Cumulative Effects – Primary Cavity Excavators, Snags and Logs

Harvest and other management history are summarized on pages 3-2 to 3-3, and are also discussed in detail in the Wildlife Report. Past harvest and other management activities have affected the current distribution of seral structural stages, and thus primary cavity excavator habitat. The majority of previously harvested areas received prescriptions, which would have removed most or all of the overstory trees and snag habitat. This intensity of treatment occurred on approximately 5,765 acres. Within these areas snag retention is assumed to be close to nothing of the capability for primary cavity excavators. Some of these treatment areas received regeneration harvest prescriptions that retained varied levels of large overstory tree retention. Prescriptions that retain approximately four to six live overstory trees would provide for some future large snag and log habitat.

Harvest units with retention sold prior to 1996 generally retain very low snag density and are assumed to have no population potential for cavity excavators. This intensity of treatment occurred on approximately 125 acres in the project area (in 1993). Prescriptions that retain scattered overstory trees in an uneven-aged management scenario would provide habitat for species that will utilize a very open canopy forest, and may have experienced some level of snag recruitment in the residual trees since the time they were harvested. Partial or selective removal has occurred on 7,356 acres in sub-watersheds that overlap the planning area and these acres are estimated to average 50 percent population potential. Much of the remaining forested stands without previous harvest history have been entered historically for selective removal, salvage, hazard tree removal and/or firewood cutting. As a result many stands have had snag density reduced by previous activities, but there has also been ongoing snag recruitment due to recent insect activity. It is estimated that 20 percent of the acres that do not have harvest history that are at 75 percent population potential (due to proximity to roads) while the remainder are at 100 percent. Based on harvest history and these assumptions, the level of snag retention within the project areas is estimated to be at approximately 42 percent of the maximum potential population capability for primary cavity excavators within the watershed. This analysis is required to compare to standards in the Forest Plan, even though this “biological potential” method has been questioned recently (Bull et al., 1997; Rose et al, 2001).

Adjacent to Forest Service managed lands there are 204 acres of privately owned timberland in watersheds that overlap the project area and are within the Forest boundary. On these lands, past timber management has reduced the abundance of overstory trees, snags and large down logs. These actions have limited the suitability of these timberlands for occupancy by woodpeckers and other primary cavity excavators that prefer high snag densities, such as black-backed woodpeckers.

Big Game

Affected Environment

Big game species in the project area include Rocky Mountain Elk, mule deer and pronghorn (antelope). Generally habitat conditions for elk will also provide habitat for mule deer. Since elk are considered more susceptible to effects of proposed vegetation management and LRMP standards apply to mule deer, the Habitat Effectiveness Index, the big game analysis for deer and elk is focused on elk as an indicator for both species. Pronghorn habitat is better represented by sage steppe dependent species such as sage-grouse and gray flycatcher. Refer to the sections on Migratory Birds and Sensitive Species for discussion of sage steppe habitat.

Long-term records indicate that elk were absent from the Forest in 1936 (Bailey 1936). This is the oldest written record of elk populations on the Forest. Anecdotal information indicates elk did inhabit the Forest in the mid to late 1800's but were probably extirpated by over-hunting and habitat losses due to heavy grazing pressure during that era. Since that time, elk populations have made steady increases in numbers and are found throughout the Ochoco National Forest at the present time.

The East Maury project area lies within one ODFW management zone, the Maury Game Management Unit (GMU). ODFW, in their state-wide “Oregon’s Elk Management Plan” established population management objectives for all GMU’s in the state. The GMU includes all lands within the boundary, whether privately owned or managed by state or federal agencies.

The population management objective for the Maury GMU was 1,100 elk in 1994, and increased to 1,400 in 2005 (ODFW, 2007). Population estimates over the past decade have ranged from a high of 1,400 in 2000 to a low of 900 in 2003. The estimate for 2007 is at 1,400 (ODFW, 2007). The GMU has an estimated population that is at the management objective. The other population goals used in the Elk Management Plan was for bull/cow and calf/cow ratios. The management objective for bull/cow ratios in the Maury GMU is 20/100 (ODFW, 2007). The 2007 estimate for this parameter for the Maury GMU is 13/100. The management objective for calf/cow ratios for the Maury GMU unit is 35/100. Estimated calf/cow ratios have exceeded the management objective in 15 out of 17 years since 1990, including 2007 in which this ratio was estimated at 60/100 (ODFW, 2007).

The population dynamics exhibited on the Forest lands are influenced by hunting pressure and adjacent land management, and are not exclusively determined by habitat conditions on the forest. Management of forage, cover, water sources and access on adjacent private lands may attract animals onto private lands and off the forest. Habitat conditions on the forest may not be the primary factor limiting elk distribution and populations on the Ochoco National Forest. Mortality rates due to hunting and disturbance to animals on the public land are factors that also limit the elk population on the Forest. Bull/cow ratios are most significantly affected by hunting activities and it is hard to determine the effect from forest management activities on this parameter. However, the abundance, quality and distribution of escapement cover and the density of open roads and OHV access are factors that likely affect survival of animals during hunting seasons. Elk calving areas include areas with known use by elk during calving season, or expected use based on habitat conditions.

The Habitat Effectiveness Index (HEI) for elk was used to analyze and describe the existing habitat condition within the East Maury project area, and the effects of the alternatives. HEI is the total habitat effectiveness within the project area, and within General Forest, General Forest Winter Range, and Winter Range management allocations. These allocations have standards and guidelines in the Forest Plan. HEI includes variables for cover quality (marginal vs. satisfactory), cover quantity (% cover), and open road density. An optimal ratio of forage to cover is 60/40 (Thomas, 1979). The total amount of cover is reflected in the HEI index for cover quantity with the % cover at 40% having the highest value and with a decreasing index value as % cover deviates from 40%. Percent cover is the percent of analyzed allocations within the project area in marginal and satisfactory thermal cover combined. In the East Maury project area, satisfactory cover is limited in amount and distribution, but total cover is not. **Table 3-48** displays existing percent cover, road density, overall HEI value and the Forest Plan goal for each management area for which standards apply.

Table 3-48 East Maury Existing Cover, Road Density, and HEI Values

Management Area (MA)	Acres in MA	% Cover by MA	Road Density (mi./sq. mi)	Existing HEI Value	Forest Plan HEI Goal (2nd Decade)
General Forest	16,458	49	2.6	45	28
G. F. Winter Range	1,749	45	0.5	82	6
Winter Range	3,773	24	0.5	28	6

Alternative 1 – Big Game

No satisfactory cover or marginal cover would be treated under this alternative, and no roads would be closed. Percent cover and HEI would remain at the current levels for a period of time. Habitat effectiveness would continue to follow the current trend, with gradual development of additional cover as the canopy of untreated stands continue to close. The year-round open road density is expected to remain at approximately the current levels.

Existing road density is 2.6 miles/square mile in General Forest, 0.5 miles/square mile in General Forest Winter Range, and 0.5 miles/square mile in Winter Range. These conditions meet the Forest Plan standard of 3.0 miles/square mile or less in General Forest; and 1.0 miles/square mile on winter range (both General Forest Winter Range and Winter Range) between December 1 and May 1.

This alternative would maintain the current condition of all existing habitat for big game animals, including elk, in the short term (see **Table 3-49**). Stands that currently provide marginal cover would continue to close in and over time more satisfactory (thermal) cover would develop as canopy closure increases. This would improve the cover quality index (proportions of marginal and satisfactory cover types). Initially, forage to cover ratios would deviate from optimal (60% forage to 40% cover). The cover quantity index (percent cover) would improve over time in Winter Range as more cover develops, but General Forest and General Forest Winter Range would gradually move away from the optimal forage/cover ratio as they are already above 40% cover. In these allocations, forage would become more limiting as stands close. This would correspond to a continual decrease in the cover quantity index in allocations where cover currently exceeds 40 percent. However, at the same time increasing stand density would gradually increase the risk of future loss of cover to fire, insects and disease which could ultimately effect forage/cover ratios (depending on intensity and extent). The road density would not be reduced under this alternative and the road density indices would not be altered. There would be no initial change in HEI in any management allocation. Over time HEI is expected to increase in Winter Range as percent cover increases, but may continually decrease in General Forest and General Forest Winter Range until one or more disturbance events restore forage.

Table 3-49 Effects to Big Game Habitat from Alternative 1

	Open Road Density (mi/sq mi)	Percent Cover	HEI Value
General Forest	2.6	49	45
General Forest Winter Range	0.5	45	82
Winter Range	0.5	24	28

This alternative would not result in disturbance to elk from human activity associated with project implementation. Cover within elk security habitat would be retained until natural disturbance reduces it. Elk calving habitat would continue the trend of increasing density of coniferous cover and decreasing condition of riparian hardwoods and other forage species.

Alternative 2 – Big Game

This alternative would alter the current condition of habitat for big game animals. This alternative would commercially harvest 1,068 acres, non-commercially thin 377 acres and burn natural fuels on 963 acres within mapped elk calving areas. This could result in disturbance to elk from human activity associated with project implementation. Elk calving habitat would be

treated (68% of the area) to reduce density of coniferous cover which could improve the condition of riparian hardwoods and other forage species where they occur, but it would also reduce security cover for animals using the calving areas. To minimize disturbance in calving areas, project activities would be restricted from May 15 to June 30 as described in detail in Design Elements, Appendix B and the Wildlife Report. Acreage of stands that currently provide marginal and satisfactory cover would be reduced in General Forest, General Forest Winter Range and Winter Range. The percentage of total cover comprised of satisfactory cover would be reduced, however the cover quality index would not change in any allocation. The cover quantity index (percent cover) would be reduced under this alternative in General Forest 5 percent, General Forest Winter Range 65 percent, and Winter Range 20 percent. Forage to cover ratios would deviate from optimal by 9 percent in General Forest, 19 percent in General Forest Winter Range, and 28 percent in Winter Range (all lower than optimal percent cover).

In General Forest 7.3 miles of new road construction is proposed. This new road construction increases the open road density from 2.6 to 2.9 miles/square mile during implementation. In General Forest Winter Range 0.9 miles of new road construction is proposed. This new road construction increases the open road density from 0.5 to 0.84 miles/square mile during implementation. In Winter Range 1.0 miles of new road construction is proposed. This new road construction increases the open road density from 0.5 to 0.7 miles/square mile during implementation. These conditions meet the Forest Plan standard of 3.0 miles/square mile or less in General Forest, and also 1.0 miles/square mile standards on Winter Range and General Forest Winter Range between December 1 and May 1. To ensure that the intent of the Forest Plan Standards and Guideline is met for open road density during implementation, seasonal restrictions will be applied to treatment units, road work and road use in both Winter Range and General Forest Winter Range as described in the Design Elements, Appendix B and the Wildlife Report. After post-harvest road closures are implemented, the resultant open road network should meet winter range standards.

The road density would be increased temporarily, and the road density indices would be decrease temporarily in all three allocations. There would be an initial decrease in overall HEI in General Forest, General Forest Winter Range and Winter Range, and even after road closures HEI would remain below existing condition in all allocations due to decreased cover quantity indices as shown in **Table 3-50**.

Table 3-50 Effects to Big Game Habitat from Alternative 2

	Open Road Density (mi/sq mi)	Percent Cover	HEI Value
General Forest	2.9	31	39
General Forest Winter Range	0.8	21	22
Winter Range	0.7	12	11

Alternative 3 – Big Game

This alternative would alter the current condition of habitat for big game animals. This alternative would commercially harvest 987 acres, non-commercially thin 457 acres and burn natural fuels on 771 acres within mapped elk calving areas. This could result in disturbance to elk from human activity associated with project implementation. Elk calving habitat would be treated (62% of the area) to reduce density of coniferous cover which could improve the condition of riparian hardwoods and other forage species where they occur, but it would also

reduce security cover for animals using the calving areas. To minimize disturbance in calving areas, project activities would be restricted from May 15 to June 30 as described in detail in Design Elements, Appendix B and the Wildlife Report. Acreage of stands that currently provide marginal and satisfactory cover would be reduced (in General Forest, General Forest Winter Range and Winter Range). In all three allocations, the percentage of total cover comprised of satisfactory cover would be reduced; however, the cover quality index (relates to relative amounts of satisfactory vs. marginal cover) would not change.

The cover quantity index would be reduced under this alternative by 5 percent in General Forest, 20 percent in General Forest Winter Range and 20 percent in Winter Range. Forage to cover ratios would deviate from optimal by 7 percent in General Forest, 12 percent in General Forest Winter Range and 26 percent in Winter Range (all lower than optimal percent cover).

In General Forest 0.4 miles of new road construction is proposed. This new road construction increases the open road density from 2.6 to 2.7 miles/square mile during implementation. No new roads are proposed in General Forest Winter Range or Winter Range. The open road density would remain at 0.5 miles/square mile in both allocations. These conditions meet the Forest Plan standard of 3.0 miles/square mile or less in General Forest; and 1.0 miles/square mile on winter range (both General Forest Winter Range and Winter Range) between December 1 and May 1.

The road density would have a slight temporary increase under this alternative in General Forest and the road density index would be decrease by 1 percent. There would be an initial decrease in overall HEI in all three allocations. Even after road closures HEI would remain below existing condition in all allocations due to decreased cover quantity indices as shown in **Table 3-51**.

Table 3-51 Big Game Habitat Alternative 3

	Open Road Density (mi/sq mi)	Percent Cover	HEI Value
General Forest	2.7	33	41
General Forest Winter Range	0.5	28	66
Winter Range	0.5	14	12

Cumulative Effects – Big Game

Past management has included construction of roads in elk habitat. Within the planning area 3.2 miles of open road exist in Winter Range (MA-20), resulting in an open road density of 0.5 miles/square mile. There are also 1.4 miles of open road in General Forest Winter Range (MA-21), resulting in an open road density of 0.51 miles/square mile. Within these allocations Forest Plan standards require a road density at or below 1.0 mile/square mile from December 1 to May 1.

Alternative 2 increases road density to 0.84 miles/square mile during implementation. This figure includes only open roads. The alternative would reopen some currently closed roads during implementation, but proposes to close all new and reopened roads after harvest activities are completed. This would bring road density back within standards after closures are implemented. To ensure that the intent of the Forest Plan Standards and Guideline is met for open road density during implementation, seasonal restrictions will be applied to treatment units, road work and road use in both Winter Range and General Forest Winter Range as described in the Design Elements, Appendix B and the Wildlife Report. However, thinning of vegetation,

establishment of travel routes (temporary roads and skid trails) and removal of woody debris through prescribed burning is likely to result in increased accessibility of treated areas to cross country travel by OHV and other motorized vehicles. There is a cumulative effect from the combination of ongoing motorized recreational use and firewood gathering and the effects of this project on accessibility. The cumulative effect is that the presence of road beds, a relative lack of woody debris and vegetative barriers, and a travel management plan that allows for cross country travel are likely to result in difficulty in maintaining road closures, and thus in meeting winter range road density standards, especially in General Forest Winter Range. Travel management planning is currently being done for Ochoco and Deschute National Forests. The forest-level travel management planning effort would address off-road and travel off of designated open roads.

Harvest and other management history are summarized on pages 3-2 to 3-3, and are also discussed in detail in the Wildlife Report. Past management has also affected the amount of big game cover and forage available in the project area. Timber and fuel management activities have affected the current distribution of seral structural stages, and thus big game cover and forage availability. Regeneration harvest treatments reduced the abundance of marginal and satisfactory cover for elk, but would have increased forage. Partial cutting reduced satisfactory cover, but would have increased marginal cover or forage depending on post treatment canopy closure. The effects of this harvest history within the three allocations with management standards for elk combine with the effects of this project to yield the cover quality and quantity measures used in this analysis and displayed in the HEI tables.

In subwatersheds that overlap the project area there are 79,142 acres of land that is not managed by the Forest Service. Of this 204 acres of privately owned timber land are within the Forest boundary. On the majority of those watershed acres the ability to provide cover with high crown closure is limited by site productivity. Much of the subwatershed acres are in juniper woodland, shrub steppe, or valley bottoms. Immediately adjacent to and within the Forest boundary there are forested private timberlands. Where they existed historically, large overstory trees have been removed on some of the forested land through past timber harvest. For this reason satisfactory cover has been reduced on private lands in the analysis area. At the same time, many second growth or residual stands (left after overstory removal, and juniper stands have not been thinned, or have been lightly thinned, on private land resulting in marginal cover in those areas. Where intensive timber management and/or juniper removal has occurred on private lands, forage is available to big game as well as livestock. In some areas agricultural practices such as hay cropping, provide seasonal forage areas of high quality when it is in proximity to cover blocks. Private land access restrictions often provide more security to big game animals than is available on the adjacent public lands. The quality of elk habitat on lands outside the Forest boundary are not represented in the HEI tables. However, these lands do contribute significantly to production of elk herds that use the Maury Mountains, especially as security habitat during hunting season and as winter range. Effects with proposed activities on National Forest land combine with effects of management on private land within herd ranges in the Maurys. As a result elk may find more abundant forage on the forest, reducing elk foraging pressure on private lands. At the same time, elk may find hiding and escapement cover more limiting on the Forest, and seek refuge on private lands seasonally during periods when human use is high on public lands.

Migratory and Focal Bird Species

Affected Environment

Partners In Flight - Northern Rocky Mountains Bird Conservation Plan (Altman, 2000) identifies priority habitats and focal species by subprovince. The Ochoco National Forest is within the Blue Mountains subprovince. **Table 3-52** lists the habitats and species listed for the Blue Mts. Subprovince.

Table 3-52 Blue Mountains Subprovince Priority Habitats and Focal Species

Priority Habitats	Focal Species for the Blue Mts. Province
Dry Forest	White-headed woodpecker, flammulated owl, chipping sparrow, Lewis's woodpecker
Mesic Mixed Conifer	Townsend's warbler, Vaux's swift, varied thrush, MacGillivray's warbler, olive-sided flycatcher
Riparian Woodland	Lewis' woodpecker, red-eyed vireo, veery
Riparian Shrub	Willow flycatcher
Subalpine Forest	Hermit thrush
Montane Meadows	Upland sandpiper
Steppe Shrublands	Vesper sparrow
Aspen	Red-naped sapsucker
Alpine	Gray-crowned rosy finch

Nine of the species listed were modeled using the data derived from the Viable Ecosystems process. Another species, the gray flycatcher was analyzed as a surrogate for steppe shrublands (in lieu of vesper sparrow). White-headed woodpecker was analyzed and is described above in the Primary Cavity Excavators section. Of the remaining species analyzed, 2 are currently above the minimum amount of habitat abundance and 4 are below. The existing amount of priority habitat has been compared to the range of habitat identified as the historic range of variability (HRV). This allows a comparison between what exists today as opposed to the balance of conditions that may have existed historically. Focal species with habitat above HRV are Townsend's warbler and hermit thrush, species often associated with dense forest conditions.

Generally, there is a relative shortage of habitat for those species associated with large tree structure and open forest conditions (chipping sparrow, Lewis's woodpecker, olive-sided flycatcher). The gray flycatcher, which uses open shrub/steppe habitat or edges of open pine stands, is also below HRV. These trends in habitats below HRV are primarily the result of past management practices (harvest of large and old forest structure) and fire suppression (allowing dense understory development in pine stands, and allowing western juniper dominance to expand in shrublands). **Table 3-53** compares historic habitat amounts to current amounts in project area.

Table 3-53 Comparison of Existing Focal Species Habitat to HRV

Species	HRV minimum (acres)	HRV maximum (acres)	Existing Area (acres)	Status

Flammulated Owl	9,439	20,808	14,595	Within Range
Chipping sparrow	9,461	18,392	5,985	Below minimum
Lewis's woodpecker	7,241	12,346	4,705	Below minimum
Varied Thrush	1,435	4,208	2,939	Within range
MacGillivray's warbler	0	0	0	Within range
Olive-sided flycatcher	8,852	15,752	5,743	Below minimum
Townsend's warbler	398	798	2,291	Above range
Hermit Thrush	1,351	2,274	3,377	Above range
Gray Flycatcher	6,193	13,131	3,818	Below minimum

Environmental Consequences - Migratory and Focal Bird Species

Alternative 1

No activities outside of the on-going operation and maintenance that occur on the forest would occur. This alternative would continue to perpetuate the abundance of wildlife species associated with dense forests having true-fir and Douglas fir understories. Under this alternative there would be a continued decline in habitat abundance for all species that select open forest and early seral conditions as denser, mid to late seral conditions continue to develop. In the long-term, Alternative 1 results in the least amount of habitat for species that select open forest or early seral conditions. In the long-term, this alternative would result in the most habitat for those species associated with dense, mid to late seral conditions, in the absence of large scale disturbance (fire, insects disease).

The red-eyed vireo, veery and willow flycatcher are associated with riparian woodland and shrub plant communities. These habitats exist within the project area, but are small in size and fragmented. These species may be present and utilizing the habitats as available. The no action alternative would retain the current trends in displacement of riparian vegetation due to encroachment by young conifers in portions of this habitat type.

Common to Alternative 2 and 3

There are no design elements specific to neotropical birds. However, measures prescribed to restrict activities within nesting seasons for goshawk and other raptors and during elk calving season will also afford reduced disturbance to nesting birds where their home ranges overlap with restricted areas. In addition, due to logistical limitations on harvest, thinning and burning activities, some of the work will be scheduled outside of the nesting season. However, a portion of the project work would occur during the nesting season and some individuals would likely be impacted by management activities. Since most migratory birds occupy relatively small nesting season home ranges and are present in relatively large numbers, it is expected that suitable habitat outside of treatment units will provide alternate cover for birds that are displaced during activities. The area outside of treatment units will also provide source populations for recolonization of areas in which individuals have been lost. Birds that are disturbed early in the nesting season may move out of the treatment area during operations and may re-nest later, or outside of the treatment area. In some cases, habitat outside of the unit may be limiting or fully occupied, in which case the displaced birds may become non-reproductive during the year of operation. These are short-term impacts to individual birds or pairs of birds. This is a trade-off for the long term benefits of providing increased amounts of habitat for the focal species (and the communities they represent) that are currently below the minimum historic levels within this

watershed, and for the restoration of habitat for species that utilize herbaceous and shrubby vegetation.

Alternative 2

This alternative results in increases in habitat for species that select for open forest and early seral conditions due to stand density reduction and the favoring of early seral species. The habitat projections as a result of Alternative 2 are shown in **Table 3-54**. Species that are currently below or above HRV, move within or toward HRV as a result of proposed treatments. Two species outside the range of viability move to within HRV. In the long-term, alternative 2 increases the amount of habitat for all open forest species as well as those that select for large tree size. Though Townsend’s warbler and hermit thrush prefer relatively dense forests, the analysis shows an increase in the amount of habitat for these species, which is due to the increase in acreage of larger size classes in the grand fir and Douglas-fir plant association groups.

Table 3-54 Alternative 2 Focal Species Habitat Projections

Species	Minimum HRV (acres)	Maximum HRV (acres)	Post Treatment Area (acres)	Status
Flammulated Owl	9,439	20,808	15,098	Within
Chipping sparrow	9,461	18,392	9,181	Below
Lewis’s woodpecker	7,241	12,346	7,972	Within
Varied Thrush	1,435	4,208	1,661	Within
MacGillivray’s warbler	0	0	0	Within
Olive-sided flycatcher	8,852	15,752	8,851	Below
Townsend’s warbler	398	798	1,254	Above
Hermit Thrush	1,351	2,274	2,138	Within
Gray flycatcher	6,193	13,131	5,105	Below

This alternative would alter the current trend in displacement of riparian vegetation due to encroachment by young conifers in the portions of this habitat type where prescribed fire or silvicultural treatments are employed. This would result in a beneficial effect to species associated with riparian woodland and shrub plant communities (red-eyed vireo, veery and willow flycatcher). This alternative also proposes aspen restoration activities involving thinning of conifers which are upslope of aspen clones or competing with aspen for light and moisture. Aspen treatments would result in a beneficial effect to species associated with aspen dominated vegetation. These treatments are consistent with the goals and objectives for these habitats as listed in the *Partners In Flight, Landbird Conservation Strategy for the Northern Rocky Mountains*.

Alternative 3

This alternative also increases habitat for species that select for open forest and early seral conditions. Species that are currently above or below HRV move toward HRV as a result of proposed treatments, but none move to within the HRV. The habitat projections as a result of Alternative 3 are shown in **Table 3-55**.

Table 3-55 Alternative 3 Focal Species Habitat Projections

Species	Minimum HRV (acres)	Maximum HRV (acres)	Post Treatment Area (acres)	Status
Flammulated Owl	9,439	20,808	15,121	Within
Chipping sparrow	9,461	18,392	8,437	Below
Lewis's woodpecker	7,241	12,346	7,209	Below
Varied Thrush	1,435	4,208	2,057	Within
MacGillivray's warbler	0	0	0	Within
Olive-sided flycatcher	8,852	15,752	8,106	Below
Townsend's warbler	398	798	1,579	Above
Hermit Thrush	1,351	2,274	2,534	Above
Gray flycatcher	6,193	13,131	5,078	Below

As discussed in Alternative 2, this alternative would benefit species associated with riparian woodlands and shrub habitat. The proposed aspen treatments would result in a beneficial effect to species associated with aspen dominated vegetation. These treatments are consistent with the goals and objectives for these habitats as listed in the *Partners In Flight, Landbird Conservation Strategy for the Northern Rocky Mountains*.

Cumulative Effects - Migratory & Focal Bird Species

Harvest and other management history are summarized on pages 3-2 to 3-3, and are also discussed in detail in the Wildlife Report. Past harvest and other management activities have affected the current distribution of seral structural stages, and thus habitat for a variety of neotropical and other bird species. Much of this harvest history resulted in a reduction of large pine and other LOS stands. Since the mid 1990's the Forest's emphasis has shifted from removal of large pine to re-establishment of large pine and larch, and other single-strata LOS stands. The combined effect of past management activities along with implementation of the alternatives for this project result in landscape level habitat abundance for focal species as displayed in **Table 3-56**.

Table 3-56 Cumulative Habitat Projections for Migratory and Focal Birds

Species	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)
Flammulated Owl	14595	15098	15121
Chipping sparrow	5985	9181	8437
Lewis's woodpecker	4705	7972	7209
Varied Thrush	2939	1661	2057
MacGillivray's warbler	--	--	--
Olive-sided flycatcher	5743	8851	8106
Townsend's warbler	2291	1254	1579
Hermit Thrush	3377	2138	2534
Gray flycatcher	3818	5105	5078

Shaded cells indicate habitat acres below the HRV.

Other forest management activities, such as grazing management can influence the quality of habitat and use of areas by migratory birds. For example, herbivores can alter the structure and composition of herbaceous and shrubby vegetation, which can influence changes in forage base and nesting cover for some species of birds. For species that nest in willow thickets, such as willow flycatchers, the effects of grazing can be negative. Future habitat could be reduced for cavity nesting species that select for riparian hardwoods (such as red-naped sapsuckers or Lewis's woodpeckers) when browsing limits development of sprouts into overstory stems in aspen or cottonwood stands. However, increases in upland forage production resulting from proposed treatments, when combined with improved upland water availability and allotment management (2006 Maury Mountains AMP), have potential to reduce grazing/browsing pressure in riparian and shrub habitats, and thus reduce impacts to habitat for riparian or shrub nesting species. For species that forage in open grassy areas, such as blue birds, the effect of grazing can be positive, and when combined with the stimulation of herbaceous vegetation resulting from proposed treatments, can provide a complementary benefit for species such as bluebirds. For grassland nesting species improved upland forage production that results from proposed activities combined with improved water availability can result in better distribution of cattle, potentially improving conditions for ground nesting birds away from the water sources. However, cover for ground or shrub nesting species may be reduced in very close proximity to upland water developments.

In subwatersheds that overlap the project area there are 204 acres of privately owned timber land within the Forest boundary. On the majority of those acres large overstory trees have been removed through past timber harvest. For this reason large tree and snag habitat has been reduced on private lands in the analysis area. Adjacent to the analysis area there are 79,142 acres in sub-watersheds that intersect the project area. The majority of those acres are juniper woodland and shrub steppe, with stringers of forest land in draws and on north or east facing slopes. Where intensive timber management and/or juniper removal has occurred on private lands, herbaceous and shrub habitat is available. Upland shrub steppe habitat has been restored on some areas where juniper density has been addressed, but has declined in areas where juniper encroachment has developed into high density stands. In some areas agricultural practices such as hay cropping, and the construction of reservoirs can provide seasonal forage areas of high quality for some bird species, however there are hazards in such areas for ground nesting birds.

Sensitive, Threatened and Endangered Wildlife Species

Affected Environment

Effects to Threatened Endangered and Sensitive Species are summarized in Section 8 of the Wildlife Report and in more detail in the Biological Evaluation for terrestrial wildlife species. The Biological Evaluation prepared for the project (summary included as **Appendix C**) documents possible effects of proposed activities on threatened, endangered and sensitive species in the project area. No federally listed terrestrial wildlife species are known to occur on the Ochoco National Forest. The Northern bald eagle was delisted in 2006 and is now addressed as a sensitive species on Ochoco National Forest. The Ochoco National Forest is also within the listing range for the Canada lynx (*Lynx Canadensis*), but has been determined to have insufficient primary habitat to warrant management of Lynx Analysis Units (per direction in the amended Lynx Conservation Assessment and Strategy, 2000). Unconfirmed lynx sightings have been reported (1999 to 2003) near the south end of the project area. It is not certain whether

these observations were actually bobcats or if they were individual lynx on long distance forays or dispersal from source populations in northern boreal forests.

There are nine wildlife species on the Regional Forester's sensitive species list that are known or suspected to occur on the Ochoco National Forest:

- Northern bald eagle (*Haliaeetus leucocephalus*),
- Peregrine falcon (*Falco peregrinus anatum*),
- bufflehead (*Bucephala albeola*),
- upland sandpiper (*Bartramia longicauda*),
- western sage-grouse (*Centrocercus urophasianus*),
- gray flycatcher (*Empidonax wrightii*),
- tricolored blackbird (*Agelaius tricolor*),
- pygmy rabbit (*Brachylagus idahoensis*), and
- California wolverine (*Gulo gulo*).

The project area contains potential habitat for bald eagle, peregrine falcon, bufflehead, western sage grouse, gray flycatcher, and wolverine. There is no habitat for the upland sandpiper, tricolored blackbird, and pygmy rabbit; therefore the project will not impact on these species.

Bald Eagle - Within the project area there is one known bald eagle nest and two mapped winter roosts (one included in the Forest Plan). Nesting, foraging and roosting use occurs in and adjacent to the project area; and actions are proposed in the Bald Eagle Management Area associated with one nesting pair, and in an Eagle (winter) Roost Areas.

Peregrine Falcon - Peregrine falcons have not been recorded within the project area, though they occasionally get reported locally, including one record from 2005 along the Crooked River. These may have been birds on migration. There are no confirmed nesting sites for this species on Lookout Mountain Ranger District. There is potential habitat in the project area, but rock features in the area have low potential for nesting by this species.

Bufflehead - There is potential habitat in or adjacent to the project area, but there are no known nesting sites or pairs. Most of the ponds or reservoirs in or adjacent to the project area are small impoundments with fluctuating water tables. These are more likely to serve as migratory stop-over sites than as nesting sites for this species.

Western Sage-Grouse - Sage grouse have been recorded just outside the project area and two leks are known within 4 miles of the project boundary. Potential habitat within the project boundary is not currently suitable as sage grouse habitat due to juniper encroachment. The state-wide sage-grouse population was relatively stable between 1980 and 2003, but sage-grouse numbers on Prineville District (primarily BLM and private land interface at lower elevation in the Crooked River and Deschutes Basins) continually declined during that period. Conversion of sagebrush habitat to agricultural land and juniper encroachment are cited as contributing factors to the sage-grouse decline within the Prineville District (ODFW, 2005). Potential habitat in the project area consists of juniper woodland and sage steppe plant associations that are currently limited in suitability for sage-grouse due to juniper encroachment and proximity to forest stands.

Gray Flycatcher - Gray flycatchers are expected to occur in the project area, though their presence there has not been confirmed. In Oregon, gray flycatcher populations are increasing (Marshall, 2003). Potential habitat in the project area consists of juniper woodland and sage

steppe plant associations that are currently limited in suitability for gray flycatchers due to juniper encroachment and lack of tall shrub structure.

California Wolverine - No wolverine dens are known or suspected near the project area. This wide ranging animal is reported occasionally, including a 1984 record about 1 mile south of the project area. It is uncertain whether wolverines exist in Oregon as reproducing populations, or if the occasional sightings in our area represent long distance foraging or dispersal of animals from northern boreal forests.

Environmental Consequences – Sensitive Species

Alternative 1

Bald Eagle - There would be no activities outside of the ongoing program of work that would affect bald eagles or their habitat within the project area. There could be increased risk of loss of habitat due to future wildfire intensity or extent due to retention of existing fuel loads and continuation of fuel development and accumulation over time. However, predicting the impact of future events on bald eagle nesting, roosting or foraging areas in a quantitative manner is difficult because of uncertainties regarding the location and conditions under which such future events might occur. Over time live trees currently supporting a nest or with potential as future nest sites may be weakened by stress from competition, and succumb to insect infestation. Once the live overstory trees die, they become less attractive as nest sites for bald eagles. The determination for the No Action Alternative is **No Impact (NI)**, because there would be no alteration of habitat (or change from current trends) and no change in potential disturbance levels.

Peregrine Falcon - The project has a very low probability of disturbing peregrine falcons that could be present in the project area because of the lack of nesting habitat. The project does not alter cliff habitat. The determination is **No Impact (NI)** because this alternative does not alter habitat or propose activities that could cause disturbance to this species.

Bufflehead - The project would not alter lake or lakeshore habitat that could provide habitat for nesting or migrating bufflehead. The determination is **No Impact (NI)** because this alternative does not alter habitat or propose activities that could cause disturbance to this species.

Western Sage-Grouse - The project does not treat potential habitat with 4 miles of known lek (breeding) sites. Increasing juniper density would not be addressed and sage grouse are not expected to occur within the project area due to limited habitat availability. Juniper encroachment occurring on private lands along the north and east sides of the project area and on BLM lands along the east side of the project area would contribute to a declining trend in suitability of sage grouse habitat. However, the importance of the marginal habitat within and along the edge of the project area is not clear, as it has not yet been determined where the females go for nesting and brood rearing after they leave the leks that are north and east of the project boundary. Under the no action alternative 452 acres of structural/seral stages capable of providing primary nesting habitat would be present within the project area. Within 1675 acres along the eastern boundary of the project area where potential for sage grouse occupancy is highest, the suitability of habitat for sage grouse would continue to decline. The determination for the no action alternative is **No impact (NI)** as there would be no change to habitat condition or trends, and no change in potential disturbance levels.

Gray Flycatcher - The no action alternative does not directly alter upland shrub habitat. However, there may be a higher risk of future large scale disturbance associated with this alternative. Under this alternative foraging and nesting habitat for gray flycatchers would continue to decline as juniper density increases in juniper steppe, juniper woodland and dry pine sites. At some point in the future succession would likely be set back to a grass/forb stage due to high intensity wildfire. Upland shrub communities would likely redevelop on some of these burned over areas in the future. Thus, availability of habitat would vary over time depending on extent and intensity of future disturbance events. The determination for the no action alternative is **No impact (NI)** as there would be no change to habitat condition or trends, and no change in potential disturbance levels.

California Wolverine - The no action alternative does not directly alter cover or forage for species that would be likely food resources for wolverine. However, there may be a higher risk of future large scale disturbance associated with this alternative. Under this alternative forage for many herbivorous species would continue to decline, resulting in less available food resources for carnivores such as wolverine. At some point in the future forage areas would likely develop due to insect or disease outbreaks or high intensity wildfire. Thus availability of prey would vary over time depending on extent and intensity of future disturbance events. Woody debris would continue to accumulate providing potential hiding or denning cover to wolverine that could use the area. These woody debris accumulations would likely contribute fuel for wildfires in the future, thus the availability of this cover would also vary over time depending on extent and intensity of future disturbances. The determination for the no action alternative is **No impact (NI)** as there would be no impact to habitat condition or trends, and no change in potential disturbance levels.

Other TES Species - On May 29, 2001, the Forest received concurrence from the U.S. Fish and Wildlife Service that implementation of any activities contained within the Forest Plan, as amended, is not likely to adversely affect the Canada lynx outside of an existing Lynx Analysis Unit. At the time this consultation took place there were, and continue to be, no Lynx Analysis Unit's existing on the Ochoco National Forest. The determination for Canada lynx is "**May effect, but Not Likely to Adversely Affect**" (NLAA) for any alternative that implements the Forest Plan, including no action. As described in the introductory paragraph, there is no habitat for the other sensitive species, and therefore the determination is **No Impact (NI)** for upland sandpiper, tricolored blackbird and pygmy rabbit.

Alternative 2 and 3 – Sensitive Species

Bald Eagle - A determination of "**May impact individuals or habitat, but not likely to result in a trend toward federal listing or loss of viability of the species or populations**" (MIIH) was reached for both action alternatives because: nesting, foraging and roosting use occurs in and adjacent to the project area; and actions are proposed in the Bald Eagle Management Area associated with one nesting pair, and in eagle winter roost areas. Both action alternatives propose to treat the nest stand with prescribed fire, and both roosts with a combination of prescribed burning, commercial and non-commercial thinning. The prescriptions for these treatments should be consistent with the intent of maintaining or promoting the development of large live trees in these areas. However, there is some risk of associated with these treatments such as crown or cambium scorch, mechanical stem or root damage, and increased accessibility to human disturbance. Opening up the canopy in winter roosts may decrease climatic buffering

of inclement weather. Seasonal restrictions on activities are prescribed in detail in the Biological Evaluation and are described in the Design Elements, and are listed in Appendix B.

Peregrine Falcon - A determination of “**May impact individuals or habitat . . .**” (MIIH) was reached for all action alternatives because there is potential foraging habitat in the project area, however the project has a very low probability of disturbing peregrine falcons that could be present in the project area because of the lack of typical nesting habitat. The project does not alter cliff habitat, therefore results in no alteration of potential nesting habitat for this species. There are no known nesting sites or pairs which would be disturbed by any of the activities associated with implementation of this project.

Bufflehead - A determination of “**May impact individuals or habitat . . .**” (MIIH) was reached for all action alternatives because there is potential habitat in the project area, however this project results in no alteration of habitat for this species, also there are no known nesting sites or pairs which would be disturbed by any of the activities associated with implementation of this project.

Western Sage-Grouse - A determination of “**May impact individuals or habitat . . .**” (MIIH) was reached for all action alternatives because potential habitat is involved, and there will be restoration of potential habitat suitability. Alternatives 2 and 3 would result in 2,003 acres of structural/seral stages capable of providing primary nesting habitat within the project area. Along the eastern boundary of the project area where potential for sage grouse occupancy is highest, the suitability of habitat for sage grouse would be improved on 1675 acres within treatment Units 43, 46, 116, 159, 172, 225, 261 and 263 under both action alternatives. It is predicted that primary nesting habitat will be increased by 1551 acres immediately after treatment within these units. Individuals of this species may be impacted during project operations that occur during the nesting season within potential habitat, but no nesting areas are known to be within these treatment units.

Gray Flycatcher - A determination of “**May impact individuals or habitat . . .**” (MIIH) was reached for all action alternatives because potential habitat is involved, and there will be short-term reduction of habitat within the project area and potential long-term habitat restoration. Thinning and burning would reduce coniferous canopy closure and water uptake, allowing more light and moisture to be available to the understory vegetation. This could improve habitat over time by allowing shrub nesting habitat to develop. Burning can also reduce nesting structure in the short term by removing tall shrubs. Relatively open juniper woodland and juniper steppe habitats have the highest potential to support nesting gray flycatchers. Treatments on these juniper sites should improve habitat for flycatchers as long as some tall shrub habitat remains scattered throughout treatment units. Improved habitat conditions is expected to occur on the units described above for sage-grouse, as well as on an additional 1374 acres in Units 9, 11, 30, 213, 214, 235, 245, 260 and 262. Individuals of this species may be impacted during project operations that occur during the nesting season. Birds that are displaced early in the nesting season may re-nest, or become non-reproductive during that nesting season. When thinning or burning occurs in the fall, the activities would be outside of the nesting season, and potentially after these birds have left Oregon for the fall migration.

California Wolverine - A determination of “**May impact individuals or habitat . . .**” (MIIH) was reached for all action alternatives because wolverines may use the area and habitat modification would occur under the action alternatives, however the project is not expected to

alter the likelihood of use of the project area by this species. The project does not alter rock talus habitat, but could alter large wood accumulations and vegetation, which could alter potential denning habitat. However, the project has a low probability of disturbing any wolverine due to the relatively low potential for occupancy of habitat in the project area. The alternatives that reduce open road density, could improve habitat conditions by reducing potential for human disturbance. However, none of the proposed alternatives reduce road density substantially enough to result in a significant change in habitat suitability for this species. The project would improve the forage base for potential prey species and sources of carrion. Therefore, potential food resources for carnivores such as wolverine would be improved under the action alternatives. Wolverines may use the area and habitat modification would occur under the action alternatives, however the project is not expected to have adverse effects to this species.

Other TES Species - On May 29, 2001, the Forest received concurrence from the U.S. Fish and Wildlife Service that implementation of any activities contained within the Forest Plan, as amended, is not likely to adversely affect the Canada lynx outside of an existing Lynx Analysis Unit. At the time this consultation took place there were, and continue to be, no Lynx Analysis Unit's existing on the Ochoco National Forest. The determination for Canada lynx is "**May effect, but not likely to adversely affect**" (NLAA) for both action alternatives. As described in the introductory paragraph, there is no habitat for the other sensitive species, and therefore the determination is no impact for upland sandpiper, tricolored blackbird and pygmy rabbit.

Cumulative Effects – Sensitive Species

Past harvest and other management activities have influenced the availability and quality of habitat for threatened and sensitive species. The construction of ponds and reservoirs have created habitat for buffleheads and bald eagles. Removal of large trees, snags and down wood through timber harvest have altered the availability of potential denning sites for wolverine and potential nest or roost sites for bald eagles. Road construction and development of recreation sites have altered the extensiveness and level of human activity throughout the project area, increasing the potential for disturbance to wildlife. Prescribed burning within the project area has reduced canopy structure and consumed some downed wood and snags potentially affecting the abundance of denning sites for wolverine, and roost sites for bald eagles. There has also been recruitment of additional down wood and snags in the areas that have been burned, as well as increased forage production for big game. Prescribed burning may have altered the availability of nesting habitat for gray flycatchers, both through short term loss of nesting structure and the beneficial restoration of open shrubland habitat. The net combined effects of implementing the alternatives in this project with the past, present and reasonably foreseeable actions in the area are the same as described under the direct and indirect effects section above. However implementation of the Davis Burn is expected to complement this project in the restoration of upland shrub habitat after a period of recovery, which would benefit gray flycatchers.

In subwatersheds that overlap the project area there are over 79,00 acres of land that are not managed by the Forest Service. On productive growing sites on those acres many of the large overstory trees have been removed through past timber harvest, limiting potential nesting and roosting habitat for bald eagles. Where intensive timber management and/or juniper removal has occurred on private lands, herbaceous and shrub habitat is available potentially improving habitat for gray flycatchers. In some areas agricultural practices such as hay cropping, or pasture management provide seasonal forage areas for big game and small mammals. Effects of private

land management practices on big game distribution and small mammal populations could have indirect effects to wolverine that may utilize the analysis area during long distance forays or dispersal, and for bald eagles which may utilize carrion and small mammals seasonally.

Heritage Resources and Plants of Cultural Value

Affected Environment

Long before Europeans set foot on the North American continent the early inhabitants of this area were well adapted to the unique ecosystems of Central Oregon. The Plateau culture area includes the interior drainages of the Frasier and Columbia River excluding the upper reaches of the Snake, John Day and Deschutes rivers (Lebow et. al. 1990). The Great Basin culture area encompasses all the Great Basin country plus peripheral parts of the southern tributaries of the Columbia River and much of the upper Colorado River. The Northern Great Basin, Klamath Basin and Columbia River cultural groups and territories overlap in the greater Central Oregon region.

The Plateau groups place great importance on salmon, taken with weirs, dip nets and spears. Columbia Plateau groups developed a more sedentary lifestyle establishing winter villages along the Columbia River. By 9,000 years ago, they harvested fish, gathered plant foods, hunted large and small animals and traded as they did more recently with Lewis and Clark's arrival (Hunn 1990). The Great Basin groups relied on a broader spectrum of resources for hunting, gathering and collecting activities. They traveled in smaller family groups during the warmer months and congregated into larger family groups and semi-permanent winter camps. Ethnographic studies refer to winter villages along the main stem of the Deschutes and its major tributaries including the Crooked River.

All tribes took advantage of root crops, fruits, berries and a variety of plant-life. Although the availability of resources fluctuated over the millennia, the archaeological record suggests the native inhabitants followed life ways similar to those documented through ethnographic studies during the late 1800s and early 1900s. The Northern Paiute, Wasco, Walla Walla (later called Warm Springs), Cayuse, Umatilla, Klamath, Modoc and Yahooskin were present when Lewis and Clark arrived and each tribe has its own unique history and heritage. Archaeological sites today are recognized through the remaining stone tools and features. However it is more important for the management of cultural resources to recognize the patterns of land use and ecological adaptations, specifically subsistence rounds, settlement patterns and social ties as manifested through material remains (Lebow et. al. 1990). An intensification of hunting and gathering life ways developed during the warmer and drier intervals 6,000 to 4,000 years ago. Archaeological evidence is characterized by an increased range of specialized tools and utensils, especially milling stones and processing activities.

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

Site patterns in the Ochoco Mountains show a broad distribution of upland use with preferences for south facing slopes, major drainages and high elevation spring sites. The environment,

available resources, travel routes and corridors and traditional use areas also contributed to site location preferences.

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

Historic sites represent several themes including exploration, settlement, mining, trapping, transportation routes, and stock grazing, ranching, developmental and administrative. Historic sites often involve wooden structures or cabins, carved trees, blazed trees, fence lines, trails, roads and log watering troughs.

Previous heritage survey and known sites were utilized for the East Maury project. Known sites were revisited and new survey was conducted in high probability areas, specifically within the proposed treatment units. Field survey work began in 2004 and continued through the fall of 2007. The effects analysis for the draft EIS was based on the results of known sites, previous survey, new survey and new sites. The East Maury Cultural Resource Report is in progress (Martin and Holtzapple in progress).

Many plant species with cultural values occur within the forested region. The plants discussed here focus on only a few of the culturally significant plants gathered by local tribes. Hanging black moss (*Bryoria fremotii*) is the most abundant culturally significant plant in the project area. It primarily grows on the lower branches of conifers. Decades of fire suppression has likely resulted in an increase of this plant. Bitterroot (*Lewisia rediviva*) and several *Lomatium* species occupy scabland. These types of roots are present in the Maury Mountains, particularly on the open plateaus, ridges and high elevation country. The east end of the Maury Mountains is particularly dry and non-forested openings do not support the abundance of root crops as compared to other areas on the Ochoco National Forest. Camas (*Camassia quamash*), generally found in moist meadows, is not abundant in the Maury Mountains. Yampa (*Perideridia gairdneri*) generally found in forested areas is abundant particularly on the south facing slopes.

Environmental Consequences – Heritage Resources

The effects analysis is based on the potential for damage to artifacts, features, environmental settings and ground disturbance by machinery, fuel loadings and potential temperature and duration of fire treatment, and degree of risk for successfully implementing design criteria for the proposed alternatives. Analysis for cultural resources used the East Maury planning area boundary for the area of potential effect. A second look focused on the proposed treatments units and changes to roads in Alternative 2 and Alternative 3 of the EIS to analyze ground disturbing activities.

Heritage resources include prehistoric, historic, and traditional cultural sites that may be affected, both negatively and positively by the proposed activities in the East Maury project. Types of sites found in the project area include lithic scatters, quarry sites, stock grazing related sites (spring developments, log watering troughs, salt log troughs, carved aspen), early settlement related sites (portable sawmills), administrative forest sites (fire lookouts, guard stations, refuse dumps, phone line corridors) and survey monuments.

The most common site type in the project area is lithic scatter sites. These sites contain flaked stone tools, associated debitage, and groundstone processing tools. The cultural stratigraphy and

artifacts may be adversely affected by ground disturbing activities from ground based logging equipment, road construction, fuels treatments or catastrophic fire events. Machinery crushes artifacts and disturbs the spatial arrangement. Wildfire and prescribed fire, specifically the degree and temperature, can melt or disfigure artifacts and alter the hydration bands on obsidian. The fire intensity and duration of burning are highly variable and dependent on the nature of available fuels and weather conditions. Methods used for dating archaeological materials and environmental conditions rely on relatively stable environmental conditions and high temperatures can “reset” the chronological indicators. Research has shown fire does effect existing hydration on obsidian when temperatures exceed 375 degrees centigrade (2002 Loyd). The threshold for loss or effect on obsidian hydration begins about 160 degrees centigrade and is seriously affected at 427 degrees (2002 Halford and Halford).

Historic sites often involve wooden structures like cabin remains, fences, and log troughs and would be adversely affected by fire, heavy equipment, and tree falling.

Traditional cultural sites include areas used in the past or present for gathering or collecting plants for food, medicine or other purposes. Ground disturbance from machinery or fire occurring before plants are dormant could adversely affect these areas and plant populations. Conversely, prescribed fire may benefit plant populations when applied during the appropriate plant cycle. Access to these areas is a concern for neighboring Tribes and activities like closing roads could restrict access. Limiting or controlling access from vehicles and OHVs would reduce surface disturbance and potential vandalism to heritage sites resulting in a positive affect.

Unplanned fires or wild land fires typically occur in the summer when fuels are drier and temperatures are hotter. Resource protection is responsive to wildfire conditions however priorities are initially based on safety and threat to life and property. Hotter burning temperatures would negatively affect artifacts and features but often a wildfire creates a mosaic of conditions and results vary over the landscape. Fire suppression activities have been found to have a greater potential to affect the resource than burning temperatures. Prescribed fire and thinning of young trees would reduce ladder fuels and, or change the arrangement of existing fuels. Reduction of these ladder fuels would lower the potential for unplanned fires and offer better protection from hotter fires for artifacts, features, and traditional cultural plant communities. Similarly, reducing young trees from encroaching on meadows and areas with traditional plants would have a positive affect on the plants and their habitat when done with combined objectives. In many cases, traditional plants overlap with low sage plant communities which may be within a prescribed fire boundary but are not targeted and would not carry fire.

Alternative 1 – Heritage Resources

Under Alternative 1 existing management practices would continue and no new vegetative treatments would be scheduled. Levels of natural fuels would continue to accumulate, densely stocked understory trees would not be thinned and stocking levels of the larger trees would not be changed. The accumulation of fuels and fuel arrangements would increase the risk for unplanned wild land fires including stand-replacement fires. Untreated fuels would increase the potential for unplanned, high intensity wildfires which would have a negative affect on the physical materials and features of cultural resource sites.

Cultural plants and their abundance would be at greater risk of loss from uncontrolled wildfires, typically with higher burning temperatures and increased risk of soil scorching. There would be no change to road systems and no change to access of cultural plants. Stand density has increased over

the past 60 to 80 years due to fire suppression activities. Conifer encroachment and juniper expansion has also occurred in the past 100 years and in some cases this has changed the distribution and type of grass and shrub communities. There may be a negative effect to artifacts, features, and site settings from unplanned wildfire and fire suppression activities like dozer fire lines, burn out operations, staging areas, and constructed fire lines.

Heritage sites would require no coordination for protection under this alternative because no new treatments would be scheduled. There would be no potential for loss of heritage resources due to commercial harvest, non-commercial thinning, road work, or prescribed fire.

Alternative 2 – Heritage Resources

The effects resulting from the proposed treatments in Alternative 2 would be managed by applying the design criteria (see **Design Criteria Common to All Alternatives and Appendix B**) incorporated into the East Maury project. The treatment recommendations and criteria were developed to protect heritage values and avoid ground disturbing actions on sites. Design criteria would modify unit boundaries to avoid heritage sites. In other cases, site areas would be avoided or not treated within the proposed treatment unit. The timing of prescribed fire treatment may be adjusted to meet objectives for traditional foods or the intensity of the treatment may be reduced to avoid adding slash or activity fuels to the ground surface.

Units within the East Maury Mountains project contain cultural sites eligible for the National Register of Historic Places. Design criteria would modify unit layout and design to avoid and protect these sites and the qualities which make them eligible. Applying the design criteria will result in treating less overall acres and may result in no commercial harvest for EIS unit 220.

Based on the heritage analysis, Alternative 2 would have a finding of “No Historic Properties Affected” under Stipulation III (B) 5 of the 2004 Programmatic Agreement (USDA 2004). The cultural resource report would be submitted to SHPO with a 30-day consultation period.

Should cultural resources be discovered or disturbed during implementation of the proposed projects, all activities would cease immediately and an evaluation of the discovery would be completed by the Forest or district archaeologist. Coordination between the Forest and the Oregon SHPO would occur prior to resuming activities.

Commercial harvest activities are proposed on an estimated 6,928 acres that have heritage sites (as shown on **Table 3-57**). A sequence of treatments would occur on most of these proposed commercial harvested acres to complete stand treatment objectives. Implementation would likely occur through timber sale or stewardship contracts over a 5 to 10 year period. Treatments would begin with commercial harvest entries, pre-commercial thinning, grapple piling where specified and slash treatment or underburning. Heritage site areas overlapping with or adjacent to proposed treatment units would require an intensive level of management to reach the desired results. There would be a greater risk for damage to heritage sites in areas where multiple treatments of commercial harvest, pre-commercial thinning, grapple piling, and activities fuels treatments are scheduled over time. Design criteria and heritage management recommendations have been applied to 29 commercial harvest units involving an estimated 2,350 acres (see **Appendix B**). Treatment acres would be reduced within the proposed commercial harvest acres due to cultural site management.

Table 3-57 Proposed Treatment Areas That Overlap Heritage Sites

	Alternative 2 (acres)	Alternative 3 (acres)
Commercial Thinning, pre-commercial thinning & fuels treatment	2,350	1,881
Noncommercial	1,328	1,763
Grapple Pile	1,349	1,012
Natural Fire	628	1,060
Total	5,650	5,720

Alternative 2 would treat acres within RHCAs in and adjacent to commercial units. Generated slash accumulations would be minimized near carved trees and stands where increased slash would pose a risk of hot fires and greater than 3 foot flame lengths.

Alternative 2 treats the most acres using commercial harvest, pre-commercial thinning and burning methods. Coordination between the road engineer and archaeologist would be scheduled for the construction of roads 1670-254-088, 1600-550, 1600-400 (unit 196 and post-haul road closure), 1750-675 (may result in no access to unit 220 and no commercial harvest treatment), 1670-000-232 and 1750 (limited access to skid trails and landings for units 238 and 220)

Non-commercial thinning would be scheduled on an estimated 4,507 acres outside of the proposed commercial harvest thinning. This includes small conifer and juniper removal. Design criteria would be applied to heritage sites on 1,328 acres. This would result in a reduction of non-commercial thinning acres because of unit layout or design modification changes.

Grapple piling of fuels would not be allowed on heritage sites to avoid disturbance by ground based equipment and hotter surface temperatures from pile burning. Grapple piling is proposed on 3,422 acres and design criteria would be applied to an estimated 1,349 acres to protect heritage values. This would result in less acres being treated using grapple pile methods.

Natural fuels burning would be prescribed on approximately 1,745 acres to reduce fuel loadings, thin younger trees, and mimic historic fire cycles and intensity. Burning prescriptions vary but are designed to mimic more frequent fire cycles with lower burning temperatures. These events are planned to meet objectives with burning prescriptions based on fuel loadings, moisture content, and weather conditions. Natural fuels burning generally would not compromise the integrity of lithic scatter sites due to low burning temperatures and short duration fire. Design criteria would be applied to an estimated 628 acres to ensure sensitive sites and features would be protected. Historic structures wooden features at risk would be identified and protected through avoidance and, or site specific design criteria.

Proposed treatments in Alternative 2 and 3 may reduce the opportunity to gather traditional plants and resources in the short-term but would not reduce the habitat. Hanging moss may be less abundant in the East Maury planning area in the next 10 to 15 years particularly in the proposed commercial harvest units. Prescribed fire units may not alter habitat but may reduce the abundance in the lower branches. Treatments are not proposed on lithosols and areas most suitable for bitterroot. Lomatium species and yampa have a broader range and habitat overall would be less affected. Any known root field or areas of abundance would be managed for the benefit of the plant and habitat.

Juniper treatments, generally located in non-forested settings, have the greatest potential to overlap with populations of culturally significant root crops and archaeological sites. Design criteria would be applied to juniper removal to avoid, girdle the tree or fall fewer junipers and prevent hot surface temperatures and additional fuel accumulation where necessary.

Thinning and burning treatments in Alternative 2 would reduce the potential risk for future unplanned wild land fire. Potential adverse affects to heritage resources from hotter burning temperatures, larger burned areas, and associated fire suppression activities associated with contemporary wild land fire would be reduced by removing ladder fuels through the proposed treatments.

There would be no affect to heritage sites for the proposed Soap Material Source expansion (3 acres to the southeast). The area was surveyed and no sites are known to exist.

Alternative 3 – Heritage Resources

Like Alternative 2, the effects resulting from the proposed treatments in Alternative 3 would be managed by applying the design criteria incorporated into the East Maury project (see **Appendix B**). Units in East Maury project include cultural sites eligible to the National Register of Historic Places and sites not evaluated because of insufficient information. Units and treatments would be modified through layout and design to avoid and protect the qualities which make these sites eligible. Fore these reasons, Alternative 3 would result in a finding of “no historic properties affected” under the 2004 Programmatic Agreement Stipulation III (B) 5.

Commercial harvest activities for Alternative 3 are proposed on an estimated 5,119 acres. There would be a greater risk for damage to heritage sites in areas where multiple treatments of commercial harvest, pre-commercial thinning, grapple piling, and activities fuels treatments are scheduled over time because there would be a greater need for coordination and several entries over 5 to 10 year period. Design criteria and heritage management recommendations have been applied to 23 commercial harvest units involving an estimated 1,881 treatment acres. Treatment acres would be reduced within the 1,881 acres of proposed commercial harvest acres due to heritage site management.

Alternative 3 would treat acres within RHCAs in and adjacent to commercial units. Generated slash accumulations would be minimized near carved trees and stands where increased slash would pose a risk for hotter fires and greater than 3 foot flame lengths.

Coordination between the road engineer and archaeologist would be scheduled for the reconstruction of roads 1600-400 and 1750 to ensure the cultural sites were protected and avoided.

Non-commercial thinning would be scheduled on an estimated 6,112 acres outside of the proposed post commercial harvest thinning. Design criteria would be applied to heritage sites on 1,763 acres. This would result in a reduction of pre-commercial thinning acres or thinning intensity due to unit layout or design modification to avoid or protect cultural sites and values.

Grapple piling of fuels would not be allowed on cultural sites to avoid disturbance by ground based equipment and hotter surface temperatures from pile burning. Grapple piling is proposed on 2,579 acres. Design criteria would be applied to an estimated 1,012 acres to protect cultural values. This would result in less acres being treated using grapple pile methods. In all cases, grapple piling would not be allowed within cultural site boundaries..

Natural fuels burning would be prescribed on approximately 2,735 acres. Design criteria would be applied to an estimated 1,060 acres to ensure sensitive sites and features would be protected. Historic structures and wooden features at risk would be identified and protected through avoidance and, or site specific design criteria. A cool, short duration prescribed fire would be allowed on certain types of sites. Prescribed fire is a natural method of reducing young trees and maintaining habitat. The timing of prescribed fire may be adjusted to meet the concerns of traditional plants and gathering seasons.

Design criteria would be applied to juniper removal to avoid, girdle the tree or fall fewer junipers and prevent hot surface temperatures and additional fuel accumulation where necessary.

Thinning and burning treatments in Alternative 3 would reduce the potential risk for future unplanned wild land fire. Potential adverse affects to heritage resources from hotter burning temperatures, larger burned areas, and associated fire suppression activities associated with contemporary wild land fire would be reduced by removing ladder fuels through the proposed treatments.

There would be no affect to heritage sites for the proposed Soap Material Source expansion (3 acres to the southeast). The area was surveyed and no cultural sites are known to exist.

Cumulative Effects – Heritage Resources

The effects from grazing, road maintenance, and recreation uses would be the similar in all alternatives. Grazing and the effects from cattle were addressed in the 2005 Maury Allotment Management Plan EIS. Decisions made under the grazing EIS would continue to be implemented. Although grazing would be rested for several years in the East Maury Allotment proposed improvements would be constructed during the next ten years. These decisions have met Section 106 compliance with the Oregon SHPO. Any new construction or changes associated with grazing and allotment management would address heritage concerns on a case-by-case basis.

Recreational uses would continue. Increasing numbers of undeveloped camping areas and off road vehicle use would have the greatest potential to damage cultural sites. The ongoing Travel Management planning would address off road vehicle use and associated dispersed camping in the future.

Treatment of noxious weed projects has addressed the protection and management of heritage values (cultural sites and traditional plants of concern) under separate project analysis and compliance. Resource protection was accomplished on a case specific basis.

The West Maury Vegetation EIS is adjacent and to the west of this project and is being implemented now. Heritage values were retained in similar ways as described in this EIS. Commercial harvest, precommercial thinning and prescribed fire is being implemented and will be slightly ahead (3 to 5) years of implementation of any proposed East Maury treatments. Because cultural sites are being protected, there would be no cumulative effects from the West Maury treatments to cultural sites.

The Prineville BLM is preparing the Davis Creek Burn, a prescribed fire project to burn 1,344 acres south of Arrowwood Point of forest and BLM land for 2008. The prescribed fire would reduce juniper and improve native grasses and shrubs for wildlife habitat. This project would be submitted to SHPO under the Davis Creek Burn. Forest units included in this project have been

surveyed for cultural sites in the East Maury project and no cultural resources have been identified. Coordination would occur between the agencies to ensure cultural properties are identified and their cultural values protected during implementation.

Stream restoration work proposed in Wildcat Creek, Drake Creek and Shotgun Creek would also be submitted to SHPO under the proposed stream restoration project for case review. Cultural resource management would be addressed for these specific proposals.

Recreational activities including dispersed camping, off road vehicle use, and artifact collecting are most damaging to heritage sites. Dispersed camping areas commonly overlap with heritage site locations along creeks, meadows, and springs. Disturbance to sites results from human use, vehicle use, fire rings temporary outhouses, and vandalism. In general increasing recreation use correlates to increasing vandalism and damage to heritage sites through removal of artifacts and disturbance to the surface and features. Site damage from off road use and all terrain vehicles has increased in the past 5 years and would be expected to continue.

Visual Quality

Affected Environment

The Forest Plan specifies visual management corridors along Road 16 in the East Maury project area. The visual quality objective is partial retention². The Forest Plan guideline for vegetation management on ponderosa pine sites is to provide a combination of multiple age class stands and open park-like stands of ponderosa pine, and maintain a diversity of species and structure in mixed conifer sites.

All local plant association groups are represented within the visual management corridor. Mixed conifer sites are found on the northern portions of the corridors where these roads are located next to streams. Douglas-fir, ponderosa pine, western juniper sites form a mosaic in the remaining corridors. A variety of species compositions and structures are found. Stands selected for treatment have high densities in the understory trees with increasing competition stress in the large overstory trees.

Environmental Consequences

Alternative 1

There would be no treatments associated with this alternative. There would be no changes to the vegetation and no additional activities that would affect the visual quality. Tree mortality would continue to increase and more dead trees would occur across the landscape. Increasing levels of fuel loadings could result in high-intensity wildfire, potentially creating large expanses of dead trees and open areas in the long term.

Alternatives 2 and 3

All treatments would meet the visual quality objectives for the visual management corridor. Commercial treatments proposed in Alternatives 2 and 3 are not regeneration harvests and would only result in reduced tree densities at the highest intensities of treatments in Alternative 2. The current condition of forested landscape pattern, line, and texture would remain after treatments,

² Definition of Visual Quality Objective for **Partial Retention** – Human activities may be evident, but must remain subordinate to the characteristic landscape.

and may even be improved with the reduction of smaller diameter tree densities which would result in more open stands and greater viewing distances within stands. The density treatments would also result in increased growth rates of residual trees which would in the future result in more numbers of large diameter trees across the landscape. Noncommercial treatments would reduce the densities of smaller diameter trees, enhance growth of residual trees, and create more open viewing distances. Slash resulting from pre-commercial thinning would be evident until the piles were burned and re-vegetated. Prescribed fire would result in scorched trees and red needles. These effects would become less evident in 2-3 years after the burn. Herbaceous vegetation would be stimulated for a few years after the burn.

For Elkhorn and Wiley campground, the Ochoco Forest Plan provides a clarification for the retention visual quality objective. It states, “Timber harvest activities will normally not be visually evident, but may for safety and visual enhancement. Scenic views may be enhanced through harvest or thinning, but will appear natural” (Forest Plan, p. 4-71). The treatments proposed include commercial harvest and prescribed fire in and around Elkhorn and Wiley campgrounds. Thinning would occur around large trees and in dense clumps to reduce overall stocking to about 40 square feet basal area per acre. Created slash would be treated by hand-piling concentrations and underburning. The fire prescription would seek to reduce scorching of residual trees and shrubs. Human activities would be evident during treatments but a few years after treatments, the visual quality of the area would be improved. Fewer large trees would die as a result of competition stress reducing potential hazard trees in a developed recreation site and reducing potential for high intensity fire.

Cumulative Effects

There are no cumulative effects related to visual quality within the project area because there are no planned or reasonable foreseeable activities that would alter visual quality.

Recreation

Affected Environment

Recreation use in the project area includes wildlife viewing, driving for pleasure, camping, hiking, and horseback riding. Current direction emphasizes dispersed rather than developed recreation. Because much of the Ochoco National Forest is currently roaded, the dispersed roaded recreation opportunities exceed the demand. There are diverse recreational opportunities within the project area at developed and dispersed sites. Elkhorn Campground and Wiley Flat Campground are the only two developed recreation areas. The project area also encompasses a variety of dispersed campsites used mostly during hunting season. Most are located adjacent to springs or streams. Several sites are located in stands where activities are proposed.

Elkhorn Camp is located on a moist pine site and currently has a young stand of ponderosa pine with few large overstory trees. Competition related stress is apparent in shortened needles, lower crown ratios and very low growth rates. Bark beetles including western pine beetle, mountain pine beetle and red turpentine beetle are active in the area.

Wiley Flat is located on a dry grand fir site. The current stand is uneven-aged with a mixture of ponderosa pine, Douglas-fir and grand fir in the overstory and a mixture of species in the understory with higher stocking of grand fir.

Rockhounding is a favorite recreational activity for many locals and visitors to Central Oregon. On the northeastern slope of the Maury Mountains are the Maury Agate Beds on Road 1690 (T12S, R19E, Section 29), which have been extensively hunted for agates. Historically, the site had large numbers of visitors during the summer Rockhound Pow-wow. Bear Creek has a petrified wood collecting area and on Camp Creek, the limbcast areas are frequently visited.

Environmental Consequences

Alternative 1

Use of recreation sites with the project area would continue. With this alternative, no treatment would occur and there would be the continuation of mortality of the large pine component. In the long term, recreation experience and scenic quality would be degraded due to the loss of the larger trees becoming less abundant and overstocking and down material becoming more prevalent. In the event of a high intensity wildfire, those stands with high canopy closures and high stand densities would probably result in high mortality. The recreation experience would be degraded because of the lack of residual trees and areas could be closed due to the danger of falling hazard trees.

Alternative 2 and 3

Use of recreation sites with the project area would continue. Vegetation treatments are proposed in and around Elkhorn Campground and Wiley Flat Campground. Both alternatives include commercial harvest, pre-commercial thinning and prescribed fire in and around the campgrounds. The campgrounds would be lightly thinned while maintaining cover and screening. Created slash would be treated by hand-piling concentrations and underburning. The fire prescription would seek to reduce scorching of residual trees and shrubs. Residual canopy closure would be approximately 50 percent. Shrub cover would be revitalized due to a more open canopy and stimulated sprouting following prescribed burning. Fewer large trees would die as a result of competition stress reducing potential hazard trees in a developed recreation site and reducing potential for high intensity fire. Treatments would improve the long-term health of timber stands adjacent to and within camping areas; however, short-term impacts (3-5 years) to the affected camping areas (whether developed or dispersed) from commercial harvest and pre-commercial thinning would include increased noise from chainsaws and grapple piling.

Cumulative Effects

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

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

Civil Rights and Environmental Justice

Civil Rights legislations, especially the Civil Rights Act (CR) of 1964, Title VI, prohibits discrimination in Forest Service program delivery. The underlying principal behind the Civil Rights Act is that no activity shall negatively affect minorities, woman, or persons with disabilities by virtue of their race, color, sex, national origin, religion, age, disability, or material or familial status.

Environmental Justice, Executive Order 12898, demands the fair treatment and meaningful involvement of all people. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from the execution of our actions. Environmental Justice focuses on minority, low income groups, and subsistence lifestyles (including Indian Tribes). The purpose of involving these groups and analyzing the effects upon them is to determine whether adverse civil rights impacts are anticipated, or whether disparate or disproportionate impacts associated with the alternatives is anticipated on any of these groups.

With this project, there is no known potential for disparate or disproportionately effects, or to discriminate or negatively impact any individual or subset of the population described above. The vegetation treatments in Alternatives 2 and 3, will provide for easier access to firewood (landing/harvest units) which should positively effect low-income, older, or those with disabilities, who are not able to afford the type of vehicle needed to access, or physically manage gathering firewood from anything but very accessible sites. Also, the types of employment opportunities provided by the alternatives, timber harvest activities (logging, hauling, etc.), prescribed burning, pre-commercial thinning, and millwork, etc., will have positive effects on the categories of individuals and population groups these laws and regulations are intended to protect.

In addition alternatives 2 and 3 will provide for human health and safety of all members of the public by reducing the risk of falling snags along travel ways, as well as reducing the risk of wildfire. The road closure and decommissioning, given the nature of the project area, there would still provide ample access throughout the project area. The actions proposed under Alternative 2 and 3 would not have any measurable impacts on Tribal rights (ceded lands) or Tribal traditional uses. The project is not located in a minority community nor would it affect residents of low or moderate income. Any impacts will not affect any specific subset of the American population at a disproportionately higher rate than others.

In addition, the effects of this project on the social and economic context of these groups are within those described in the Forest Plan. The benefits and risks associated with implementation of the proposed action are provided to all members of the public. Therefore, the project would not pose disproportionately high or adverse effects to minority communities or to low income groups. As a result, no formal Civil Rights Impact or Environmental Justice Analysis was undertaken.

Short-term Uses and Long-term Productivity

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including

financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

The action alternatives propose short-term harvest of timber, while enhancing the long-term health of forested stands. Existing conditions are outside the HRV and may not be sustainable over the long term. Proposed treatments including prescribed fire, in part, mimic natural disturbance processes and move conditions toward a balance of sustainable vegetative conditions. Soil and Water are two key factors in ecosystem productivity and protection of these resources is provided by the design criteria discussed in Chapter 2. Sustainable wildlife habitat, water quality and other resources depend on maintaining the long-term soil productivity upon which vegetation relies. Quality and quantity of water from the project area would fluctuate as described previously, but no long-term effects to water resources are anticipated as a result of commercial harvest, pre-commercial thinning, and fuels reduction treatments. All alternatives provide fish and wildlife habitat at levels necessary to maintain viable populations of the species within the project area. The amounts of suitable habitat vary with the level of density management in each alternative.

Unavoidable Adverse Effects

All of the alternatives considered result in some adverse effects. Many of these adverse effects would be minimized through implementation of design criteria and resource protection measures identified in Chapter 2 or through mitigation measures. Even with implementing these measures, there would still be adverse effects that cannot be avoided.

Soils

Additional detrimental soil conditions are expected as a result of implementing Alternative 2 or 3. The use of ground-based tractor logging would result in additional compaction and displacement. The design criteria in Chapter 2 and on in **Appendix D** describe resource protection measures to minimize these unavoidable adverse effects. The alternatives were designed to limit the amount of detrimental soil conditions consistent with R6 Supplement 2500-98-1 (Regional Guidelines), effective August 24, 1998.

Road construction would also result in adverse effects on soils. Both permanent and temporary road construction results in soil compaction and displacement. On temporary and decommissioned roads, the road surface can be revegetated, but soil productivity is reduced because of compaction. These adverse effects to soils cannot be avoided.

Air Quality

The nearest Class I wilderness is the Strawberry Mountain Wilderness, 75 miles to the east. The nearest Special Protection Zone is Bend, 40 miles to the west, into the prevailing winds. Prescribed burning has occurred in the Maury Mountains over the last two years as part of the West Maurys Fuel and Vegetation Management Project. Winds in the project area are typically from the southwest to northeast during the spring and fall prescribed burning periods. Inversions are common at night in the fall in the Paulina valley, but tend to dissipate by mid-morning as surface temperatures increase due to solar heating.

Due to the location of the project area, prevailing winds, and the short duration and low volume of smoke from prescribed fire, smoke from the East Maury project would not effect Class I

wilderness areas or urban Special Protection Zones. Prescribed burning would be suspended during persistent inversion conditions to avoid having smoke pool in the Paulina Valley for several days. Impact from smoke could affect scattered individual dwellings in the Paulina Valley, and would be short-term. Smoke from prescribed fires could impact hunter camps, especially in the late evening and early morning hours as smoke pools in draws and valleys.

A high percentage of wildfire smoke (by mass) is within the PM 2.5 particle class size, which are respirable particles less than 2.5 micrometers in diameter (USDA SMILE Management Guide 2001). **Table 3-58** compares production of PM 2.5 between high intensity fire and low fire intensity. Wildfire conditions have lower fuel moistures than prescribed fire conditions.

Table 3-58 Example of PM 2.5 Smoke Production by East Maury

High Fire Intensity East Maury unit 26 Wildfire	Low Fire Intensity East Maury unit 40 Wildfire	Low Fire Intensity East Maury unit 40 Prescribed fire
532 lbs/acre	349 lbs/acre	240 lbs/acre

Slash piles from whole tree yarding would be available for market. As the market for biomass increases, more fuel will be removed from the forest, reducing the smoke from prescribed fires.

Noxious Weeds

The potential for introduction and spread of noxious weeds exists under every alternative considered, including no action. A noxious weed risk assessment concluded that the potential for introducing and spreading noxious weeds cannot be completely avoided. Both action alternatives create conditions that are conducive to the introduction and spread of noxious weeds. Implementation of design criteria and resource protection measures would minimize these adverse effects. However, proposed activities such as road construction, commercial timber harvest, grapple piling, and prescribed fire would result in conditions conducive to the introduction and spread of noxious weeds.

Sedimentation/Turbidity

Both action alternatives propose new and temporary roads. Most sediment delivered to streams would come from stream crossings, road drainage close to streams and harvest and fuels treatments adjacent to Class IV streams and in ephemeral draws.

Alternative 2 proposes two temporary culverts, one located on Tom Vawn Creek and a perennial tributary of Wiley Creek would be left in over winter in this alternative. Tom Vawn Creek has headcuts on the toe of an old landslide downstream of the crossing and Wiley Creek is currently incising below the proposed stream crossing. If these stream crossings were to fail, accelerated head-cutting could occur. This would have an adverse effect to water quality and aquatic habitat.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

Irreversible commitments are decisions affecting nonrenewable resources such as soils, wetlands, roadless areas, and cultural resources. Such commitments are considered irreversible because

the resource has deteriorated to the point that renewal can occur only over a long period of time or at great expense or because the resource has been destroyed or removed.

The construction of roads, to provide access to timber, is an irreversible action because of the time it takes for a constructed road to revert to natural conditions. Alternatives 2 and 3 propose some level of road construction.

Removing aggregate (gravel) from mineral material sources would result in an irreversible commitment of resources. Once aggregate is removed from material source sites and placed on roads, it cannot be renewed except over long periods of time.

Irretrievable commitments of natural resources involve the loss of production or use of resources. This represents opportunities foregone for the period of time that the resource cannot be used.

Timber stands that are not managed at this time present an irretrievable loss of growth potential. Although the lost growth is irretrievable, it is not irreversible because the stands could be managed at a later date.

Cumulative Effects

Cumulative effects have been discussed throughout this chapter. As discussed in the June 24, 2005, Council on Environmental Quality Memorandum on Guidance of the Consideration of Past Actions in Cumulative Effects Analysis, past actions that warrant consideration because they are continuing to cause identifiable effects in the project area have been considered. For example, in the last 30-35 years there has been harvest on more than 11,800 acres. Harvest reduced the amount of LOS and wildlife habitat in the project area. This past harvest was considered in the sections on LOS and wildlife species such as the goshawk and pileated woodpecker. Past activities that have changed the environmental baseline have been included in the description of the affected environment. For example, in the analysis of effects to soils, past harvest activities using ground-based equipment resulted in detrimental soil conditions. The unit-by-unit analysis for soils contained in Appendix B describes the existing amount of detrimental soil conditions by alternative. Much of the detrimental disturbance was caused by past harvest. Other activities in the project area such grazing and implementation of new allotment management plans are also discussed where appropriate.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with ...other environmental review laws and executive orders.”

National Historic Preservation Act

A cultural resource survey has been completed for the East Maury project. Activities in Alternative 2 have been designed to minimize the effects to cultural resources through site protection, avoidance or design modification. Alternative 2 initially had a conflict with unit 267 commercial harvest treatment and construction of Road 1600-453-267a-c. However, commercial treatment in unit 267 and temporary road construction has been dropped from Alternative 2 during the draft EIS review and the conflict has been eliminated. Applying design criteria (see **Appendix B**) would result in treating less overall acres. Alternative 2 would have “no affect to historic properties” under the terms and conditions of the 2004 Programmatic Agreement among

the USFS Region 6, ACHP and SHPO, Stipulation III (B) 5. This would require a 30-day consultation period with the Oregon SHPO.

Like Alternative 2, proposed activities in Alternative 3 would have “no historic properties affected” under the terms of the 2004 Programmatic Agreement among the USFS Region 6, ACHP and SHPO, Stipulation III (B) 5. This would require a 30-day review period with the Oregon SHPO. Potential conflicts would be resolved by applying heritage design criteria to avoid or protect the qualities which make these sites eligible. Units of concern are identified in the **Appendix B**. In some cases units may be modified during layout or treatments may be modified to meet heritage objectives.

During implementation, the district archaeologist would coordinate with various specialists to achieve heritage objectives and apply the heritage design criteria. For both Alternative 2 and 3, cultural resource management would result in treating fewer acres in order to protect or avoid cultural values. The cultural resource report for the East Maury project area is in progress at the time of the DEIS. The cultural resource report would be forwarded to SHPO for the preferred alternative for the required 30-day review period

Range of Finding(s) of Effect for Draft EIS alternatives:

Alternative 1 - No Action - No Historic Properties Affected, Stipulation III (B) 1.

Alternative 2 – No Historic Properties Affected, Stipulation III (B) 5– SHPO 30 day review required.

Alternative 3 – No Historic Properties Affected, Stipulation III (B) 5 – SHPO 30 day review required.

The Forest has notified interested Tribes and persons. Letters describing the proposal were sent to the Confederated Tribes of the Warm Springs Reservation, Confederated Tribes of the Umatilla Reservation, Burns Paiute Tribe and The Klamath Tribe in August 2005. Proposal letters were also sent to the Archaeological Society of Central Oregon (ASCO). No responses or comments were received from the neighboring Tribes or ASCO. The Forest Specialist certifies that this project would comply with Section 106 of the National Historic Preservation Act under the terms and conditions of the 2004 Programmatic Agreement for the State of Oregon when the report is submitted to the Oregon SHPO and the 30-day review and consultation period is completed.

US Fish and Wildlife Service and NOAA Fisheries

Biological Evaluations (**Appendix D**) have been prepared to document possible effects of proposed activities on threatened and endangered species in the project area. There are no endangered species known or suspected to occur on the Ochoco National Forest. Threatened species that are known or suspected to occur on the Ochoco National Forest include bull trout, mid-Columbia River steelhead, and Canada lynx.

On May 29, 2001 the Forest received concurrence from the U.S. Fish and Wildlife Service that implementation of any activities contained within the Forest Plan, as amended, is not likely to adversely affect the Canada lynx outside of an existing Lynx Analysis Unit. At the time this consultation took place there were, and continue to be, no Lynx Analysis Unit’s existing on the Ochoco National Forest. The determination for Canada lynx is “May effect, but not likely to adversely affect” for both action alternatives.

There would be no effect to bull trout or mid-Columbia River steelhead trout. Consultation with the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration is not applicable for the East Maury project area.

Clean Air Act

Both proposed alternatives are designed to be consistent with the Clean Air Act. The Oregon Department of Environmental Quality (DEQ) is responsible for assuring compliance with the Clean Air Act. In 1994, the Forest Service, in cooperation with DEQ, the Oregon Department of Forestry, and the BLM signed a Memorandum of Understanding to establish a framework for implementing an air quality program in Northeast Oregon. The Memorandum of Understanding includes a prescribed fire emission limit of 15,000 tons of PM-10 per year for the Malheur, Ochoco, Umatilla, and Wallowa-Whitman national forests. All prescribed burning on these forests is coordinated with DEQ through the State of Oregon smoke management program. All prescribed fire treatments in the selected alternative would be conducted in compliance with the State of Oregon Smoke Management System and would meet smoke management objectives for total emissions.

Clean Water Act

The selected alternative would comply with the Clean Water Act, as amended. This Act establishes a non-degradation policy for all federally proposed projects. The selected alternative meets anti-degradation standards through project, application, and monitoring of BMPs. The EPA has certified the Oregon Forest Practices Act and regulations as BMPs. The State of Oregon has compared Forest Service practices with State practices and concluded that the Forest Service practices meet or exceed State requirements. Site-specific BMPs have been designed to protect beneficial uses. Chapter 2 lists the design criteria and resource protection measures that have been developed for all action alternatives. **Appendix F** contains water quality BMPs that will be implemented.

Chapter 3 documents the effects the proposed alternatives would have on streams listed on the 2002 State 303(d) list of Water Quality Limited Water Bodies for summer water temperature. These streams are Shotgun and Wildcat creeks. Implementation of either proposed action alternative should not result in any measurable increase in water temperatures to fish bearing or non-fish bearing streams in the project area. Commercial timber harvest and non-commercial thinning activities were designed so that they do not reduce shade. There is a possibility that conifer thinning in aspen stands would cause short-term reductions in shade. However, these slight reductions in shade should not result in any measurable increase in water temperature because the area affected is small. There is a potential to increase water temperature in intermittent non-fish bearing streams (Class IV) when they are flowing, but this should not result in a violation of state water quality standards because these streams go dry before peak water temperature occurs in the project area.

National Forest Management Act

To ensure consistency with the National Forest Management Act, the Ochoco National Forest Land and Resource Management Plan, as amended, was consulted. The Forest Plan contains several standards and guidelines that apply forest-wide or to specific management areas. Both forest-wide and management area specific standards and guidelines were reviewed. **Table 3-57**

briefly identifies the applicable standards and guidelines and how the alternatives are consistent. If the alternatives are not consistent with the standards and guidelines, a brief description of the needed Forest Plan amendment is included. In addition, the requirements at United States Code 1604(g)(3) were reviewed and the proposed activities are consistent.

Alternative 1 is the no action alternative and is not included in **Table 3-59** because no management activities would occur.

All of the action alternatives are consistent with long-term management objectives as discussed in the Forest Plan as amended. However, alternatives 2 and 3 would require two amendments. These amendments are briefly discussed in the alternative descriptions in Chapter 2 and in **Table 3-59**.

Amendment 1 – Harvest in LOS

The Eastside Screens (aka Regional Forester’s Forest Plan Amendment No. 2) contain standards that when LOS is currently below the HRV, commercial harvest is not permitted. Currently the overall amounts of multi-strata and single strata LOS are below HRV. The East Maury project area is below the HRV for both multi-strata and single-strata LOS. A forest plan amendment is needed because both alternatives 2 and 3 propose commercial harvest in the multi-strata LOS structural condition. Timber harvest in multi-strata LOS is designed to reduce competition and maintain large trees in this area; these stands would be converted to single-strata LOS. A Forest Plan amendment is needed to allow this activity in Alternatives 2 and 3 because the Eastside Screens does not allow timber sale activities to occur in LOS that is below HRV.

These commercial harvest activities are designed to reduce stand density, improve growth of the residual trees, and reduce potential mortality resulting from inter-tree competition. Commercial harvest would more quickly restore historic seral/structural stage conditions and improve growing conditions for larger trees than no action, noncommercial thinning alone, or prescribed fire alone. Commercial harvest would also decrease the probability of wildfires and decreases the severity of wildfire impacts. No trees greater than 21 inches diameter would be cut and removed in any area except in isolated cases for safety reasons or for road construction.

This amendment is consistent with the Regional Forester’s June 11, 2003, letter on guidance for implementing Eastside Screens. In that letter the Regional Forester encouraged Forest Supervisor’s to encourage site-specific Forest Plan amendment that would meet LOS objectives of increasing the number of large trees and LOS on the landscape. The commercial harvest proposed in multi-strata LOS is consistent with the intent of the Eastside Screens to maintain and/or enhance LOS.

Non-significant forest plan amendments are allowed under Forest Service Manual 1926.51 and can result from:

2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term.

The commercial harvest treatments in Alternative 2 and 3 are expected to be implemented within the next 5 years. In Alternative 2 approximately 573 acres would be treated out of the 1,322 acres of LOS within the 24,200 acre project area. In Alternative

3, approximately 249 acres would be treated. In both alternatives, the acres that are treated would remain LOS; it would change from multi-strata LOS to single-strata LOS.

There would be no change in the long-term relationships between the levels of goods and services projected by the Forest Plan Final EIS and the impacts of implementing any of these alternatives because of the small number of acres treated and the objectives of the treatments (to maintain LOS in the long term).

The amendment applies only to this project area and would not apply to future decisions within the project area. The amendment does not alter the desired future condition of the land or resources or the anticipated goods and services to be produced. Only a small acreage would be treated and options for future management of LOS would be maintained.

Amendment 2 – Harvest in Connective Corridors

The Eastside Screens contain standards that indicate timber harvest should be deferred in connective corridors when all the criteria for connective corridors cannot be met. A Forest Plan amendment is needed to implement alternatives 2 and 3 to allow commercial harvest within connective corridors. Commercial harvest in these alternatives would reduce canopy closure to less than two-thirds of site potential. The Eastside Screens indicate that canopy closure should be maintained within the top one-third of site potential. Connective corridors within the project area represent the best connections given the existing conditions resulting from physical restrictions such as ridges, meadows, and previous harvest practices. Timber harvest in alternatives 2 and 3 within connective corridors are designed to maintain existing large trees and promote development of additional large trees. Alternative 2 includes 83 acres of commercial harvest in connective corridors. Alternative 3 includes 72 acres of commercial harvest in connective corridors. This activity will help develop LOS in corridors and would improve connectivity in the long term.

This amendment is consistent with the Regional Forester's June 11, 2003, letter on guidance for implementing Eastside Screens. In that letter the Regional Forester encouraged Forest Supervisor's to encourage site-specific Forest Plan amendment that would meet LOS objectives of increasing the number of large trees and LOS on the landscape. The commercial harvest proposed in connective corridors is consistent with the intent of the Eastside Screens to maintain and/or enhance LOS.

2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term.

The commercial harvest treatments in Alternative 2 and 3 are expected to be implemented within the next 5 years. The project area contains 289 acres of connective corridors. Alternative 2 includes 83 acres of commercial harvest in connective corridors, and Alternative 3 includes 72 acres of commercial harvest in connective corridors. The commercial harvest retains options for future management of connective corridors. Treatments would maintain existing large trees and would promote the development of additional large trees.

There would be no change in the long-term relationships between the levels of goods and services projected by the Forest Plan Final EIS and the impacts of implementing any of

these alternatives because of the small number of acres treated and the objectives of the treatments (to maintain LOS connectivity in the long term).

The amendment applies only to this project area and would not apply to future decisions within the project area. The amendment does not alter the desired future condition of the land or resources or the anticipated goods and services to be produced. Only a small acreage would be treated and options for future management of corridors would be maintained.

Table 3-59 Applicable Forest Plan Direction

Forest Plan	Alternative 2	Alternative 3
<p>MA-F6 Old Growth Areas. Vegetative management will not be allowed until further research is available on the needs of the dependent species (Forest Plan, P. 4-251). Two allocated old growth areas are located within the project area (OG-D3-02 near Drake Creek and OG-D3-07 in Rimrock Creek).</p>	<p>No treatments are proposed in allocated old growth areas.</p>	<p>Same as Alternative 2.</p>
<p>MA-F12 Eagle Roosting Area. Provide winter roosting habitat for migrating bald eagles from December through April.</p>	<p>Harvest and associated treatments would occur on approximately 2 acres. Selected merchantable trees less than 21 inches in diameter would be cut and removed. Juniper or precommercial thinning with associated prescribed fire would occur on an additional 40 acres. Thinning treatments would reduce understory conifer stocking improving large tree vigor. Prescribed fire would reduce accumulated and harvest-related ground fuels. Reduced stand density and prescribed fire would reduce the potential for high intensity fire thus reducing long-term risk. Outside of the designated eagle roosting areas, both action alternatives propose similar treatments in other suitable and potential roosting areas that will help maintain large tree roosting opportunities.</p>	<p>Same as Alternative 2.</p>
<p>MA-F13 Developed Recreation. Provide safe, healthful, and aesthetic facilities for people to utilize while they are pursuing a variety of recreational experiences within a relatively natural outdoor setting (Forest Plan, p. 4-71). The project area includes 57 acres within the developed recreation management area in the Wiley Flat and Elkhorn campgrounds. Direction for developed campgrounds specifies management of ponderosa pine stands to encourage large trees and open park-like stands.</p>	<p>Commercial harvest, precommercial thinning and prescribed fire would occur in and around the campgrounds. The campgrounds would be lightly thinned while maintaining cover and screening. Created slash would be treated by hand-piling concentrations and underburning. The fire prescription would seek to reduce scorching of residual trees and shrubs. Shrub cover would be revitalized due to a more open canopy and stimulated sprouting following prescribed burning. Fewer large trees would die as a result of competition stress reducing potential hazard trees in a developed recreation site and reducing potential for high intensity fire.</p>	<p>Same as Alternative 2.</p>

Chapter 3 - Affected Environment and Environmental Consequences

Forest Plan	Alternative 2	Alternative 3
MA-F14 Dispersed Recreation. Provide and maintain a near-natural setting for people to utilize while pursuing outdoor recreation experiences (Forest Plan, p. 4-72). The project area includes 52 sites that were identified as dispersed recreation sites.	Harvest, precommercial thinning and fuel treatments are designed to improve forest health, stand vigor and reduce fuels hazards. Hazard trees would be removed. Evidence of activities will be noticeable during and immediately following implementation. Activities would be designed to avoid equipment use on camping sites.	Same as Alternative 2.
MA-F26 Visual Management Corridors. Maintain the natural-appearing character of the Forest along major travel routes, where management activities are usually not evident or are visually subordinate to the surrounding landscape (Forest Plan, p. 4-95). The project area includes approximately 1,491 acres in visual management corridors along Road 16. The visual quality objective is partial retention.	Proposes commercial harvest on 757 acres, pre commercial thinning on 162, and prescribed burn on 213 acres within the visual management corridor. Thinning treatments would promote development of open park-like stands dominated by ponderosa pine, reduce dwarf mistletoe infected trees, maintain the presence of western larch and remove conifers from aspen stands located in the corridors. Prescribed fire and grapple piling would reduce ground fuels. Stands located in riparian areas would have higher residual stocking.	Proposes commercial harvest on 656 acres, precommercial thinning on 242, and prescribed burn on 172 acres within the visual management corridor. Prescribed treatments have the same objective as Alternative 2 and would have similar results.
MA-F20 Winter Range. Manage for big game winter range habitat (Forest Plan, p. 4-82).	HEI would be reduced Winter Range. HEI would meet standards established in the Forest Plan.	Same as Alternative 2.
MA-F21 General Forest Winter Range. Manage for timber production with management activities designed and implemented to recognize big game habitat needs (Forest Plan, p. 4-84).	HEI would be reduced in General Forest Winter Range. HEI would meet standards established in the Forest Plan.	Same as Alternative 2.
MA-F22 General Forest. Produce timber and forage while meeting the Forest-wide standards and guidelines for all resources. In ponderosa pine stands, management will emphasize production of high value (quality) timber (Forest Plan, p. 4-86).	HEI would be reduced in General Forest. HEI would meet standards established in the Forest Plan.	Same as Alternative 2.

Chapter 3 - Affected Environment and Environmental Consequences

Forest Plan	Alternative 2	Alternative 3
<p>Forest-wide. Protect active bird of prey nests from human disturbance until nesting, feeding, and fledgling are completed. Nesting areas are divided into primary and secondary zones. In the primary zone, maintain the present habitat characteristics (Forest Plan, pp. 4-248-249).</p>	<p>A primary buffer of 330 feet will be flagged around each nest site and a seasonal restriction (March 1 to August 1), within 660 feet of active raptor nests, would be implemented.</p> <p>No commercial harvest would occur within primary buffers for known nests. The seasonal restrictions may be waived on a case-by-case basis, if appropriately timed monitoring indicates that the nest area is not reproductive during that nesting season. Waivers would only be valid for the year in which they are granted.</p>	<p>Same as Alternative 2.</p>
<p>Forest-wide. Do not allow timber sale harvest activities within LOS stages that are below HRV (Eastside Screens, App. B, p. 9).</p>	<p>The East Maury project area is currently below HRV for LOS. Activities would decrease the amount of multi-strata LOS and increase the amount of single-strata LOS. There would be no net loss of LOS. A Forest Plan amendment is needed because harvest activities would occur in LOS stands that are currently below HRV.</p>	<p>Same as Alternative 2.</p>
<p>Forest-wide. Maintain or enhance connectivity between LOS stands and Old Growth Management Areas (Eastside Screens, App. B, p. 10).</p>	<p>Activities within connective corridors would enhance development of large trees over time. Commercial harvest would reduce canopy closure below the upper third of site potential. A Forest Plan amendment is needed to implement harvest activities within connective corridors.</p>	<p>Same as Alternative 2.</p>
<p>Forest-wide. Protect active and historic goshawk nest sites. Seasonal restrictions will be required for activities near sites that may disturb or harass pair while brooding and nesting (Eastside Screens, App. B, p. 13).</p>	<p>400-acre post fledgling areas have been identified around known nest sites. Harvest activities within post-fledgling areas will not remove late and old structure trees or snags, except those deemed to be a safety concern. Seasonal restrictions would be employed for disturbance activities from March 1 to August 31 of each year (within ½ mile nest site for habitat modifying activities, or ¼ mile for disturbance only activities). Post-treatment monitoring would be conducted to determine if objectives were met, and to verify continued occupancy and reproduction in mapped goshawk territories.</p>	<p>Same as Alternative 2.</p>
<p>TM-1b. Prohibit timber harvest in RHCAs except</p>	<p>210 acres of commercial harvest is proposed in</p>	<p>Includes 166 acres of commercial harvest in</p>

Chapter 3 - Affected Environment and Environmental Consequences

Forest Plan	Alternative 2	Alternative 3
<p>to acquire desired vegetation characteristics where needed to attain Riparian Management Objectives. Apply silvicultural practices in a manner that does not retard attainment of Riparian Management Objectives and that avoids adverse effects on inland native fish (INFISH, p. A-7).</p>	<p>portions of RHCAs in Wildcat, Stewart, Wiley, Parrish, Double Cabin and Indian Creeks and tributaries. Trees harvested from RHCAs would be removed by horse logging or other methods without the use of ground-based logging to meet lower disturbance objectives.</p> <p>Conifer thinning would stimulate growth of remaining trees, reduce the risk of mortality, develop future large wood sources and improve long term shade development. A small amount of sediment may occur but not be measurable in the short term if a rain event occurs immediately following treatment; fish can move to another part of the stream if disturbed; remaining vegetation and duff would filter sediment; long term sedimentation would be reduced, improvement in shade and recruitment of large wood; large wood would be left in Wiley and Double Cabin Creeks after harvest in aspen sites as they are deficient in large wood.</p>	<p>portions of RHCAs in the same drainages as Alternative 2</p> <p>Results are the same for treated RHCAs.</p>
<p>FM-1 Design fuel treatment so as not to prevent attainment of Riparian Management Objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could perpetuate or be damaging to long-term ecosystem functions or inland native fish (INFISH, P. A-111).</p>	<p>This alternative proposes fuel treatments on 746 acres within RHCAs. No ignition would occur within 50 feet of channel. Underburning would be designed to burn in a mosaic fashion, burning 10-50% of the ground in areas proposed within RHCAs.</p> <p>Streamside vegetation and large wood would be retained to filter sediment. A small amount of sediment may occur in the short term if a rain event occurs immediately following treatment. Remaining vegetation and duff provide sediment filter. Fire use would stimulate growth of ground vegetation. Long term sedimentation would be reduced.</p>	<p>This alternative proposes fuels treatment on 799 acres within RHCAs.</p> <p>Objectives and effects of prescribed burn would be the same as Alternative 2.</p>
<p>FM-4 Design prescribed burn projects and prescriptions to contribute to the attainment of Riparian Management Objectives. *Short term effects must not be great enough to</p>	<p>The proposed action would reduce fuel loading to approximate historic levels and maintain or enhance the growth of riparian hardwood species by reducing competition from conifers. Fire use</p>	<p>Same as in Alternative 2.</p>

Chapter 3 - Affected Environment and Environmental Consequences

Forest Plan	Alternative 2	Alternative 3
jeopardize the RMOs, avoidance of all short-term effects should not be allowed to preclude management changes or restoration actions necessary for the long-term recovery of habitats and/or populations. (USDA 1995 letter)	would be prescribed to retain large down wood. No heavy equipment or OHVs would be used in RHCAs or on closed roads in RHCAs.	
Forest Wide. Snag and down wood log levels to be maintained are described in the Regional Forester's Forest Plan Amendment No. 2.	Dead trees and down wood would not be included in commercial timber sales. Due to requirements to cut hazardous trees snags levels would be reduced in harvest units and along haul routes. A small amount of snag recruitment is expected where prescribed fire is used. Overall, continued mortality is expected in both treated units and untreated units although recruitment will decrease in thinned units. Approximately 474 snags would be created in unit 244 when large trees infected with dwarf mistletoe are girdled. Because all large trees will remain after harvest, large replacement snags will be available and increase in the future.	Same as in Alternative 2.
Pileated Woodpeckers The Forest Plan indicates that the allocated Old Growth Management Areas are intended to provide reproductive habitat for pileated woodpeckers. Maintain a minimum average of two hard snags per acre, greater than or equal to 10 inches DBH in designated feeding areas.	No treatments are proposed within the Old Growth Management Areas. Within designated feeding areas, harvest is proposed on 48 acres in 2 units with objectives including retaining and augmenting large trees in the long term. Snags and down wood not be included in harvest. Treatments are designed to maintain uneven-aged structure.	Same as Alternative 2.
Equivalent Harvest Area. Current Forest Plan threshold of EHA is 35 in all watersheds in the project area.	Equivalent Harvest Area-increases to 30 for 1 year and remains above 25 for 7 years in Indian Cr. EHA in two subwatersheds (Camp Cr. And Maury Cr.) increases above 25 but stays less than 30 for 5 and 6 years. All other subwatersheds remain below 25.	Equivalent Harvest Area increases to 25 for 1 year in Maury Creek subwatershed. EHA for Camp Cr. And Indian Cr. Are the same as for Alternative 2.

Chapter 3 - Affected Environment and Environmental Consequences

Forest Plan	Alternative 2	Alternative 3
<p>RF-2. For each existing or planned road, meet the Riparian Management Objectives and avoid adverse effect to inland native fish by:</p> <ul style="list-style-type: none"> a. completing watershed analyses prior to construction of new roads or landings in Riparian Habitat Conservation Areas within priority watersheds. b. minimizing road and landing locations in Riparian Habitat Conservation Areas. c. initiating development and implementation of a Road Mangement Plan or a Transportation Management Plan. d. avoiding sediment delivery to streams from the road surface. e. avoiding disruption of natural hydrologic flow paths. f. avoiding sidecasting of soils or snow. <p>Sidecasting of road material is prohibited on road segments within abutting RHCAs in priority watersheds.</p>	<ul style="list-style-type: none"> a. The Maury Mountain Watershed Analysis was completed in 2001. b. This alternative would construct 311 feet of new road within RHCAs of Stewart Creek, Keeney Creek, Poison Creek (all Class IV). Existing roads and crossings within RHCAs were evaluated within the overall transportation plan. Where better access was found, selected roads within RHCAs were recommended for decommissioning and incorporated into the proposed action. New construction and stream crossings within RHCAs are designed to minimize disturbance and new and rebuilt crossings would be removed after harvest is complete. New landings are located outside of RHCAs. c. The Ochoco National Forest Roads Analysis was completed in January 2003. A roads analysis was completed for this project in November, 2007. d. Long term sediment reductions resulting from road decommissioning include 0.9 mile of open road within 400 feet of streams. In addition, this alternative would close 0.8 miles of road within 400 feet of streams. Reconstruction of stream crossings would maintain or improve channel function over existing condition. Design elements include installing relief drainage or erosion control devices to route drainage away from stream channels. Road reconstruction and culvert removal included to reduce sediment delivery to streams. Log haul would be suspended during wet periods. Best Management Practices incorporated into design and implementation plans. e. road construction and reconstruction plans will include sufficient relief drainage to minimize concentration of flow. Surface and subsurface flow would not be interrupted. Reconstructed crossings on perennial streams will include temporary bridge (cattle guard). One culvert may be replaced temporarily. After removal existing channel 	<ul style="list-style-type: none"> a. Same as Alternative 2. b. No new or temporary roads within RHCAs are proposed. Applicable recommendations from the roads analysis were incorporated. No new landings are proposed in RHCAs. c. Same as Alternative 2. d. Long term sediment reductions resulting from road decommissioning include 0.1 mile of open road within 400 feet of streams plus an additional 0.7 mile of non-system road that currently is not open but would be used. In addition, 0.7 miles of road within 400 feet of streams would be closed. Design elements include installing relief drainage or erosion control devices to route drainage away from stream channels. Road reconstruction and culvert removal included to reduce sediment delivery to streams. Log haul would be suspended during wet periods. Best Management Practices incorporated into design and implementation plans. e. road reconstruction plans will include sufficient relief drainage to minimize concentration of flow. Surface and subsurface flow would not be interrupted. Reconstructed crossings on perennial streams will include temporary bridge (cattle guard). One culvert may be replaced temporarily. After removal existing channel problems will be corrected and restored. f. Same as Alternative 2.
<p>East Maury Fuels</p>	<p>and Vegetation Management Project Draft EIS f. Road maintenance will follow BMPs.</p>	<p>◆ Page 213</p>

Chapter 3 - Affected Environment and Environmental Consequences

Forest Plan	Alternative 2	Alternative 3
<p>RF-3 Determine the influence of each road on the Riparian Management Objectives. Meet Riparian Management Objectives and avoid adverse effects on inland native fish by:</p> <p>a. 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 that retard attainment of RMOs, or do not protect priority watershed from increased sedimentation.</p> <p>c. 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.</p>	<p>a. Proper drainage and surfacing is included to reduce sedimentation and erosion, including road work within RHCAs to stabilize roads and reduce sediment delivery. Road 1680-050 at Wildcat Cr. crossing was identified as needing improvement. Post activity culvert removal and channel restoration at crossing is included in proposed actions.</p> <p>c. Existing closed roads would be reclosed after completion of proposed actions. An additional 2 miles of road would be closed and 2.5 miles of road would be decommissioned project wide. Temporary roads would be obliterated after harvest.</p>	<p>a. Same as Alternative 2</p> <p>c. Existing closed roads would be reclosed after completion of proposed actions. An additional 1 miles of road would be closed and .8 miles of road would be decommissioned project wide. Temporary roads would be obliterated after harvest.</p>
<p>RF-4 Construct new, and improve existing, culverts, bridges, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those improvements would/do pose a substantial risk to riparian conditions. Substantial risk improvements include those that do not meet design and operation maintenance criteria, or that have been shown to be less effective than designed for controlling erosion, or that retard attainment of Riparian Management Objectives, or that do not protect priority watersheds from increased sedimentation. Construct and maintain crossings to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure (INFISH, P. A-8).</p>	<p>All proposed new construction and reconstruction of stream crossings are designed reduce risk. Proposal includes use of temporary bridges, armored crossings, or suitably sized culverts. Crossings would be in place for 1 year and then removed. Stream channels at crossings would be restored and revegetated.</p>	<p>No new road work in RHCAs proposed.</p>
<p>RF-5. Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams (INFISH, P. A-8).</p>	<p>Proposed use of temporary bridges on fish-bearing streams will maintain fish passage. Stream channel restoration work included at Wildcat Cr. where road 1680-050 crosses.</p>	<p>No reconstruction or new stream crossings are proposed in Alternative 3. Stream channel work on Wildcat Cr. is the same as Alternative 2.</p>
<p>FW-1. Design and implement fish and wildlife</p>	<p>Restoration of aspen stands, maintenance and</p>	<p>Same as Alternative 2.</p>

Chapter 3 - Affected Environment and Environmental Consequences

Forest Plan	Alternative 2	Alternative 3
habitat restoration and enhancement actions in a manner that contributes to attainment of the Riparian Management Objectives.	improvement of riparian shrub cover, long term development of large trees, and channel restoration (Wildcat Cr.) are expected to improve riparian conditions.	
Forest-wide. Project activities will be planned to reduce soil compaction and displacement to the lowest reasonable level. Strive to reduce compaction and displacement of the total activity area to get as close to 90 percent of the activity area in a noncompacted/nondisplaced condition. The minimum will be 80 percent (Forest Plan, P. 4-196).	Unit specific mitigations to reduce compaction and displacement have been identified. These include design of logging system, avoidance of specific areas, and restoration where needed. See appendix D for unit specific soil disturbance projections and expected tillage needs.	Unit specific mitigations to reduce compaction and displacement have been identified. These include design of logging system, avoidance of specific areas, restoration where needed. See appendix D for unit specific soil disturbance projections and expected tillage needs.
Forest-wide. Maintain viable populations or all threatened, endangered, and sensitive plant and animal species (Forest Plan, P. 4-120).	A Biological Evaluation has been prepared for the project. This project will have no effect to endangered species, and may affect, but not likely to adversely affect threatened species. This alternative may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to any populations of sensitive species.	Same as Alternative 2.
Forest-wide. Protect fragile sites such as shallow soil areas (scablands) and natural meadows (Forest Plan, p. 4-121).	Design elements were incorporated into the project to protect fragile sites. Ground based equipment would be restricted in scablands, meadows, and RHCAs, with the exception of building new or temporary roads.	Design elements were incorporated into the project to protect fragile sites. Ground based equipment would be restricted in scablands, meadows, and RHCAs. No new or temporary roads would be built in RHCAs or scablands.
Forest-wide. Prevention of invasive plant introduction, establishment, and spread will be addressed in fuels and vegetation management plans (2005 ROD for Preventing and Managing Invasive Plants, Standard 1).	Prevention measures have been developed and incorporated as design elements in Chapter 2.	Same as Alternative 2.

CHAPTER 4 CONSULTATION AND COORDINATION

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental impact statement:

Interdisciplinary Team Members

Barbara Fontaine, IDT Leader
Barb Franano, District Fisheries Biologist
Paul Cuddy, Forest Environmental Coordinator
Jim David, Forest Soil Scientist
Carrie Gordon, District Geologist
Gayle Hammond, Road Management
Terry Holtzapple, District Archeologist
Mark Lesko, District Botanist
Bryan Scholz, Fuels Planner
Jim Seymour, District Hydrologist
Dede Steele, District Wildlife Biologist

Paul C. Cuddy, Forest Environmental Coordinator, has a Bachelors degree in the Social Sciences from Providence College and a Masters in Forest Management from Utah State University. His experience includes 27 years with the Forest Service on the Salmon, Wasatch-Cache, Bridger-Teton, Siskiyou, and Ochoco National Forests. He has been involved in numerous planning efforts including the Forest and Grassland Land and Resource Management Plans, timber sales, range allotment plans, Wild and Scenic River management plans, land exchanges, and roads and watershed analyses. He is currently the Forest Environmental Coordinator and Forest Planner for the Ochoco National Forest and Crooked River National Grassland.

Jim David, Forest Soil Scientist, has a B.S. degree in Range and Wildlands Science (soils and hydrology emphasis) and a M.S. degree in Range Ecology from the University of California at Davis. His experience includes working in ranching, farming, contract inventory, California Division of State Lands, BLM, and the Forest Service. His experience includes 23 years of federal service with the Ely and Las Vegas Districts of the BLM in Nevada and the Ochoco National Forest in central Oregon. He has worked as the Forest Soil Scientist for the Ochoco National Forest and Crooked River National Grassland for the last 17 years.

Katherine Farrell was the Project Leader. She has more than 18 years experience working for the Forest Service in planning. She has been involved in numerous planning efforts including timber sales, range allotment plans, Wild and Scenic River management plans, land exchanges, watershed analyses, and recreation projects. She is currently the Planning and Environmental Coordinator for the Twin Falls District, Bureau of Land Management.

Barbara Fontaine, Forester, Project Leader, has a B.S. degree in Forest Management from Oregon State University. She became a certified silviculturist after completing studies in the

Silviculture Institute (Oregon State University and University of Washington) in 1992. Her experience includes project planning, timber sale planning, preparation and appraisal, timber stand improvement and reforestation program management, and silvicultural prescriptions preparation. As a forester/silviculturist she has been observing growth and development of local forest stands for 30 years.

Barbara Franano has B.S. and M.S. degrees in Biology (fish and wildlife emphasis) from West Texas State University in Canyon, Texas. Her experience includes 26 years of government service working for the Wasatch-Cache, Uinta, and Ochoco National Forests, U.S. Bureau of Reclamation, and the Division of Wildlife Resources in Utah. She has worked as a fisheries and wildlife biologist and as a program manager for special uses. For the last 9-1/2 years, she has been the Fisheries Biologist for the Lookout Mountain Ranger District and Crooked River National Grassland, Ochoco National Forest.

Caroline L. (Carrie) Gordon, Forest Geologist, earned her B.A. in Geology in 1977 from Central Washington University, Ellensburg, WA. She is a Registered Geologist in the State of Oregon and in the State of Washington. She began working for the Forest Service in 1978 as a Civil Engineering Technician. In 1984, she converted to the Geology series. Carrie specializes in providing general geology for planning areas/watershed analysis, managing the rock resource program, and conducting slope stability investigations. In addition, she assists administering small scale mineral material permits and plans of operation for small mining claims. She has worked on the Ochoco National Forest since 1992.

Gayle Hammond, Road Manager, has an A.S. degree in Engineering Technology from Linn-Benton Community College. She has been with the Forest Service 26 years working for the Malheur, Siskiyou, and Wallowa-Whitman National Forests as an engineering technician. Her experience includes planning, location, survey and design, contract preparation and administration of roads and recreation sites. She is currently the road manager and transportation planner for the Ochoco National Forest.

Theresa (Terry) Holtzapple is the District Archaeologist. She earned a B.A. in Anthropology from the University of Texas at Austin in 1975 with one year of post graduate work. She has more than 25 years experience in excavation, survey, historic restoration and cultural resource management. She has worked in Texas, Alaska and Oregon with university, state and federal agencies. Terry has worked on the Ochoco National Forest since 1979.

Mark G. Lesko, Botanist and Noxious Weed Coordinator, has a B.S. in Forest Science from The Pennsylvania State University, and post-graduate education in botany from Oregon State University. His experience includes 29 years in forestry, ecology, lands and minerals, botany, and noxious weed management for The Confederated Tribes of the Warm Springs Reservation of Oregon, Bureau of Land Management, and the Forest Service. For the last 9 years, he has been the botanist for the Lookout Mountain Ranger District and Crooked River National Grassland, Ochoco National Forest.

Bryan Scholz, Fuels Specialist, has an A.S. degree in Forestry, an A.S. degree in Wildfire Science, and is a graduate of Technical Fire Management through Colorado State University. He is an Assistant Fire Management Officer in the fuels management program on the Crooked River National Grassland and the Lookout Mountain Ranger District of the Ochoco National Forest. He has 22 years of government employment with fire and fuels management with the Forest Service.

James Seymour, Hydrologist, has a B.S. from Colorado State University in Watershed Science with a concentration in Hydrology. His experience includes 27 years of government service as a hydrologist working on the Deerlodge National Forest in Montana, and the Olympic National Forest in Washington. Jim is currently the hydrologist on the Lookout Mountain Ranger District of the Ochoco National Forest.

Dede Steele, Wildlife Biologist, has a B.S. degree in Wildlife Science and a B.S. degree in Rangeland Resources from Oregon State University. Her experience includes 25 years of government service working for the Willamette, Ochoco, and Deschutes National Forests and for the U.S. Fish and Wildlife Service. She has worked as a District and Forest level Biologist, as an interdisciplinary resource planner, and as a Service Biologist. She is currently a District Wildlife Biologist on the Lookout Mountain Ranger District, Ochoco National Forest.

Additional Contributors

Kevin Keown, Acting District Ranger
Jim Grace, Geographic Information System Specialist/Analyst
Susan Cunningham, Writer/Editor

Federal, State, and Local Agencies

Crook County, Scott Cooper
Environmental Protection Agency, Office of Federal Activities
Environmental Protection Agency, Region 10
National Marine Fisheries Service, Scott Hofer
Oregon Department of Fish and Wildlife, Glen Ardt
Oregon Department of Fish and Wildlife, Tim Unterwegner
OSU, County Extension Office, Tim DeBoodt
USDA, National Agricultural Library
USDI Office of Environmental Policy and Compliance
U.S. Fish and Wildlife Service, Jerry Cordova

Tribes

Confederated Tribes of the Warm Springs Reservation
The Burns Paiute
The Confederated Tribes of the Umatilla Indian Reservation
The Klamath Tribes

Others

96 Ranch, Al and Nina Luttrell
American Forest Resource Council, Charles Burley
Archaeological Society of Central Oregon, Susan Gray
Aspen Valley Ranch, Jim Wood
Alex Berlin
Susan Jane M. Brown
The Bulletin
Central Oregonian, Vance Tong
Crook County Natural Resources Planning Committee, Lynne Angland

Crown Pacific Ltd. Partnership, Gary Cremer
D.R. Johnson Lumber Co., Gerald Keck
D.R. Johnson Lumber Co., Dan Bishop
Deschutes Resource Conservancy, Scott McCaulou
Interfor Pacific, Greer Kelly
Kastor Ranch, Rance and Nancy Kastor
Les Schwab Tire Centers of Oregon, Inc., Dan Roberts
LS Ranch, Mark Jamison
McCormack & Sons, Jeff and Runinda McCormack
Bob Mullong
Natural Resources Research Library, S.J. and Jessie E. Quincy
Ochoco Lumber Company, John Morgan
Oregon Hunters Association
Oregon Trout, Aubrey Russell
Oregon Wild, Chandra LeGue
Oregon Wild, Tim Lillebo
Post Ranch, Phil and Lavern Moerschell
Prineville-Crook County Chamber of Commerce, Diane Bohle
Tom Raglan
B. Sachau
Sierra Club, Oregon Chapter, Asante Riverwind
Candace Thompson

Distribution of the Environmental Impact Statement

This environmental impact statement has been distributed to individuals who specifically requested a copy of the document. In addition, copies have been sent to the following Federal agencies, federally recognized tribes, State and local governments, and organizations representing a wide range of views.

REFERENCES

- Alexanian, K. 2000. Personal communication on potential spread of various noxious weed species in Central Oregon.
- Agee, J.K. 1993. *Fire Ecology of Pacific Northwest Forests*. Island Press. Washington, DC. pp. 53-74, 113-186, 320-408.
- Ager, A. 2005. ArcFuels: Forest planning tools for managing wildfire fuels. International ESRI users conference. August 2005. San Diego, CA.
- Altman, B. 2000. *Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington*. American Bird Conservancy, for Oregon-Washington Partners in Flight. Corvallis, OR. 128 p.
- Anderson, B. 1989. *Background Information on the EHA Model*. Unpublished, on file at the Ochoco National Forest, 3160 NE Third Street, Prineville, OR.
- Arno, S.F. 2000. Fire in western forest ecosystems. In: Brown, J.K., Smith, J.K., eds. *Wildland fire in ecosystems: Effects of fire on flora*. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 97-120.
- Asher, J.E., S. Dewey, C. Johnson and J. Olivarez. 2001. Reducing the spread of invasive exotic plants following fire in western forests, deserts, and grasslands. In: Galley, Krista. E. M.; Wilson, Tyrone P., eds. *Proceedings of the invasive species workshop: The role of fire in the control and spread of invasive species; Fire conference 2000: the first national congress on fire ecology, prevention, and management; 2000 November 27 - December 1; San Diego, CA*. Misc. Publ. No. 11. Tallahassee, FL: Tall Timbers Research Station: 102-103. Abstract. (40681)
- Barrett, J. 1981. Twenty-year growth of thinned ponderosa pine in the Methow Valley of northern Washington. Research Paper PNW-RP-286. USDA Forest Service, Pacific Northwest Research Station. Portland, OR.
- Barrett, J. 1982. Growth of ponderosa pine saplings thinned to five spacings in central Oregon. Research Paper PNW-RP-301. USDA Forest Service, Pacific Northwest Research Station. Portland, OR.
- Barrett, J. 1989. Growth of ponderosa pine poles thinned to different stocking levels in central Oregon. Research Paper PNW-RP-311. USDA Forest Service, Pacific Northwest Research Station. Portland, OR.
- Barrett, J. and Lewis Roth. 1985. Response of Dwarf Mistletoe-Infested Ponderosa Pine to Thinning. PNW-RP-330 and 331. USDA Forest Service, Pacific NW Research Station: Portland, OR.
- Bartuska, A.M. 2000. Letter dated November 6, 2000, to John Talberth, National Forest Protection Alliance. File designation: 2400. Comments on the report entitled "The economic case against national forest logging." 9 p. On file at the Ochoco National Forest, 3160 NE Third Street, Prineville, OR.
- Baker, M.B. 1988. *Hydrologic and Water Quality*

- Effects of Fire. Proceedings: Effects of Fire in Management of Southwest Natural Resources (Tucson, AZ, November 14-17, 1988). p. 31-42.
- Belnap, J. 1997. Introduction to Microbiotic Crusts, USDA- Natural Resources Conservation Service.
- Belsky, A.J. 2000. Livestock Grazing and Weed Invasions in the Arid West. Oregon Natural Desert Association. Bend, OR.
- Beschta, R.L., R.E. Bilby and G.W. Brown, [and others]. 1987. Stream temperature and aquatic habitat; fisheries and forestry interaction. Pages 191-232 in: Salo, E.O.; Cudy, T.W., eds. Forestry and fisheries interactions. Contribution 57. Seattle, WA: University of Washington Institute of Forest Resources.
- Bosch, J.M. and J.D. Hewlett. 1982. A review of catchment experiments to determine the effects of vegetation changes on water yield and evaporation. *J Hydrol.*55:3-23.
- Bjorn, T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. *American Fisheries Society Special Publication* 19:83-138.
- Britton, D.L. 1991. The benthic macroinvertebrate fauna of a South African Mountain Stream and its response to fire. *South African Journal of Sci.* 17(1/2), P 51-64. ISSN 1018 3469.
- Broderson, J.M. 1973. Sizing buffer strips to maintain water quality. M.S. thesis. University of Washington, Seattle, WA.
- Brooks, P., K. Urban, G. Yates and C. Johnson. 1991. Sensitive Plants of the Malheur, Ochoco, Umatilla and Wallowa-Whitman National Forests. USDA Forest Service publication FSR6-WAW-TP-027-91.
- Brown, Ervin C. and T. P. Thayer. 1966. Geologic Map of the Canyon City Quadrangle Northeastern Oregon, Oregon Department of Geology and Mineral Industries, USGS, Miscellaneous Geologic Investigations Map I-447
- Buckley, Geoffrey L. 1992. Desertification of the Camp Creek Drainage in Central Oregon. 1826-1905. Masters Thesis. University of Oregon. Eugene, OR.
- Bull, E.L. and M.P. Hayes. 2001. Post-breeding season movements of Columbia spotted frogs (*Rana luteiventris*) in northeastern Oregon. *Western North American Naturalist* 61: 119-123.
- Bull, E.L. and M.P. Hayes. 2002. Overwintering of Columbia spotted frogs in northeastern Oregon. *Northwest Science.* 76:141-147.
- Carlton, D. n.d. Fuels Management Analyst program licenced to USDA Forest Service.
- Clary, W.P. 1999. Stream channel and vegetation responses to late spring cattle grazing. *Journal of Range Management* (52) 3, May 1999. p. 218-227.
- Cochran, P. H. and James Barrett. 1993. Long-term Response of Planted Ponderosa Pine to Thinning in Oregon's Blue Mountains. *Western Journal of Applied Forestry*, Vol. 8, No.4, October 1993.
- Cochran, P. H. and James Barrett. 1999. Thirty-Five-Year Growth of Ponderosa Pine Saplings in Response to Thinning and Understory Removal. PNW-RP-512. Portland, OR: USDA Forest Service, Pacific NW Research Station.

- Cochran, P. H. and James Barrett. 1999. Growth of Ponderosa Pine Thinned to Different Stocking Levels in Central Oregon: 30-Year Results. PNW-RP-508. Portland, OR: USDA Forest Service, Pacific NW Research Station.
- Cochran, P. H. and W.E. Hopkins. 1991. Does Fire Exclusion Increase Productivity of Ponderosa Pine? In the proceedings of The Management and Production of Western Montane Forest Soils, Boise, Idaho; USDA-Forest Service, Intermountain Research Station, General Technical Report INT-280.
- Cordova, J.J. 1995. Streamside forest, channel constraint, large woody debris characteristics, and pool morphology in low order streams, Blue Mountains, Oregon. M.S. thesis, Oregon State University, Corvallis, OR. 143 p.
- Croft, L., W. Owen and J. Shelly. 1997. Interior Columbia Basin Ecosystem Management Project - Analysis of Vascular Plants.
- David, J. 2001. Personal communication on changes in lithosol (scabland) soils on the Ochoco NF and Crooked River National Grassland, based on unpublished data from Region 6 ecology plots in the Blue Mountains, by F. Hall.
- David, J. 2002. Mule/Horse Logging Impacts on Mule TS #3; Ochoco National Forest.
- Deal, Krista. 2002. Effects of Prescribed Fire on Obsidian and Implications for Reconstructing Past Landscape Conditions. edited by J. M. Loyd, T.M. Origer and D.A. Fredrickson. USDI BLM, Cultural Resource Publication, Anthropology – Fire History.
- DeByle, N.V. and P.E. Packer. 1972. Plant nutrient and soil losses in overland flow from burned forest clearcuts. Watersheds in Transition, Proc. Symposium AWRA & Colorado Sate Univ., p.296-307.
- DeClerck, F.R. 1997. Cattle as dispersers of hound's tongue on rangeland in southeastern British Columbia. Journal of Range Management. 50:239-243.
- Dewey, R. 2006. Personal communication on *Dermatocarpon meiophyllizum*. Deschutes National Forest, Bend, OR. R. Dewey is the assistant Forest Botanist and non-vascular plant specialist for the Deschutes/Ochoco NF.
- DiTomaso, J.M. 1997. Risk analysis of various weed control methods. Proc., California Exotic Pest Plant Council Symposium 3:34-39.
- Dollhausen, J.V. 2003. Personal communication on *Penstemon peckii* populations and habitat.
- Douglas, J.E. 1967. Effects of species and arrangement of forests on evapotranspiration. In W.E. Sopper and H.W. Lull (Eds.) Int. Symp. Forest Hydrology. pp 451-461. Pergamon Press, New York.
- Dumas, P.C. 1966. Studies of the *Rana* species complex in the Pacific Northwest. Copeia 1966:60-74).
- Eddleman, L.E. 1996. Personal communication on the seed bank viability of knapweed species. Oregon State University. Corvallis, OR.
- Finney, M., S. Britten, and R. Seli. n.d. In prep. FlamMap, version 3. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Missoula, MT. Accessed April 10, 2007. <http://www.fire.org>.

- Fontaine, B.J. 1998. Personal Communication on shade monitoring in non-commercial thinning in Riparian Habitat Conservation Areas (RHCAs).
- Gebert, K.M., C.E. Keegan III, S. Willits and A. Chase. 2002. Utilization of Oregon's timber harvest and associated direct economic effects. General Technical Report PNW-GTR-532. USDA Forest Service, Pacific Northwest Research Station. Portland, OR.
- Gedney, Donald R., David L. Azuma, Charles L. Bolsinger and Neil Mcay. 1999. Western Juniper in Eastern Oregon. General Technical Report PNW-464. USDA Forest Service, Pacific NW Research Station: Portland, OR
- Graham, R.T., A.E. Harvey, T.B. Jain and J.R. Tonn. 1999. The Effects of Thinning and Similar Stand Treatments on Fire Behavior in Western Forests. US Forest Service Technical Report PNW-GTR-463.
- Gregory, S.V., G.A. Lamberti, D.C. Erman, [and others]. 1987. Influence of forest practices on aquatic production. Pages 233-256 in: Salo, E.O.; Cudy, T.W., eds. Forestry and fisheries interactions. Contribution 57. Seattle, WA: University of Washington Institute of Forest Resources.
- Grenier, K. 2002. Summary of *Castilleja chlorotica* sites on the Deschutes National Forest. K. Grenier is the Forest Botanist for the Deschutes/Ochoco National Forests.
- Glavich, D. 2007. Conservation Assessment for *Dermatocarpon meiophyllizum* Vainio. USDA Forest Service, Region 6, and USDI Bureau of Land Management, Oregon and Washington.
- Geist, J. M. and. H.A. Froehlich. 1994. Basis and Principles of Subsoiling in Forest Ecosystems, unpublished USFS paper.
- Gonthier, J. B. 1985. A Description of Aquifer Units in Eastern Oregon. U.S. Geological Survey Water-Resources Investigations Report 84-4095, 39 pages.
- Gordon, N. D., Thomas A. McMahon and Brian L. Finlayson. 1992. Stream Hydrology, An Introduction for Ecologists. 526 pp.
- Gordon, C. 2000. Maury Watershed Analysis Geology Report; June 7, 2000. 26 pg.
- Hall, F. 1973. Plant Communities of the Blue Mountain Area in Eastern Oregon and Southeastern Washington. USDA Forest Service. Pacific NW Region, Area Guide 3-1.
- Hall, F. 1996. Personal communication on establishing native species on highly disturbed soils.
- Halvorson, R. 2000. BLM Special Status Plant Habitat/ Distribution Narrative. Prineville, OR.
- Halvorson, R. 2003. Personal communication on BLM Special Status Plants. Bureau of Land Management. Prineville, OR. R. Halvorson is the botanical specialist for the BLM.
- Halford, Kirk and Anne S. Halford. 2002. The Trench Canyon Prescribed Fire Burn: An Analysis of Fire Effects On Archaeological Resources within the Sagebrush Steppe Community Type, edited by J. M. Loyd, T.M. Origer and D.A. Fredrickson. USDI BLM, Cultural Resource Publication, Anthropology _ Fire History.
- Hardy, C.C., K.M. Schmidt, J.M. Menakis, and N.R. Samson. 2001. Spatial data for national fire planning and fuel management. International Journal of Wildland Fire. 10:353-372.

- Harpel, J. 2005. Conservation Assessment for *Scouleria marginata* Britton. USDA Forest Service, Region 6, and USDI Bureau of Land Management, Oregon and Washington.
- Harvey, A.E., J.M. Geist, G.I. McDonald, [and others]. 1994. Biotic and abiotic processes in eastside ecosystems: the effects of management on soil properties, processes, and productivity. USDA Forest Service Gen. Tech. Rep. PNW-GTR-323, Pacific Northwest Research Station.
- Harvey, A., D. Page-Dumroese, M. Jurgensen and R. Graham. 1991. Organic Matter Function in the Western Montane Forest Soil System, In the proceedings of The Management and Production of Western Montane Forest Soils, Boise, Idaho; USDA-Forest Service, Intermountain Research Station, General Technical Report INT-280, 1991
- Haupt, H.F. and W.J. Kidd. 1965. Good logging practices reduce sedimentation in central Idaho. *Journal of Forestry*. 63:664-670.
- Helliwell, R. 2001. Personal communication on *Carex interior*.
- Hibbert, A.R. 1965. Forest Treatment Effects on Water Yield. In W. E. Sopper & H. W. Lull (Eds.), *Int. Symp. For. Hydrology*, P. 527-543. Pergamon Press, New York.
- Hitchcock, C.L. and A. Cronquist. 1973. *Flora of the Pacific Northwest*. University of Washington Press. Seattle.
- Hopkins, W.E. and S. Garrett. 1990. Sensitive Plant, Animal and Noxious Weeds Guide for the Deschutes, Fremont, Ochoco and Winema National Forests-Area IV. USDA Forest Service, Pacific Northwest Region. R6-DES-TP-017-90.
- Hungerford, R. D. 1996. Fire in ecosystem management notes: Unit II-I, USDA Forest Service, National Advanced Technology Center, Marana, AZ. As cited by DeBano and others.
- Hunn, Eugene S. 1990. *Nc'I-Wana "The Big River" Mid-Columbia Indians and Their Land with James Selam and Family*. University of Washington Press, Seattle, Washington.
- Interagency Implementation Team (IIT). 2000. *Grazing Implementation Monitoring Module*, USFWS, NMFS, Forest Service, and BLM.
- Ingram, Elaine R. 1997. Department of Botany and Plant Pathology, Oregon State University, Corvallis, Oregon 97331-2902. *Organisms in the Soil: Functions of Bacteria, Fungi, Protozoa, Nematodes and Arthropods*.
- Johnson, C.G. 1994. *Forest Health in the Blue Mountains: A Plant Ecologist's Perspective on Ecosystem Processes and Biological Diversity*. Gen Tech. Report. PNW Research Sta. Portland, OR.
- Johnson, C.G. 1998. *Vegetation Response after Wildfires in National Forests in Northeastern Oregon*. USDA Forest Service.
- Johnson, C.G. and R.R. Clausnitzer. 1991. *Plant Associations of the Blue and Ochoco Mountains*. USDA Forest Service publication R6-ERW-TP-036.
- Kagan, J.S. 1996. *Draft Species Management Guide for Calochortus longebarbatus* Wats. var. *peckii* Ownbey

- Kaufmann, J.B. 1990. Ecological relationships of vegetation and fire in Pacific Northwest Forests. In: Walstad, et al, Natural and Prescribed Fire in Pacific Northwest Forests. Oregon State University Press, Corvallis, OR
- Kovalchik, Bernard L. n.d. Riparian Zone Associations of the Deschutes, Ochoco, Fremont and Winema National Forests, USDA-Forest Service, Pacific Northwest Region, R6 Ecology TP-279-87
- Kurtz, Tory. 2007. Personal communication- Range Specialist; Lookout Mountain District.
- Larson, S., R. Oren, R.H. Waring and J.W. Barrett. 1983. Attacks of mountain pine beetle as related to tree vigor of ponderosa pine. *Forest Science*. 29(2):395-402.
- Lebow, Clayton G., Richard Pettigrew, Jon M. Silvermoon, David H. Chance, Robert Boyd, Yvonne Hajda and Henry Zenk. 1990. A Cultural Resource Overview for the 1990s, BLM Prineville District, Oregon. US Dept. of Interior, Bureau of Land Management, Portland, Oregon.
- Leitritz, E., and R.C. Lewis. 1980. Trout and Salmon Culture. Sacramento: California Department of Fish and Game, Bulletin 164. 197 pp.
- Leven, A.A. 1971. Q/D Note #1, A procedure for estimating delivery coefficients of surface erosion from source area to channel. Region 5, Forest Service.
- Loyd, Janine M. 2002. Rehydration of Burned Obsidian. In the Effects of Fire and Heat on Obsidian, edited by J. M. Loyd, T.M. Origer and D.A. Fredrickson. USDI BLM, Cultural Resource Publication, Anthropology – Fire History.
- Lynch, J.A., E.S. Corbett and K. Mussallem. 1985. Best management practices for controlling nonpoint-source pollution on forested watersheds. *Journal of Soil and Water Conservation*, 40: 164-167.
- Lytjen, D. 2003. Personal communication on recently documented populations of *Carex backii*.
- Ma and others. 2003. Effect of Burning and Thinning on Soil Respiration, Short Term Effects of Experimental Burning and Thinning on Soil Respiration in an Old Growth, Mixed Conifer Forest; Univ. of Toledo, OH; Univ. of Calif; Davis and Univ. Metropolitana, San Juan, PR.
- Maffei, H. 1996. Definition and Procedures for Classifying Stands as Imminently Susceptible to Insect Attack and Wildfire. White Paper, Deschutes NF, Pacific Northwest Region
- Mafera, D. 2003. Botany Report for Deep Vegetation Management - Draft EIS
- Martin, Kathleen and Terry Holtzapple. in progress 2005 – East Maury Cultural Resource SHPO Report, on file, Ochoco National Forest, Lookout Mountain and Paulina Ranger District, Prineville, Oregon, OHIMS 06070300155P.
- McGonagil, K. 1979. USFS Production Study – Horseslogging at Latour State Forest, Logging Systems Guide, US Dept. of Agriculture, Forest Service, Alaska Region.
- Maze, J. and K.A. Robson. 1996. A new species of *Achnatherum* (*Oryzopsis*) from Oregon. *Madrono* 43:393-403.
- Megahan, W.F. 1976. Effects of forest cultural treatments upon stream flow. The Forest Acts Dilemma Symposium, 1975. Montana Forest and Conservation Experiment Station. University of Montana. pp. 14-34.

- Megahan, W.F. 1980. Nonpoint source pollution from forestry activities in the western United States: results of recent research and research needs. Conference on U.S. Forestry and Water Quality: What course is the 80's. Proceedings, Water Pollution Control Federation, Richmand, VA.
- Meineke, R.J. 1995. *Mimulus evanescens* (Scrophulariaceae): A New Annual Species from the Northern Great Basin. *Great Basin Naturalist*. pp. 249-257.
- Miller, R.F. and J.E. Rose. 1999. *Journal of Range Management*. 5:550-559.
- Milstein, M. 2000. Forest Service tells fire retardant maker to remove cyanide. *The Oregonian*, Portland Oregon. Wednesday, September 20, 2000.
- Monello, R.J. and R.G. Wright. 1999. Amphibian habitat preferences among artificial ponds in the Palouse Region of Northern Idaho. *Journal of Herpetology* 33:298-303.
- Montgomery, D. R. and J.M. Buffington. 1993. Channel classification, prediction of channel response, and assessment of channel condition. TFW-SH10-93-022. Prepared for the SHAMW committee of the Washington State Timber Fish & Wildlife agreement. Timber Fish & Wildlife, Seattle, Washington.
- Moring, J.R. 1982. Decrease in stream gravel permeability after clear-cut logging: an indication of intragravel conditions for developing salmonid eggs and alevins. *Hydrobiologia*. 88:259-298.
- Morris, R.L. and W.W. Tanner. 1969. The ecology of the western spotted frog, *Rana pretiosa pretiosa* Baird and Girard, a life history study. *The Great Basin Naturalist* 29:45-81.
- Moor, J.W. 1990. *Inorganic Contaminants of Surface Water, Research and Monitoring Properties*. Springer-Verlag. 334 pp.
- Munger, J.C., B. Barnett and A. Ames. 1997. 1996 Sawtooth Wilderness Amphibian Survey. Report to the US Forest Service.
- Nakamura, F. and F.J. Swanson. 1993. Effects of Coarse Woody Debris on Morphology and Sediment Storage of a Mountain Stream System in Western Oregon. *Earth Surface processes and Landforms*. 18:43-61.
- Nehlsen, Willa PhD. 1995. *Historical Salmon and Steelhead Runs of the Upper Deschutes River and Their Environments*.
- Norris, L.A. 1967. Chemical brush control and herbicide residues in the forest environment. In *Proc., Herbic. And Veg. Manage. Symp.*, p. 103-123. *Oreg. State Univ., Corvallis*.
- Norris, L.A., M.L. Montgomery, L.E. Warren, L.E. and W.D. Mosher. 1978. 2, 4, 5-T persistence in a West Virginia watershed. In *abstracts, 1978 Meeting of Weed Sci. Soc. Am.*, p. 38-39. *Weed Sci. Soc. Am., Campaign, IL*.
- Norris, L.A. n.d. Brush control with herbicides on hill pasture sites in southern Oregon. *J. Range Manage.* 35(1):75-80.
- Oliver, William W. 1979. *Growth of Ponderosa Pine Thinned to Different Stocking Levels in Northern California*. PSW – 147. USDA Forest Service, PSW Forest and Range Experiment Station: Berkeley, CA.

- Olson, B.E. 1999. Grazing and weeds. Pages 85-96. R.L. Sheley and J.K. Petroff, eds. In: Biology and Management of Noxious Rangeland Weeds. Oregon St. Univ. Press, Corvallis.
- Omi, Philip N. and Erik J. Martinson. 2002. Effect of Fuels Treatment on Wildfire Severity. Submitted to the Joint Fire Science Program Governing Board.
- Oregon Department of Agriculture. 2001. Noxious Weed Policy and Classification System. Salem, OR.
- Oregon Department of Fish and Wildlife. 1991. Fish Population Reports - Completed by the Oregon Department of Wildlife. Prineville, OR.
- Oregon Department of Geology and Minerals Industry. 1982. Geothermal Resources of Oregon. 1:500,000.
- Oregon Natural Heritage Program . 2001. Rare, Threatened, and Endangered Plants and Animals of Oregon. Portland, OR
- Orr, Elizabeth L., William N. Orr and Ewart M. Baldwin. .1992. Geology of Oregon. Kendall Hunt Publishing Company, 254 pg.
- Owen, W. 2003. The Effects of Fire on Rare Plants. Unpublished report distributed by the USDA Forest Service, Washington, DC.
- Oregon Natural Heritage Information Center (ORNHIC, formerly ONHP). 2004. Rare, Threatened, and Endangered Species of Oregon. Portland, OR.
- Owens, D. 1998. Proposed Snag and Coarse Woody Material Levels Based On Viable Ecosystems Mangement Guide; Ochoco National Forest
- Pacific Fishery Management Council letter. 2000. Consultation with National Marine Fisheries Service on Federal Actions in Essential Fish Habitat.
- Page-Dumroese, D., R. T. Graham and A. E. Harvey. 1991. Soil Organic Matter Effects on Douglas Fir Growth in Northern Idaho Soils.
- Patla, D.A. and C.R. Peterson. 1997. Idaho native species accounts: Columbia Spotted Frog. Idaho Herp News 9:7-9.
- Paulson, D. J. 1977. Ochoco National Forest Soil Resource Inventory, Pacific Northwest Region. U. S. Forest Service, Ochoco National Forest.
- Peterson, D.L., M.C. Johnson, J.K. Agee, [and others]. 2005. Forest structure and fire hazard in dry forests of the western United States. General Technical Report PNW-GTR-628. USDA Forest Service, Pacific Northwest Research Station. Portland, OR.
- Phillips, R. 2004. Personal communication. Regional Economist. USDA Forest Service, Pacific Northwest Region. Portland, OR.
- Pilliod, D.S., C.R. Peterson and P.I. Ritson. 2002. Seasonal migration of Columbia spotted frogs (*Rana luteiventris*) among complementary resources in a high mountain basin. Canadian Journal of Zoology 80: 1849-1862.
- Pollet, J. and P.N. Omi. 2002. Effect of thinning and prescribed burning on crown fire severity in ponderosa pine forests. International Journal of Wildland Fire. 11:1-10.

- Powell, D.C. 1999. Suggested stocking levels for forest stands in northeastern Oregon and southeastern Washington: an implementation guide for the Umatilla National Forest. F14-SO-TP-03-99. USDA Forest Service, Pacific Northwest Region. Pendleton, OR. 25p.
- Rashin, E.B., C.J. Clishe, A.T. Loch, and J.M. Bell. 2006. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. *Journal of the American Water Resource Association*, October 2006, p. 1307-1327.
- Reaser, J.K., and D.S. Pilliod. 2005 in press. Species Account: Columbia Spotted Frog (*Rana luteiventris*). In Lannoo M., Status and Conservation of U.S. Amphibians, Volume II. University of California Press, Berkeley, Ca.
- Richards, B.N. 1987. Introduction to the Soil Ecosystem.
- Rittenhouse, Kaye, T. 1990 (revised 1994 by Wooley, B.). Conservation Strategy for *Calochortus longebarbatus* var. *longebarbatus*. Fremont National Forest.
- Robinson, Paul T. 1975. Reconnaissance Geologic Map of the John Day Formation in the Southwestern part of the Blue Mountains and Adjacent Areas, North-Central Oregon" USGS, Misc. Geologic Investigations Map I-872.
- Roché, C.T. and Roché, B.F. Jr. 1988. Distribution and amount of four knapweed (*Centaurea* L.) species in eastern Washington. *Northwest Science* 62:242-253.
- Rosgen. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.
- Roth, L.F. and J. Barrett. 1985. Response of dwarf mistletoe-infested ponderosa pine to thinning. Research Paper PNW-RP-331. USDA Forest Service, Pacific Northwest Research Station. Portland, OR.
- Rothacher, J. 1971. Regimens of streamflow and their modification by logging. Symposium on Forest Land Use and Stream Environment Processes. Oregon State University, Corvallis, Oregon. pp 40-54.
- Rothermel, R.C., R.A. Wilson, Jr., G.A. Morris and S.S. Sackett. 1986. Modeling moisture content of fine dead wildland fuels. Research Paper INT-359. USDA Forest Service, Intermountain Research Station. Ogden, UT.
- Sanborn, P, M. Kranabetter and Bulmer. 1999. Soil Rehabilitation in the Prince George Forest Region: A Review of Two Decades of Research; Forest Research Note, British Columbia Forest Service.
- Sartwell, Charles. 1971. Thinning ponderosa pine to prevent outbreaks of mountain pine beetles. In: Baumgartner, David M., editor. Precommercial thinning of Coastal and Intermountain Forests in the USDA Forest Service. 1991.
- Schmidt, K.M., J.P. Menakis, C.C. Hardy, [and others]. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. General Technical Report RMRS-GTR-87. USDA Forest Service, Rocky Mountain Research Station. Fort Collins, CO. 41 p. + CD.
- Schmidt, Thomas. 1996. Water Conservation Plan for Ochoco National Forest and Crooked River National Grasslands. U.S. Forest Service, Ochoco National Forest, 8 p.
- Scholz, B. 2007. Personal communication. Fuels Specialist, Ochoco National Forest.

- Schultz, B. W., P. T. Tueller and R. J. Tausch. 1990. Ecology of curlleaf mahogany in western and central Nevada: community and population structure. *J. of Range Management*. Vol. 43, No. 1, pages 13-20
- Shank, D. 2004. Fire Related Soil Impacts: Monitoring of the Eyerley, B & B, Booth West, Cabot Creek and Brush Creek Reburns; Deschutes National Forest.
- Sheley, R.L. 2004. Discussion on patterns of noxious weed spread. Medusahead Conference. Burns, OR
- Sheley, R.L., J.S, Jacobs and M.F. Carpinelli. 1998. Distribution, biology, and management of diffuse knapweed (*Centaurea diffusa*) and spotted knapweed (*Centaurea maculosa*). *Weed Technol.* 12:353-362.
- Sheley, R.L., S. Kedzie-Webb and B.D. Maxwell. 1999. Integrated weed management on rangeland. Pages 57-68 in R. L. Sheley and J. K. Petroff, eds. *Biology and Management of Noxious Rangeland Weeds*. Oregon St. Univ. Press, Corvallis.
- Sheley, R.L. and L.L. Larson. 1994. Observation: Comparative live-history of cheatgrass and yellow starthistle. *Journal of Range Management* 47:450-456.
- Sheley, R.L., M. Manoukian and G. Marks. 1999. Preventing noxious weed invasion. Pages 69-72 , 87 in R. L. Sheley and J. K. Petroff, eds. *Biology and Management of Noxious Rangeland Weeds*. Oregon St. Univ. Press, Corvallis.
- Sheley, R.L, B.E. Olson and L.L. Larson. 1997. Effect of weed seed rate and grass defoliation level on diffuse knapweed. *Journal of Range Management*. 45:9-12.
- Sheley, R.L., J. Petroff and M. Borman. 1999. Introduction, p. 1. In: R. L. Sheley and J. K. Petroff, eds. *Biology and Management of Noxious Rangeland Weeds*. Oregon St. Univ. Press, Corvallis.
- Simpson, M. 2004. Personal communication on *Calochortus longebarbatus* Wats. var. *peckii* Ownbey
- Simpson, M., D. Zalunardo, A. Eglitis, [and others]. 1994. (draft) Viable ecosystem management guide. USDA Forest Service, Ochoco National Forest. Prineville, OR.
- Solomon, Madeline. 2002. Fire and Glass: Effects of Prescribed Burning on Obsidian Hydration Bands, edited by J. M. Loyd, T.M. Origer and D.A. Fredrickson. USDI BLM, Cultural Resource Publication, Anthropology – Fire History.
- Swanson, D. A.. 1969. Reconnaissance Geologic Map of the East Half of the Bend Quadrangle, Crook, Wheeler, Jefferson, Wasco and Deschutes Counties, Oregon. USGS, Misc. Geologic Investigations Map I-568.
- Swanson, F.J., J.A. Jones, D.O. Wallin and J.H. Cissel. 1994. Natural variability--Implications for ecosystem management. In: Volume II: Ecosystem management: Principles and applications. General Technical Report PNW-GTR-318. USDA Forest Service, Pacific Northwest Research Station. Portland, OR.
- Swinney, C. M., A. C. Waters and C. P. Miller. 1968. Reconnaissance Geologic Map of the Lookout Mountain Quadrangle, Crook and Wheeler Counties, Oregon. USGS, Misc. Geologic Investigations Map I-543.

- Taylor, George. 1997. OSU Extension talk, Prineville, Oregon, January 16, 1997.
- Tiedeman, A.R., J.D. Helvey and T.D. Anderson. 1978. Stream chemistry and watershed economy following wildfire and fertilization. *Journal Environ. Qual.*, Vol. 7, no. 4. p. 580-589.
- Tout, D. 1989. Mineral Potential Report for the Ochoco National Forest. U.S. Forest Service, unpublished, 13 pg.
- Toms, C. W., J. H. Wilhoit and R. B. Rummer. 1996. Animal Logging in the Southern United States, presented to the ASAE, annual meeting Phoenix, AZ.
- Troendal, C.A. and C.F. Leaf. 1980. Hydrology, Chapter III. An approach to water resources evaluation on non-point silvicultural sources. EPA 60018-80-012. Environmental Research Lab. Atlanta, Georgia. 173 p.
- US Congress. 1974. Federal Noxious Weed Act of 1974. 7 USC 2801.
- USDA Forest Service. 1981. "Guide for Predicting Sediment Yields from Forested Watersheds." USDA Forest Service, Region 1 and Region 4.
- USDA Forest Service. 1988. General water quality best management practices. Pacific Northwest Region, Forest Service. 85 p.
- USDA Forest Service. 1985. Management Guidelines for Soils Derived from Volcanic Ash in the Blue Mountains of Oregon and Washington, Draft of July, 1985, Region 6 Soils Personnel
- USDA Forest Service. 1988. Managing Competing and Unwanted Vegetation Final Environmental Impact Statement. Pacific Northwest Region, Portland, Oregon.
- USDA Forest Service. 1989. Final Environmental Impact Statement: Land and Resource Management Plan, National Forest and Crooked River National Grassland. U.S.D.A. Forest Service, Pacific Northwest Region (August 1989).
- USDA Forest Service. 1989. Land and Resource Management Plan. Part 1. Ochoco National Forest. Reprinted 1991. Prineville, OR.
- USDA Forest Service. 1989. Managing Competing and Unwanted Vegetation Final Environmental Impact Statement. Pacific Northwest Region. Portland, OR.
- USDA Forest Service. 1990-2003. Region 6 Threatened, Endangered, and Sensitive Plant Sighting Forms. Unpublished records on file at Lookout Mt. Ranger District Office, Ochoco National Forest, Prineville, OR.
- USDA Forest Service. 1991, 1999, 2004a. Regional Forester's (R-6) Sensitive Species List.
- USDA Forest Service. 1992. Forest Service Manual 2670 - Threatened, Endangered, and Sensitive plants and animals.
- USDA Forest Service. 1992. WATSED, Water yield and sediment model. Range, air, watershed, and ecology staff unit, Region 1, USDA Forest Service & Montana cumulative watershed effects cooperative.
- USDA Forest Service. 1995. Decision Notice for the Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales. Region 6: Colville, Deschutes, Fremont, Malheur, Ochoco, Okanogan,

- Umatilla, Wallowa-Whitman and Winema National Forests in Oregon and Washington. June 5, 1995. Portland, OR.
- USDA Forest Service. 1995. Decision Notice and Finding of No Significant Impact. Inland Native Fish Strategy Environmental Assessment. Intermountain, Northern, and Pacific Northwest Regions. July 28, 1995. Coeur d'Alene, ID.
- USDA Forest Service. 1995. Decision Notice and Finding of No Significant Impact, Ochoco National Forest and Crooked River National Grassland Plan Amendment No. 16. Environmental Assessment for the Integrated Noxious Weed Management Program. July 20, 1995. Prineville, OR.
- USDA Forest Service. 1995. Forest Service Manual 2670-- Threatened, Endangered, and Sensitive plants and animals.
- USDA Forest Service. 1995. Forest Service Manual Washington, D.C. Series 2000-National Forest Resource Management (Noxious weeds). Amendment No. 2000-95-5. Effective Nov. 29, 1995. Page 9. 2081.2.
- USDA Forest Service. 1995. Implementation of the Inland Native Fish Strategy letter. Northern Region, Intermountain Region and Pacific Northwest Region.
- USDA Forest Service. 1996. Water Conservation Plan for the Ochoco National Forest, May 1, 1996. Prineville, OR.
- USDA Forest Service. 1998. Environmental Assessment and Decision Notice for Integrated Noxious Weed Management Program. Ochoco National Forest and Crooked River National Grassland, Ochoco National Forest, Prineville, Oregon.
- USDA Forest Service. 1999. Smith, G. Noxious Weed Strategy. Pacific Northwest Region. August 1999. (<http://www.fs.fed.us/r6/weeds/r6memo.htm>)
- USDA Forest Service. 2000. Marks Cr. Watershed Assessment. Ochoco National Forest, Prineville, OR
- USDA Forest Service. 2002. Fire Effects Information System, Species: *Cynoglossum officinale*. (http://www.fs.fed.us/database/feis/plants/forb/cynoff/fire_effects.html)
- USDA Forest Service. 2002. Standards, Guidelines, and Amendments For Botanical Resources. Oct. 4, 2002. Forest Plan Standards and Guidelines.
- USDA Forest Service. 2003. Guide to Noxious Weed Prevention Practices (http://www.fs.fed.us/r1/b-d/deis/postfirevegfuels/appf_weedbmp.htm)
- USDA Forest Service. 2004. Forest Service 2004 Programmatic Agreement Among the United States Department of Agriculture (Region 6), The Advisory Council of Historic Preservation, and the Oregon State Historic Preservation Officer Regarding Cultural Resource Management in the State of Oregon, Linda Goodman, James Hamrick and John M. Fowler, Portland, Oregon.
- USDA Forest Service. 2004. National Strategy and Implementation Plan for Invasive Species Management. FS-805. October 2004. Washington, DC.

- USDA Forest Service. 2005. Final Environmental Impact Statement (DEIS) and Record of Decision for The Pacific Northwest Invasive Plant Program, Preventing and Managing Noxious Weeds. Pacific NW Regional Office. Portland, OR.
- USDA Northwest Regional Office letter. 2001. Consultation with National Marine Fisheries Service on Federal Actions in Essential Fish Habitat.
- USDA/USDI Joint Aquatic and Terrestrial Programmatic Biological Assessment For Federal Lands within the Deschutes and John Day River Basin's Administered by the Deschutes and Ochoco National Forests. August 2006-August 2009.
- USDA/USDI Forest Service/Bureau of Land Management. 1997. Eastside Draft Environmental Impact Statement, Interior Columbia Basin Ecosystem Management Project. Vol. 1, Ch 2, p. 104-109, 130-131.
- USDA/USDI Forest Service/Bureau of Land Management. 2000. Interior Columbia Basin Supplemental Draft Environmental Impact Statement. Vol. 1, Ch. 2, pp.39, 243, 245, 246.
- U.S Department of Commerce, Bureau of Census. 2001. Decennial Census of Population and Housing.
- U.S Department of Commerce, Bureau of Economic Analysis. 2001. Labor Trends October 2007.
- US Department of Commerce, National Oceanic and Atmospheric Administration 50 CFR Part 600.
- USDI Bureau of Land Management. 2003. Personal communication on *Carex hystericina*, *Calochortus longebarbatus* var. *peckii*, and other sensitive species.
- USDI Fish and Wildlife Service. 2005. Endangered and Threatened Plants Species List. 50 CFR 17.12.
- US President. 1999. Whitehouse. Clinton, W.J. February 3, 1999. Executive Order 13112 of February 3, 1999 – Invasive Species laws & regulations. (<http://invasivespecies.gov/laws/main.shtml>)
- Van Wyk, D.B. 1982. Influence of prescribed burning on nutrient budgets on mountain fynbos catchments in S. W. Cape Rep. of South Africa. Gen. Tech. Rep. PSW-58. Berkeley, CA: Southwest Forest and Range Experiment Station, Forest Service, USDA..
- Veverka, C. 2003. Summary of survey results for *Botrychium* Spp. In E. Maury area. Ochoco NF, Prineville, OR
- Vrilakas, S. 1990. Draft Species Management Guide for *Oryzopsis hendersonii*. Unpublished report submitted to the Wallowa-Whitman National Forest.
- Wallander, R.T., B.E. Olson and J.R. Lacey. 1995. Spotted knapweed seed viability after passing through sheep and mule deer. *Journal of Range Management*. 48:145-149
- Walker, G. W. 1990. Geology of the Blue Mountains Region of Oregon, Idaho and Washington: Cenozoic Geology of the Blue Mountains Region. USGS, Professional Paper 1437, 135 pg.
- Walker, G. W. and N. S. MacLeod. 1991. Geologic Map of Oregon, Department of Oregon Geology and Minerals Industry, 1:500,000.

- Walker, G. W., N. V. Peterson and R. C. Greene. 1967. Reconnaissance Geologic Map of the East Half of the Crescent Quadrangle, Lake, Deschutes and Crook Counties, Oregon. USGS, Misc. Geologic Investigations Map I-493.
- Water Resources. 1970. Appendix V, Columbia-North Pacific Region Comprehensive Framework Study, Volume 2 (Subregions 7-12), April 1970, prepared by Columbia-North Pacific Technical Staff, Pacific Northwest River Basins Commission, Vancouver, Washington.
- Waters, A. C. and R. H. Vaughn. 1968. Reconnaissance Geologic Map of the Ochoco Reservoir Quadrangle, Crook County, Oregon. USGS, Misc. Geologic Investigations Map I-541.
- Wood, J. 2003. Personal communication on *Carex backii*.
- Yates, G. 2001. Personal communication on *Carex interior*.
- Yohannan, J. 2006. Personal communications with Jason Yohannan, Regional Economist, April 2006.
- Zancanella, J. 2000. Logan Butte fossil significance, by correspondence/conversation, Prineville BLM District.
- Ziemer, R.R. 1981. Roots and the strength of forested slopes. Erosion and sediment transport in Pacific Rim steepplands. I.A.H.S. publ. no. 132, p. 343-361.
- Zika, P.F. 1992. Draft management guide for rare *Botrychium* species (moonworts and grape ferns) for the Mount Hood National Forest. Prepared by the Oregon Natural Heritage Program.
- Zimmerman, J., W. Johnson, M. Eiswerth. 2002. Univ. of Nevada. Medusahead: Economic Impact and Control in Nevada. Cooperative Extension Fact Sheet FS-02-37. Reno, NV

Index

Best Management Practices	x, 23, 95, 124, 204, 213
Clean Water Act.....	204
Columbia spotted frog.....	28, 119, 127, 135, 136, 137, 138, 221, 227
Connective Corridors	12, 20, 23, 30, 33, 52, 53, 54, 55, 137, 206, 207, 210
Design Elements	11, 23, 93, 96, 98, 99, 101, 107, 110, 113, 114, 124, 151, 180, 215
Eastside Screens.....	8, 9, 12, 13, 20, 22, 23, 43, 46, 52, 153, 157, 158, 171, 205, 206, 210
Fire Regimes	3, i, iii, 5, 6, 12, 39, 67, 68, 70, 97
Fisheries	24, 27, 29, 131, 132, 217, 221, 223
Fisheries, redband trout.....	118, 127
Forest Plan Amendments	vi, 9, 20, 22
Inland Native fish Strategy (INFISH).....	8, 9, 28, 90, 95, 96, 115, 116, 117, 118, 119, 120, 125, 126, 129, 130, 131, 132, 134, 135, 136, 210, 211, 214
Late and Old Structure (LOS).i, ii, iii, iv, v, 2, 3, 4, 9, 10, 13, 15, 16, 20, 22, 33, 40, 43, 46, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 59, 62, 65, 71, 131, 153, 155, 156, 157, 158, 165, 167, 168, 182, 202, 205, 206, 207, 210	
Livestock grazing.....	74, 77, 114, 125, 126, 130, 151
Management Area	i, 2, 6, 8, 38, 165, 174, 184, 186
Management Indicator Species	127, 153, 168
Monitoring	vi, 9, 10, 23, 26, 31, 92, 96, 99, 101, 110, 114, 118, 123, 144, 150, 151, 204, 210, 223
Noxious Weeds	vi, 25, 26, 31, 35, 112, 142, 144, 145, 146, 147, 148, 149, 150, 151, 152, 201
Old Growth Management Area.....	8, 52, 53, 73, 165, 167, 208, 210, 212
Public Involvement	10
Purpose and Need	1, 2, 12, 13, 14, 40, 131
Recreation	8, 30, 38, 197, 208, 209
Relative Erosion Rate	96, 97, 102
Riparian Habitat Conservation Areas (RHCAs) ...	iv, 8, 9, 12, 17, 25, 26, 27, 28, 29, 34, 57, 60, 61, 63, 65, 66, 92, 93, 94, 97, 98, 99, 101, 103, 108, 111, 115, 116, 118, 119, 120, 121, 122, 123, 124, 125, 126, 129, 130, 131, 132, 133, 134, 135, 137, 142, 143, 193, 194, 210, 211, 213, 214, 215, 223
Sensitive Species.....	138, 144
Soils	28, 39, 97, 98, 100, 104, 108, 109, 114, 124, 150, 200, 222, 224, 227, 230
Water Quality.....	x, 23, 28, 39, 63, 82, 91, 92, 94, 115, 118, 124, 125, 132, 135, 136, 204, 220, 226
Wildlife	
bufflehead.....	184, 185, 187
California wolverine.....	12, 37, 184
elk	30, 37, 173, 174, 175, 176
focal species.....	179
goshawk.....	9, 12, 30, 36, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 180, 202, 210
gray flycatcher	181, 182, 184
osprey	29
peregrine falcon.....	37, 184
pileated woodpecker.....	36, 164, 165, 168
Primary Cavity Excavators.....	168, 169, 170, 171, 172, 179
pronghorn	173
red-tailed hawk	163
snag habitat.....	171
upland sandpiper.....	179
western sage grouse.....	184

APPENDIX A - DESCRIPTION OF PROPOSED ACTIVITIES

Harvest Activities

Harvest treatments would remove trees that are large enough to have commercial value and would be sold to a timber purchaser. Commercial-size trees are generally 9 inches diameter and larger. Trees larger than 21 inches diameter would not be cut, either live or dead unless the tree is a safety hazard to operations or needs to be removed for road construction activities. Three types of commercial thinning are proposed with this project: sanitation harvest, individual tree selection and commercial thinning.

Sanitation Harvest – This prescription may be prescribed for stands where severe insect and or disease problems are preventing stand growth and development. Due to damage or the presence of disease the remaining trees are not capable of vigorous growth and the development of large structure is impaired. These conditions most often occur locally in stands that have severe dwarf mistletoe infection. These stands contain few trees larger than 21 inches diameter but do have multiple canopy layers that provide a continuous infection source to the understory. Damaged or diseased trees less than 21 inches diameter would be cut and if merchantable would be sold and removed from the stand. Trees larger than 21 inches diameter infected with dwarf mistletoe would be girdled and left on site. The prescription also includes precommercial thinning of overstocked non-merchantable trees. The residual stocking³ following treatment will be between the minimum and recommended stocking levels. Residual basal area is between 25 and 40 square feet.

Uneven-aged Management, Individual Tree Selection -- This prescription would be used in overstocked stands with an existing component of large trees (greater than 21 inches diameter). Current stand conditions also include multiple canopies and dense stocking and may include all seral stages. This is the only harvest prescription that would be applied to stands containing late and old structure. The stand is thinned from below to recommended stocking levels. Merchantable trees would be sold and removed from the stand. Precommercial thinning is included when stands contain large amounts of non-merchantable trees. Treatment creates immediate structure and species composition changes to larger structures and generally earlier seral conditions because some treated stands will no longer be dominated by a dense understory and trees cut will tend to be mid and late seral species such as grand fir and Douglas-fir. Species diversity remains but the proportion of early seral species (ponderosa pine) increases. The stand remains uneven-aged (contains two or more age classes) and exhibits multiple canopies. Existing large trees will benefit from reduced competition and the increased growth rate in younger, smaller trees will eventually augment the number of large trees to help increase the amount of late and old structure. Residual basal area is usually greater than 50 square feet and will exceed 100 square feet

³ Recommended stocking levels vary depending on site quality, tree size, and species. For example, the desired density range for an uneven-aged ponderosa pine stand on a grand fir-pinegrass site is 89 to 133 trees per acre when the average tree diameter is 10 inches diameter. The basal area would be between 49 and 73 square feet per acre. If the average diameter were larger, then fewer trees would be retained but the residual basal area would increase. Fewer trees would be retained on drier sites relative to moister sites. Recommended stocking levels are derived from “Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington: An Implementation Guide for the Umatilla National Forest” (Powell 1999).

if numerous trees larger than 21 inches diameter are present. Canopy cover generally remains higher than 48 percent.

Commercial Thinning – Although commercial thinning is often specified as an intermediate treatment in even-aged silvicultural systems in this analysis commercial thinning has been identified for stands lacking a significant component of large trees. These stands appear even-aged with a single dominant canopy although the diameter range often includes a large number of sapling and pole-size trees. Thinning is usually from below unless a change in species composition is desired due to dwarf mistletoe problems. Merchantable trees would be sold and removed from the stand. The prescription also includes precommercial thinning where stand conditions include overstocking of non-merchantable trees. The resulting stand is at recommended stocking. A small structural change may be immediately apparent and often results in earlier seral species compositions. Residual basal area is between 40 and 70 square feet and canopy cover ranges from 40 to 50 percent.

Aspen Treatments – Where aspen occurs within or adjacent to proposed treatment units, treatment prescriptions would be adjusted to provide additional benefits to maintain aspen within riparian habitat conservation areas and upland areas. The project area contains numerous small aspen stands usually associated with riparian areas but sometimes also located in upland areas. Aspen develop as clones where individual trees are short-lived and replaced by sprouts from the root system. Aspen is sensitive to conifer encroachment and high stand density, over-browsing by livestock and wildlife, and lowered water tables. Thinning of conifers would occur in aspen stands that are located within treatment units. In general, conifers younger than the mature aspen (100 years) would be cut within 100 feet of any aspen including sprouts. The conifers thinned which are merchantable would be harvested using either horse, winch-lining or by a skyline system. Upland thinning treatments would benefit aspen by increasing moisture and light availability. The clones would respond by producing more sprouts and expanding in area which would strengthen overall clone health. After harvest, non-commercial thinning and fuel treatments aspen would be planted in selected areas to augment existing low aspen counts or to restore aspen to sites where the aspen has died. Planted aspen and existing sprouts would be protected as needed from excessive browsing and grazing. Protection may include leaving higher levels of slash around sprouts, caging or enclosure fencing.

Logging Systems

This proposal includes skyline, tractor, and horse logging systems. Tractor systems include the use of ground-based equipment such as tractors, rubber-tired skidders, and feller/bunchers to move the logs to a landing where they can be loaded onto a truck. Tractor systems are usually prescribed in areas with slopes that are less than 35 percent. On steeper slopes, such as those more than 35 percent, skyline systems are prescribed. Skyline systems include the use of a cable system to suspend the logs into the air to move them to a landing.

Skyline – Skyline systems are proposed in units which have greater than 35 percent slope. One-end suspension of logs is required. Skyline systems may be indicated for some areas with slopes less than 35 percent in order to reduce road use next to streams. Full suspension would be used over riparian areas. Cable corridors, approximately 15 feet wide, may need to be cut through an occasional stream crossing. When full suspension cannot be gained over riparian areas, logs would be pulled away from the stream to the landing. Trees felled for corridors would generally be

included in the harvest unless needed meet stream wood guidelines. Stumps, standing trees, or tractors may be used for anchors (and may be located within the RHCA but tractors would not be allowed within RHCAs unless on existing roads or closed roads). Maximum distance between skyline corridors is 150 feet. Skyline corridor placement depends on topography and may be parallel or fan out from one landing. Parallel corridors generally produce less damage to the residual trees. Landings average 0.25-acre in size.

Tractor – Tractor yarding refers to ground-based equipment and includes tractors, rubber tired skidders, and feller/bunching systems. Machinery use is restricted to slopes less than 35 percent and average slope is less than 20 percent. In small portions of tractor units where slopes are greater than 35 percent, winch-lining of logs would be required in the timber sale contract. Winch-lining is limited to distances of less than 100 feet. Directional felling places logs closer to the skidder for yarding. Optimum skidding distances are 300 to 600 feet. Longer skidding distances up to 1,500 feet are possible but rare. When skidding distances exceed 600 feet, temporary road location may reduce site disturbance. Uphill tractor skidding is limited, usually to slopes less than 15 percent. Skid trails are laid out in parallel or branching patterns. Major skid trails are planned at 150 feet apart to keep area of disturbance at less than 10 percent. Existing skid trails are reused where practicable.

Winch-lining logs would be required in sensitive areas to reduce ground disturbance. In these areas the machinery remains outside of the sensitive area while logs are winched by cable. Winching distances are limited to 100 feet or less and may be designated for small areas exceeding 35 percent slope or to remove trees from RHCAs.

Mechanized harvest includes the use of a feller/buncher machine with a cutting head attached to a boom capable of reaching 25 to 30 feet. Skid trails average 50 to 75 feet apart. Cut trees are bunched together in preparation for removal to the landing by a rubber-tired skidder or tractor. Fewer landings are needed in feller/buncher systems but the landings tend to be larger (0.5 acre) than other ground-based systems (0.25 acre) due to larger amounts of landing slash and additional machinery needed. Feller/buncher systems usually yard the whole tree to the landing where the limbs and top are removed by a delimeter machine. The landing slash generated may be sold for biomass utilization. Whole tree yarding reduces the need for additional grapple piling following harvest.

Horse Logging – Horse logging may be selected in some units to meet specific needs. Needs may include less disturbance and tracking to protect certain resources. Skidding distances are usually shorter than in tractor systems. Maximum slope is less than 25 percent.

Noncommercial Vegetative Treatments

Precommercial Thinning – Precommercial thinning or noncommercial thinning reduces stocking in the non-merchantable stand component (generally up to 9 inches diameter). This is often prescribed in addition to commercial harvest to reduce overall stocking to recommended levels. Generally, structure or seral stage does not change from the existing situation but growth and development are promoted. Normally, spacing between trees varies between 18 feet to 30 feet depending on the density of overstory residual trees. Spacing would also vary depending on other resource objectives such as in riparian habitat conservation areas where more trees would be left because of the desire to maintain shading on streams or less trees would be left to promote the development of broadleaf shrub and tree cover such as aspen.

Juniper Thinning – Juniper thinning reduces the amounts of young junipers that have increased in number due to fire suppression. This prescription has been prescribed for dry ponderosa pine, western juniper woodland and steppe sites to reduce the amount of post-1900 juniper stocking. All younger trees would be cut or girdled and all old-growth junipers would be retained. This usually results in a return to the grass and shrub stage or maintains the large structural component but in more open stages. Juniper cutting increases the growth and development of grass and shrub cover.

Fuels Reduction Treatments

Prescribed fire is the application of fire in pre-determined patterns under pre-determined conditions in order to produce a desired flame length and rate of spread. The combination of environmental conditions used to determine when to burn is called a “fire prescription.” The most common ignition technique involves igniting strips of fire across a unit, starting at the uphill end, or on the leeward side of a unit on flat ground. Flame length and rate of spread is controlled by adjusting the distance between the strips and how fast they are lit. Based on past experience, 40 to 80 percent of the surface area of prescribed fire units is burned; mineral soil exposure usually occurs on less than 5 percent of a unit, usually where downed logs are consumed. The objectives of prescribed fire are:

- To lessen the intensity, resistance to control and cost of future wildfires by reducing natural fuels (naturally occurring forest debris), activity fuels (debris from forest thinning operations) and ladder fuels (seedlings and saplings);
- To maintain forest health by using fire to meet the objectives of the silviculture prescription (reducing seedlings and saplings, controlling species composition); and
- To improve wildlife habitat by increasing the quantity and vigor of native grasses, forbs and shrubs.

Prescribed fire would be used to reduce surface fuels and reduce the potential intensity, suppression cost, and resistance to control of future wildfires. Prescribed fire reduces seedling and sapling densities, ladder fuels, regenerates grasses, forbs, and shrubs and reduces the encroachment of western juniper into ponderosa pine stands.

Prescribed burning in RHCA's would be done to encourage deciduous hardwoods such as aspen, decrease conifer competition, and to reduce fuel loadings. Burning would take place in both the spring and fall as long as burning prescription parameters could be met. Generally, south and west slopes would be burned in the spring. North and east slopes normally do not dry out enough to conduct burning in the spring so generally burning would occur in the fall.

Surface fuels consist of natural fuels (pine needles, sticks, downed trees, grass) and activity fuels (slash), which are a product of harvest and noncommercial thinning. The amount of surface fuel on a site is referred to as a fuel load, and is measured in tons per acre. The greater the fuel load, the more intensely a fire can burn. Fine fuels (less than 3 inches in diameter) are the primary influence on rate-of-spread (how fast a fire moves) and flame lengths (measured in feet from the ground to the tip of the flame). The Forest Plan guideline is to manage for an average fuel load of less than 5 tons per acre for fuels less than 3 inches in diameter. Heavy fuels (greater than 3 inches in diameter) are the primary influence on fire duration and crown scorch; the guideline for large fuels is to manage for the less than 10 tons per acre.

Ladder fuels are trees in the forest understory which provide a ladder for fire to move from the forest floor to the overstory (crown). As ladder fuels increase, the risk of crown fire increases. Ladder fuels are reduced by thinning trees and then underburning to treat the slash, or by underburning alone (thinning with fire). Underburning also prunes the lower branches of larger trees, increasing the canopy base height, which reduces the risk of crown fire. Underburning is usually not prescribed for reducing trees more than 3 inches in diameter.

Fireline construction would be minimized by using roads, major streams, rocky areas, or other existing fuel breaks. Fireline construction consists of clearing a 5 to 10 foot wide path of seedlings, saplings, brush, and downed woody debris, and removing ground fuels (litter and duff layer) down to mineral soil for a width of 1 to 3 feet. Water bars (a small trench to direct the flow of water off the line) would be dug into the fireline to disperse run-off. Where it is necessary to limit fire spread near streams or cultural resource sites, surface fuels would be cleared without disturbing the soil. The types of prescribed fire activities with this project include: underburning natural fuels, thinning with fire, underburning activity fuels, and pile burning.

Grapple and Hand Piling – Piling slash and burning the piles is proposed where fuel loadings are expected to be too high to underburn without causing undesired effects. Piling can occur immediately after thinning, before the fuels dry out, reducing the duration of the short-term hazard that exists after thinning. Piles would be centered in the spaces between trees in order to prevent damage to the trees when the piles are burned. Large down wood and/or rotten wood would not be piled. Piling usually removes 60 to 70 percent of the fuel in any given area, leaving the rest to maintain effective ground cover and to provide nutrients for cycling. Piles would be burned in the late fall or early winter of the second or third season after they are piled generally with snow cover. Piles would burn for varying amounts of time, depending on the size of the piles and how dry the piles are. Hand piles and grapple piles would finish burning within a few hours; landing piles would finish burning within a few days.

Generally, mechanized harvest systems that yard the whole tree reduce or eliminate the need for piling after harvest. Piling may still be necessary in units where a large amount of precommercial thinning slash is generated.

Grapple piling is using a machine such as an excavator, with a grapple on an articulating arm, to pile forest fuels. Grapple piling machinery would operate on existing skid trails. Piles are normally 5 to 10 feet high and 10-15 feet in diameter.

The handpiles are normally 4 to 6 feet high and 5 to 10 feet in diameter.

Road Actions

Road Construction – Roads will be constructed to a minimum standard which will accommodate a single user (i.e. logging and administrative traffic). New road locations will take advantage of existing openings and disturbed soils such as old skid trail locations. This will reduce clearing and new ground disturbance. Roads will be single lane with turnouts. The width of new roads will be 12 to 14 feet.

Road Reconstruction – Reconstruction work is that necessary to bring a road back to its original standard, repair work necessary to support log haul, or maintenance work (surface blading, clearing, etc). Relocating segments of existing road also fall under reconstruction. Reconstruction includes: (1) clearing and grubbing on grown in roads or heavy roadside brushing and limbing to

provide a minimum 12-foot wide clearing for the movement of equipment and log trucks; (2) heavy grading or minor excavation to re-establish the roadbed surface facilitating surface drainage, fill in gullies and deep ruts, and repairing larger slumps, slides, scarps, etc.; and (3) placing rock to strengthen the subgrade in soft spots; to armor the road surface and/or fill slope at stream crossings, drain dips, drainage outlets.

Road Closure – Closed roads are in Maintenance Level 1. Level 1 is assigned to intermittent service roads when they are closed to vehicle traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur. Traffic management strategies are "prohibit" and "eliminate." The distinction between closing and decommissioning is that the closed road is intended to be re-opened and used at some time in the future while the intent of a decommissioned road is no future use. The following items are examples of activities and considerations for closing and decommissioning roads: (1) Blocking and/or obscuring the entrance by constructing a berm, or barricade; (2) recontouring the road prism to natural slope within sight distance; (3) installing waterbars every 100 feet within sight distance; (4) dragging or placing brush, logs, and rocks onto roadbed; (5) seeding areas of disturbed soils; (6) cutting a side ditch on intersecting road across the junction of the road; and/or (7) storm proofing or removing culverts.

Road Decommission – Activities that result in the stabilization and restoration of unneeded roads to a more natural state. This includes re-establishing vegetation and, as necessary, restoration of ecological processes interrupted or adversely impacted by the unneeded roads. Decommissioning may include the following activities in addition to those mentioned above: (1) reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation; (2) removing culverts, reestablishing drainage-ways, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed; (3) ripping and/or subsoiling the road surface; and/or (4) eliminating the roadbed by restoring natural contours and slopes.

APPENDIX B - PROPOSED TREATMENT BY UNIT

The following table identifies the specific activities that are prescribed in each unit, by alternative. The activities are displayed in sequential order. For example, in Unit 5 harvest would occur using a ground-based (tractor) logging system. Harvest would be followed by precommercial thinning and then underburning would occur. There are two parts to unit 5: 58 acres in the uplands and 3 acres in a Class IV RHCA.

The table also identifies specific elements for that unit that match design elements in Chapter 2 that need to be adhered to during implementation.

Appendix B – Proposed Treatment By Unit

Table B-1 Specific Activities by Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Non-commercial Treatments	Fuel Treatments	Harvest Method	Non-commercial Treatments	Fuel Treatments	Big Game	Gos-hawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
2	96	Tractor	0	HSL	PCT	RxFire		PCT	RxFire	WR	GH					
2	14		2		PCT	RxFire		PCT	RxFire	WR	GH					
3	20	Skyline	0	HSL	PCT	RxFire		PCT	RxFire	WR		Hawk				
4	142	Tractor	0	HSL	PCT	GP		PCT	GP	WR	GH	Hawk			Site	
4	16		2		PCT			PCT		WR	GH	Hawk			Site	
4	2	T-winch	4	HSL	PCT			PCT		WR	GH	Hawk			Site	
5	58	Tractor	0	HSL	PCT	RxFire		JUT	RxFire	WR						
5	3	T-winch	4	HSL	PCT	RxFire		PCT	RxFire	WR						
6	39		0		JUT			JUT		WR, EC						
7	18		0		JUT	RxFire		JUT	RxFire	WR, EC	GH					
7	53		0		JUT	RxFire		PCT	RxFire	WR, EC	GH					
7	38		2		JUT	RxFire		JUT	RxFire	WR, EC	GH					
8	12		0		PCT	RxFire		PCT	RxFire	WR						
8	3		2		PCT	RxFire		PCT	RxFire	WR						
9	147		0		JUT			JUT		WR						
9	4		2		JUT			JUT		WR						
9	2		4		JUT			JUT		WR						
10	67		2		PCT	RxFire		PCT	RxFire	WR	GH					
10	3		0		PCT	RxFire		PCT	RxFire	WR	GH					
10	4		0		PCT	RxFire		PCT	RxFire	WR	GH					
11	91		0		JUT	GP*		JUT		WR	GH					
11	4		4		JUT			JUT		WR	GH					
12	16		0		PCT	RxFire		PCT	RxFire	WR						
13	53	Skyline	0	HSL	PCT	RxFire		PCT	RxFire	WR	GH		Scabland			
13	1		4		PCT	RxFire		PCT	RxFire	WR	GH		Scabland			

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
15	80	Tractor	0	HSL	PCT	RxFire		PCT	RxFire	WR		Eagle			Site	
15	2		4		PCT	RxFire		PCT	RxFire	WR		Eagle			Site	
16	84	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	WR	GH					
16	15		2		PCT			PCT		WR	GH					
17	46	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	WR						
18	30	Tractor	0	HSL	PCT	RxFire		PCT	RxFire	WR	GH					
19	10		2		JUT			JUT		WR	GH					
19	4		4		JUT			JUT		WR	GH					
21	25	Tractor	0	HSL	PCT	RxFire		PCT	RxFire				Scabland			
21	2		4		PCT	RxFire		PCT	RxFire				Scabland			
23	11		0		PCT	RxFire		PCT	RxFire							
25	20		0		PCT			PCT			GH					
26	37	Tractor	0	HSL	PCT	GP	HSL	PCT	GP		GH				Site	
28	12	Tractor	0	HTH	PCT	HP	HTH	PCT	HP	EC	GH				Site	Elk CG
28	3		2		PCT	HP		PCT	HP	EC	GH				Site	Elk CG
29	35	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	WR, EC	GH		Lily, Scabland			
29	17	T-winch	2		PCT		HSL	PCT		WR, EC	GH		Lily, Scabland			
30	69		0		JUT	RxFire		JUT	RxFire		GH					
30	1		2		JUT	RxFire		JUT	RxFire		GH					
32.1	32	Tractor	0	HSL	PCT	GP	HSL	PCT	GP		GH			Weed		
32.2	14	Tractor	0	HSL	PCT	GP		PCT	GP		GH			Weed	Site	
33	15	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC		Eagle				DC
33	12	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC		Eagle				DC
33	4		4		PCT			PCT		EC		Eagle				DC
35	5	Tractor	0	HSL	PCT	GP	HSL	PCT	GP							
36	28	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC		Osprey				
36	17		2		PCT			PCT		EC		Osprey				
36	2		4		PCT			PCT		EC		Osprey				

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
37	15	Skyline	0	HSL	PCT	GP	HSL	PCT	GP							
37	19		2		PCT			PCT								
39	140		0		PCT	RxFire		PCT	RxFire	EC						
40	121		0			RxFire			RxFire		GH					
41	25		0		PCT	GP		PCT	GP		GH					
41	23		2		PCT			PCT			GH					
42	35		0			RxFire			RxFire	EC	GH				Site	DC
42	30		0			RxFire			RxFire	EC	GH	Eagle			Site	DC
42	13		4			RxFire			RxFire	EC	GH	Eagle			Site	DC
43	322		0		JUT			JUT		WR	GH					
43	9		4		JUT	RxFire		JUT	RxFire	WR	GH					
44	146		0			RxFire				EC						DC
44	1.5726		4			RxFire				EC						DC
45	6		4		PCT			PCT		EC	GH	Eagle				
45.1	19	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC		Eagle				
46	87		0		JUT			JUT			GH					
46	7		4		JUT			JUT			GH					
49	61		0			RxFire			RxFire	EC	GH	Eagle				DC
49	10		4			RxFire			RxFire	EC	GH	Eagle				
49	1		4			RxFire			RxFire	EC		Eagle				
52	16		2			RxFire			RxFire	EC	GH	Osprey				
52	12		3			RxFire			RxFire	EC	GH	Osprey				
52.1	119		0			RxFire			RxFire	EC	GH	Osprey				
53	135	Tractor	0	HSL	PCT	GP	HSL	PCT	GP				Scabland			
60	71		0			RxFire			RxFire	EC	GH					
60	3		2			RxFire			RxFire	EC	GH					
61	31	Skyline	0	HSL	PCT	RxFire		PCT	RxFire				Scabland			
61	42	Skyline	2	HSL	PCT	RxFire		PCT	RxFire				Scabland			
66	16		0			RxFire					GH					
68	95	Tractor	0	HTH	PCT	RxFire				WR			Scabland			

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
69	73		0			RxFire				EC	GH					
69	6		3			RxFire				EC	GH					
70	8		4			RxFire				EC	GH					
71	47	Tractor	0	HSL	PCT	RxFire							Scabland			
71	2		4		PCT	RxFire	HSL	PCT	RxFire				Scabland			
74	59	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC						
74	25		2		PCT			PCT		EC						
74	8	Horse	3	HSL	PCT		HSL	PCT		EC						
76	28	Tractor	0	HSL	PCT	RxFire										
76	1		2		PCT	RxFire										
76	1		4		PCT	RxFire										
76	1		4		PCT	RxFire										
77	29		0		PCT			PCT		EC	GH					
77	14		2		PCT			PCT		EC	GH					
77	3		3		PCT			PCT		EC	GH					
78	66		0			RxFire			RxFire	EC	GH					
78	13		2			RxFire			RxFire	EC	GH					
78	15		3			RxFire			RxFire	EC	GH					
79	139	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC		Osprey				DC
79	1	Tractor	4	HSL	PCT		HSL	PCT		EC		Osprey				DC
81	72		0			RxFire			RxFire	EC	GH	Osprey				
81	13		2			RxFire			RxFire	EC	GH	Osprey				
81	8		3			RxFire			RxFire	EC	GH	Osprey				
82	89		0			RxFire			RxFire							
84	28		0			RxFire			RxFire	EC						
86.1	138	Tractor	0	HSL	PCT	RxFire		PCT	GP							Site
86.1	2		2		PCT	RxFire		PCT								Site
86.1	4		3		PCT	RxFire		PCT								Site
86.1	6		3		PCT	RxFire		PCT								Site
86.2	23		0		PCT	RxFire		PCT	RxFire							Site

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
87	167	Tractor	0	HSL	PCT	RxFire		PCT	RxFire	WR			Scabland			
87	2		4		PCT	RxFire		PCT	RxFire	WR			Scabland			
87	2		4		PCT	RxFire		PCT	RxFire	WR			Scabland			
88	76	Tractor	0	HTH	PCT	GP	HTH	PCT	GP				Scabland		Site	DC
88	1	Tractor	0	HTH	PCT	GP	HTH	PCT	GP				Scabland		Site	DC
88	3		4		PCT			PCT					Scabland		Site	DC
93	135	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC				Weed	Site	
94	26		0		PCT			PCT		EC						
94	9		2		PCT			PCT		EC						
95	105		0			RxFire			RxFire	EC						
95	6		2			RxFire			RxFire	EC						
95	19		2			RxFire			RxFire	EC						
96	3		0		PCT			PCT					Scabland			
96	76	Tractor	0	HTH	PCT	GP	HTH	PCT	GP				Scabland			
96	2		4		PCT			PCT								
96	3		4		PCT			PCT								
97	147	Tractor	0	HSL		RxFire	HSL		RxFire	EC				Weed	Site	
97	1		3			RxFire			RxFire	EC				Weed	Site	
97	2		3			RxFire			RxFire	EC				Weed	Site	
97	2		4			RxFire			RxFire	EC				Weed	Site	
98	69	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire						Site	DC
98	17		2		PCT	RxFire		PCT	RxFire						Site	DC
99	100	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC						
99	2		3		PCT			PCT		EC						
101	6		2		JUT	RxFire		JUT	RxFire						Site	
104	101		0			RxFire			RxFire	EC						
104	19		2			RxFire			RxFire	EC						
104	2		3			RxFire			RxFire	EC						
106	208		0			RxFire			RxFire	EC					Site	
107	72	Skyline	0	HSL	PCT	RxFire		PCT	RxFire	EC					Site	

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
110	74	Tractor	0	HTH		RxFire	HTH		RxFire							
111	68	Tractor	0	HTH	PCT	GP	HTH	PCT	GP				Scabland			
111	3		4		PCT			PCT								
112	79	Tractor	0	HTH	PCT	GP	HTH	PCT	GP							
112	3		4		PCT			PCT								
112	1		4		PCT			PCT								
113	33	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire					Weed		DC
113	1	Horse	2	HSL	PCT	RxFire	HSL	PCT						Weed		DC
113	7	Horse	2	HSL	PCT	RxFire	HSL	PCT	RxFire					Weed		DC
114	24	Tractor	0	HTH		RxFire	HTH		RxFire							
115	38		0			RxFire				EC						
115	16		2		PCT			PCT		EC						
116	125		0		JUT			JUT		WR	GH					
118	42		0		PCT			PCT		EC						
119	144	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC					Site	DC
119	1		3		PCT			PCT		EC					Site	DC
120	135		0			RxFire			RxFire	EC					Site	
121	252	Tractor	0	HSL	PCT	GP	HSL	PCT	RxFire	EC					Site	DC
121	8		3		PCT			PCT	RxFire	EC					Site	DC
121	3	T-winch	4	HSL	PCT		HSL	PCT	RxFire	EC					Site	DC
122	13		0		PCT	RxFire		PCT	RxFire		GH					
123	32		0			RxFire			RxFire	EC					Site	
123	6		2			RxFire			RxFire	EC					Site	
124	97	Tractor	0	HSL	PCT	RxFire	HSL	PCT	GP				Lily			
125	119	Tractor	0	HSL	PCT	GP		PCT	GP							
126	123	Skyline	0	HSL	PCT	RxFire			RxFire							
133	31		0		PCT			PCT		EC						
133	2		2		PCT			PCT		EC						
137	54		0			RxFire			RxFire						Site	
137	1		3			RxFire			RxFire						Site	

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
145	33		0		PCT			PCT		EC						
149	207		0			RxFire			RxFire		GH					
149	3		4			RxFire			RxFire		GH					
149	5		4			RxFire			RxFire		GH					
151.1	44	Tractor	0	HSL	PCT	RxFire							Scabland		Site	
151.1	2		3		PCT	RxFire							Scabland		Site	
151.1	2		4		PCT	RxFire							Scabland		Site	
151.2	12	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire				Scabland			
151.3	12	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire				Scabland			
153	112	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire							
154	61	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire	EC						
154	50	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire	EC						
154	1	T-winch	4	HSL	PCT	RxFire				EC						
157	42	Tractor	0	HSL	PCT	RxFire		PCT		EC						
158	43	Tractor	0	HSL	PCT	GP	HSL	PCT	GP		GH		Scabland			
158	2	Tractor	0	HSL	PCT	GP					GH		Scabland			
158	2		4		PCT			PCT			GH		Scabland			
159	77		0		JUT			JUT		WR	GH				Site	
159	2		4		JUT			JUT		WR	GH				Site	
159	3		4		JUT			JUT		WR	GH				Site	
161	110	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC	GH		Scabland			DC
161	2		4		PCT			PCT		EC	GH		Scabland			DC
164.1	54	Tractor	0	HSL	PCT	GP		PCT					Scabland	Weed		
164.2	34	Tractor	0	HSL	PCT	GP	HSL	PCT	GP				Scabland	Weed		
164.3	39	Tractor	0	HSL	PCT	GP	HSL	PCT	GP				Scabland	Weed		
164.4	2		4		PCT								Scabland	Weed		
164.5	2		4		PCT								Scabland	Weed		
166	135	Tractor	0	HSL	PCT	GP	HSL	PCT	GP		GH			Weed	Site	
166	2		4		PCT			PCT			GH			Weed	Site	
172	237		0		JUT			JUT		WR	GH	Eagle			Site	

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
172	1		3		JUT			JUT		WR	GH	Eagle			Site	
172	4		4		JUT			JUT		WR	GH	Eagle			Site	
172	5		4		JUT			JUT		WR	GH	Eagle			Site	
174	58		0			RxFire			RxFire						Site	
174	2		2			RxFire			RxFire						Site	
176	36		0		PCT			PCT		EC						
180	49	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire							
181	51	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC	GH				Site	
181	2	T-winch	4	HSL	PCT		HSL	PCT		EC	GH				Site	
182	29		0		PCT			PCT		EC						
185	23	Skyline	0	HSL	PCT	RxFire		PCT	RxFire	EC	GH					
186	29	Skyline	0	HSL	PCT	RxFire		PCT	RxFire	EC						
188	34		0		PCT			PCT		EC						
189	11	Skyline	0	HSL	PCT	RxFire		PCT	RxFire	EC						
190	289		0			RxFire			RxFire						Site	
190	19		2			RxFire			RxFire						Site	
190	8		4			RxFire			RxFire						Site	
192	11	Skyline	0	HSL	PCT	RxFire		PCT	RxFire	EC						
193	14		0		PCT			PCT			GH					
193	7		2		PCT			PCT			GH					
195	9	Skyline	0	HSL	PCT	RxFire	HSL	PCT	RxFire	EC					Site	
195	15	Skyline	0	HSL	PCT	RxFire	HSL	PCT	RxFire	EC					Site	
195	2	Skyline	4	HSL	PCT	RxFire	HSL	PCT	RxFire	EC					Site	
196	2	Horse	0	HSL	PCT	RxFire	HSL	PCT	RxFire	EC	GH					WF CG
196	26	Horse	2	HSL	PCT	RxFire	HSL	PCT	RxFire	EC	GH					WF CG
197	44		0			RxFire			RxFire							
198	49	Tractor	0	HSL	PCT	GP	HSL	PCT	GP							
200	70	Tractor	0	HTH	PCT	GP	HTH	PCT	GP		GH		Scabland	Weed		
200	2		4		PCT			PCT			GH		Scabland	Weed		
202.1	58	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	WR	GH		Scabland			

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
202.2	4		4		PCT			PCT		WR			Scabland			
202.3	25	Tractor	0	HSL	PCT	GP		PCT		WR			Scabland			
202.4	0		4		PCT			PCT					Scabland			
205	14		2		PCT			PCT		EC	GH					Site
207	23		0		PCT			PCT			GH					
207	4		0		PCT			PCT			GH					
207	18		0		PCT			PCT			GH					
207	3		4		PCT			PCT			GH					
207	5		4		PCT			PCT			GH					
208	20		0		PCT			PCT			GH					Site
208	5		2		PCT			PCT			GH					Site
210	76		0			RxFire			RxFire							
211	179		0			RxFire			RxFire		GH					Site
211	9		2			RxFire			RxFire		GH					Site
213	29		0		JUT	RxFire		JUT	RxFire	EC						Site
213	4		0		JUT	RxFire		JUT	RxFire	EC						Site
213	0		4		JUT	RxFire		JUT	RxFire	EC						Site
213	2		4		JUT	RxFire		JUT	RxFire	EC						Site
214	39		0		JUT	RxFire		JUT	RxFire							Site
214	26		2		JUT	RxFire		JUT	RxFire							Site
214	2		4		JUT	RxFire		JUT	RxFire							Site
218	33		0		JUT	RxFire		JUT	RxFire							
220	73	Tractor	0	HTH	PCT	GP	HTH	PCT	GP		GH		Scabland			Site
222	26	Tractor	0	HSL	PCT	GP	HSL	PCT	GP	EC	GH					Site DC
222	8	Horse	2	HSL	PCT		HSL	PCT		EC	GH		Lily			Site DC
222	25	Horse	3	HSL	PCT		HSL	PCT		EC	GH		Lily			Site DC
225	359		0		JUT			JUT		WR						Site
225	3		3		JUT			JUT		WR						Site
225	20		4		JUT			JUT		WR						Site
225	7		4		JUT			JUT		WR						Site

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements				
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites	
230	27		0			RxFire			RxFire							Site	
231	64	Tractor	0	HTH	PCT	RxFire	HTH	PCT	RxFire			Eagle				Site	
232	56	Skyline	0	HSL	PCT	RxFire		PCT	RxFire								
233	9		4		PCT			PCT		WR			Scabland	Weed			
233.1	251	Tractor	0	HSL	PCT	GP	HSL	PCT	RxFire	WR						Site	
233.2	69	Tractor	0	HSL	PCT	GP	HSL	PCT	RxFire	WR							DC
233.3	45	Tractor	0	HSL	PCT	GP	HSL	PCT	RxFire	WR							
233.4	66	Tractor	0	HSL	PCT	GP	HSL	PCT	RxFire	WR							DC
235	90		0		JUT	RxFire		JUT	RxFire	WR							
235	115		0		JUT	RxFire		JUT	RxFire	WR							
235	9		2		JUT	RxFire		JUT	RxFire	WR							
235	10		4		JUT	RxFire		JUT	RxFire	WR							
236	55		0			RxFire			RxFire		GH	Eagle					DC
238	13	Tractor	0	HSL	PCT	GP	HSL	PCT	GP				Scabland			Site	
243	16	Horse	2	HTH	PCT		HTH	PCT			GH			Weed			
243	28		2		PCT			PCT			GH			Weed			
243	9	Horse	2	HTH	PCT		HTH	PCT			GH			Weed			
243.1	140	Tractor	0	HTH	PCT	RxFire	HTH	PCT	RxFire		GH						DC
243.2	48	Tractor	0	HTH	PCT	RxFire	HTH	PCT				Hawk					
244.1	195	Tractor	0	HSA	PCT	RxFire	HSA	PCT	RxFire							Site	DC
244.2	41	Tractor	0	HSA	PCT	RxFire	HSA	PCT									
245	25		0		JUT	RxFire		JUT	RxFire	WR, EC						Site	
245	65		2		JUT	RxFire		JUT	RxFire	WR, EC						Site	
245	1		4		JUT			JUT		WR, EC						Site	
247	12		0		JUT	RxFire		JUT	RxFire								
249	27	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire	EC			Lily				
253.1	46	Tractor	0	HSL	PCT	GP	HSL	PCT	RxFire		GH						

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
253.2	24	Tractor	0	HSL	PCT	GP	HSL	PCT	RxFire	WR	GH					
255	10		0		JUT			JUT		EC						
257	2		2			RxFire			RxFire							
257.2	48		0			RxFire			RxFire							
258.1	54	Tractor	0	HSL	PCT	RxFire		PCT	RxFire							
258.2	32	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire							
258.2	13		3		PCT	RxFire		PCT	RxFire							
259	1		4		PCT			PCT		WR						
259.1	127	Tractor	0	HSL	PCT	GP	HSL	PCT	RxFire	WR	GH					
259.2	35	Tractor	0	HSL	PCT	GP	HSL	PCT	RxFire	WR	GH					
260	82		0		JUT	RxFire		JUT	RxFire	WR						Site
260	3		3		JUT	RxFire		JUT	RxFire	WR						Site
260	4		4		JUT	RxFire		JUT	RxFire	WR						Site
261	187		0		JUT			JUT		WR						Site
261	4		4		JUT			JUT		WR						Site
262	241		0		JUT	RxFire		JUT	RxFire	WR	GH					
262	9		4		JUT	RxFire		JUT	RxFire	WR	GH					
262	2		4		JUT	RxFire		JUT	RxFire	WR	GH					
263	210		0		JUT			JUT		WR						
263	6		4		JUT			JUT		WR						
264	150	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire	WR, EC						Site
264	9		2		PCT	RxFire		PCT	RxFire	WR, EC						Site
264	31	Horse	2	HSL	PCT	RxFire	HSL	PCT	RxFire	WR, EC			Lily			Site
264	1		3		PCT	RxFire		PCT	RxFire	WR, EC			Lily			Site
264	13	Horse	3	HSL	PCT	RxFire	HSL	PCT	RxFire	WR, EC			Lily			Site
265	151	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire					Weed		DC

Appendix B – Proposed Treatment By Unit

Unit	Acres	Logging System	RHCA Class	Alternative 2			Alternative 3			Seasonal Restrictions			Other Elements			
				Harvest Method	Noncommercial Treatments	Fuel Treatments	Harvest Method	Noncommercial Treatments	Fuel Treatments	Big Game	Goshawk	Other Raptors	Sensitive Plants/Habitats	Noxious Weeds	Cultural Res.	Recreation Sites
267	33		0		JUT	RxFire		JUT	RxFire	WR			Scabland		Site	
267	6		2		JUT	RxFire		JUT	RxFire	WR			Lily		Site	
267	19		3		JUT	RxFire		JUT	RxFire	WR			Lily		Site	
269	50	Tractor	0	HTH	PCT	RxFire	HTH	PCT	RxFire		GH					DC
269	1		4		PCT	RxFire		PCT	RxFire		GH					DC
269	2		4		PCT	RxFire		PCT	RxFire		GH					DC
276	173	Tractor	0	HSL	PCT	RxFire	HSL	PCT	RxFire	EC				Weed		
276	4	Horse	2	HSL	PCT	RxFire	HSL	PCT	RxFire	EC			Lily	Weed		
276	3	Horse	2	HSL	PCT	RxFire	HSL	PCT	RxFire	EC			Lily	Weed		
276	4	Horse	4	HSL	PCT	RxFire	HSL	PCT	RxFire	EC			Lily	Weed		
279	94	Tractor	0	HTH	PCT	RxFire		PCT	RxFire	WR, EC						
279	19		2		PCT	RxFire		PCT	RxFire	WR, EC						
280	102		0		JUT	RxFire		JUT	RxFire	WR	GH					
280	120		0		JUT	RxFire		JUT	RxFire	WR	GH					
280	4		4		JUT	RxFire		JUT	RxFire	WR	GH					
280	2		4		JUT	RxFire		JUT	RxFire	WR	GH					
281	39	Tractor	0	HTH	PCT	RxFire	HTH	PCT	RxFire	WR						
281	9		2		PCT	RxFire		PCT	RxFire	WR						
281	3		4		PCT	RxFire		PCT	RxFire	WR						
283	17	Tractor	0	HTH	PCT	RxFire		PCT	RxFire	WR						
285	22		0		JUT	RxFire		JUT	RxFire	WR, EC		Hawk			Site	
285	24		0		JUT	RxFire		JUT	RxFire	WR, EC		Hawk			Site	
285	4		2		JUT	RxFire		JUT	RxFire	WR, EC		Hawk			Site	
285	14		2		JUT	RxFire		JUT	RxFire	WR, EC		Hawk			Site	

Appendix B – Proposed Treatment By Unit

List of abbreviations:

T-winch	Winchline pulling to tractor	RxFire	Prescribed fire, underburning	Elk CG	Elkhorn Campground
HSL	Single tree selection harvest	GP	Grapple pile	WF CG	Wiley Flat Campground
HSA	Sanitation harvest	WR	Winter Range		
HTH	Commercial thinning	EC	Elk calving area		
PCT	Precommercial thinning	GH	Goshawk area		
JUT	Juniper thinning	DC	Dispersed camp		

Appendix B – Proposed Treatment By Unit

Table B-2 Road Work and Use

Road Reconstruction

Road #	Miles	Description	Sensitive Areas	Alt. 2	Alt. 3
1600000	0.1	Wiley creek crossing (MP 25.8) evaluate drainage.	Weeds at several locations	X	X
1600452	0.6	Reshape roadbed for drainage and add cross drainage. Cross Wiley Cr. Trib 1 with cattle guard or temporary bridge.	Dormant landslide terrain	X	X
1600475	0.2	From Rd 16 to MP 0.2, reshape for drainage and add cross drainage. Consider rock surface.		X	X
1600550	0.7	From MP 1.1 to Rd 1750. Reshape for drainage and add cross drainage. Consider rock surface.	Heritage sites	X	X
1600551	0.3	From MP 0.5 to end. Clearing, shaping, drainage beyond scope to TS maintenance.	Dormant landslide terrain, weed site	X	X
1600650	0.3	From Rd 16 to Rd 1600663. Reshape for drainage, add cross drainage, rock reinforcement and armor on drainage structures.	Dormant landslide terrain	X	X
1670080	0.8	Reshape to fill ruts and gullies, add cross drainage, Class 4 stream crossing would have armored drain dip.		X	
1670110	1.2	Heavy clearing to open road beyond scope of TS maintenance.	Goshawk SR w/in .25 mi. of nest	X	
1670120	0.4	Roadbed has been ripped. Shaping and oversize beyond scope of TS maintenance.		X	X
1670250	2.6	From 1670300 to end. Add cross drainage, reinforce soft spots, some grading beyond scope of TS maintenance. Reclose end from road 1600255.	Goshawk SR w/in .25 mile of nest. Dormant landslide terrain	X	X
1670000-1	4.1	From Rd 16 (south termini) to 1670050. Improve cross drainage, rock subgrade reinforcement in soft areas.	Dormant landslide terrain, weed sites	X	X
1670000-2	3.7	From 1670200 to 1670250. Improve cross drainage, rock subgrade reinforcement in soft areas, clearing beyond scope of TS maintenance.	Dormant landslide terrain, weed sites	X	X
1680011	0.3	Consider jct. work, clearing to open beyond scope of TS maintenance.		X	X
1680050	1.1	Reshape for drainage and add cross drainage; repair embankment over culvert or replace culvert; consider rock subgrade reinforcement. Remove culvert and restore channel.	Goshawk SR w/in .25 mi. of nest	X	X
1690000	0.4	Consider rock subgrade reinforcement of soft spots.	Goshawk SR w/in .25 mi. of nest	X	X
1750000-1	0.8	From 1600550 to 1750720. Improve cross drainage, rock subgrade reinforcement in soft areas, remove cmp at head of Maury trib.	Dormant landslide terrain, weed site, heritage sites.	X	X
1750000-2	0.1	At Unit 164. Improve cross drainage, rock subgrade reinforcement in soft areas.		X	X

Appendix B – Proposed Treatment By Unit

New Road Construction

Road #	Miles	Description	Sensitive Areas	Alt. 2	Alt. 3
1600170-264	0.1		Dormant landslide terrain	X	X
1600190-279	0.3		Dormant landslide terrain	X	
1600289-071	0.4	Temporary culvert would be removed at completion of harvest.	Stewart Creek crossing	X	
1600475-061	0.2			X	
1600500	0.1		Goshawk SR w/in .25 mi. of nest	X	
1600500-013	1.0	Follow scabland construction requirements.	Scabland crossing	X	
1600600-015	0.5	Relocates section of road to bypass steep grade.		X	
1600640-003	0.6	Maintain subsurface flow or install culvert. Remove culvert at completion of harvest.	Keeney Creek crossing	X	
1670050-126	1.1		Dormant landslide terrain	X	
1670000-232	0.3		Heritage site	X	
1670215	0.1	Armored crossing would be constructed. Removed at completion of harvest. Crossing would be blocked.	Goshawk SR w/in .25 mi. of nest	X	
1670250-124	0.1			X	X
1670254-068	0.6		Heritage site	X	
1750000-185	0.4		Dormant landslide terrain	X	
1750000-186	0.2		Dormant landslide terrain	X	
1750000-189	0.1		Dormant landslide terrain	X	
1750000-192	0.2		Dormant landslide terrain	X	
1750680-107	0.6		Dormant landslide terrain	X	
1750680-151	0.3			X	

Temporary Road Construction

Road #	Miles	Description	Sensitive Areas	Alt. 2	Alt. 3
1600400-222	0.1		Dormant landslide terrain	X	X
1600640-002	0.3		Dormant landslide terrain	X	
1670000-125b	0.3			X	
1670250-087	0.4		Goshawk SR w/in .25 mi. of nest	X	
1670250-124	0.1		Dormant landslide terrain	X	
1670350-098	0.3		Dormant landslide terrain	X	
1670355-086a	0.4			X	

Appendix B – Proposed Treatment By Unit

1680032-016	0.1			X	X
1760011-164	0.2		Dormant landslide terrain	X	

Road Closure

Road #	Miles	Description	Sensitive Areas	Alt. 2	Alt. 3
1600400	1.0	From Rd 16 to fence West of Wiley Flat Campground to Protect Wiley Trib. 1. Coordinate with archeologist for road closure.	Heritage site, dormant landslide terrain, goshawl SR w/in .25 mile of nest	X	X
1680050	1.1	Close road to reduce erosion at stream crossings (Wildcat Cr.). Close after proposed activities are completed.		X	
1690015	1.1	Close road to reduce disturbance in goshawk habitat		X	X

Road Decommission

Road #	Miles	Description	Sensitive Areas	Alt. 2	Alt. 3
1600289	0.3	Decommission old segment when road is relocated out of RHCA to protect Stewart Cr.		X	
1600500	0.5	From top of draw (MP 0.25) to end (1600640-018) to protect Tom Vawn Cr.		X	
1600600	0.3	Segment of steep grade when road is relocated.		X	
1670000	0.7	From 1670050 to 1670200 for water quality and soils. Timber sale use is prohibited.		X	X
1670015	0.1	From Rd 1670 (North termini) through Class 4 stream crossing for water quality and weeds.	Dormant landslide terrain, weed site	X	X
1670254	0.6	Segment in Class 4 RHCA. Stream has cut into the roadbed.		X	

APPENDIX C - BIOLOGICAL ASSESSMENT AND BIOLOGICAL EVALUATION SUMMARY

The following table summarizes the effect determinations of East Maury Fuel and Vegetation Project for sensitive, threatened and endangered species. The complete Biological Evaluations for Sensitive Species and Biological Assessment for federally listed species are available at the Lookout Mountain Ranger District.

Species:	Alt. 1	Alt. 2	Alt. 3
Redband trout	NI	MIIH	MIIH
Bull trout	NE	NE	NE
Mid-Columbia River steelhead trout	NE	NE	NE
Malheur mottled sculpin	NI	NI	NI
Mid-Columbia River spring chinook salmon EFH	NI	NI	NI
Mid-Columbia River spring chinook salmon	NI	NI	NI
Westslope cutthroat trout	NI	NI	NI
Columbia spotted frog	NI	MIIH	MIIH
Northern bald eagle	NI	MIIH	MIIH
Canada lynx	NLAA	NLAA	NLAA
California wolverine	NI	MIIH	MIIH
Peregrine falcon	NI	MIIH	MIIH
Upland sandpiper	NI	NI	NI
Bufflehead	NI	MIIH	MIIH
Tri-colored blackbird	NI	NI	NI
Gray flycatcher	NI	MIIH	MIIH
Western sage grouse	NI	MIIH	MIIH
Pygmy rabbit	NI	NI	NI
<i>Achnatherum hendersonii</i>	NI	MIIH	MIIH
<i>Achnatherum wallowaensis</i>	NI	MIIH	MIIH
<i>Artemisia ludoviciana</i> ssp. <i>estesii</i>	NI	NI	NI
<i>Astragalus diaphanus</i> var. <i>diurnus</i>	NI	NI	NI
<i>Astragalus peckii</i>	NI	NI	NI
<i>Astragalus tegetarioides</i>	NI	NI	NI
<i>Botrychium ascendens</i>	NI	MIIH	MIIH
<i>Botrychium crenulatum</i>	NI	MIIH	MIIH
<i>Botrychium minganense</i>	NI	MIIH	MIIH
<i>Botrychium montanum</i>	NI	MIIH	MIIH
<i>Botrychium paradoxum</i>	NI	MIIH	MIIH
<i>Botrychium pinnatum</i>	NI	MIIH	MIIH
<i>Calochortus longebarbatus</i> var. <i>longebarbatus</i>	NI	NI	NI
<i>Calochortus longebarbatus</i> var. <i>peckii</i>	NI	MIIH	MIIH
<i>Camissonia pygmaea</i>	NI	NI	NI
<i>Carex backii</i>	NI	MIIH	MIIH
<i>Carex hystericina</i>	NI	MIIH	MIIH
<i>Carex interior</i>	NI	MIIH	MIIH

Species:	Alt. 1	Alt. 2	Alt. 3
<i>Carex stenophylla (C. eleocharis)</i>	NI	NI	NI
<i>Cypripedium parviflorum</i>	NI	NI	NI
<i>Lomatium ochocense</i>	NI	NI	NI
<i>Mimulus evanescens</i>	NI	NI	NI
<i>Penstemon peckii</i>	NI	NI	NI
<i>Rorippa columbiae</i>	NI	NI	NI
<i>Thelypodium eucosmum</i>	NI	NI	NI
<i>Thelypodium howellii</i>	NI	NI	NI
<i>Dermatocarpon luridum</i>	NI	MIIH	MIIH
<i>Scouleria marginata</i>	NI	MIIH	MIIH

Determination for Federally Listed Species:

- NE no effect
- LAA may effect - likely to adversely affect
- NLAA may effect - not likely to adversely affect
- BE beneficial effect

Determination for Sensitive Species:

- NI no impact
- MIIH may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species
- WIFV⁴ 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

Biological Evaluations for this project were prepared by Mark G. Lesko, Botanist; Barbara Franano, Fisheries Biologist; and Dede Steele, Wildlife Biologist. The signed copies of these documents are included in the project file. This summary table is provided in the DEIS for convenience to the reader. For more detailed discussion of the species listed in the table and rationale for effects determinations, please refer to the Biological Evaluations.

⁴ *Trigger for a Significant Action as defined in NEPA*

APPENDIX D - SOILS CONDITION ANALYSIS

Proposed harvest on individual units was determined through a process which involved the Forest soil scientist and other members of the interdisciplinary team. A combination of local knowledge, walk-through transecting, and aerial photo interpretations were used to determine existing soil disturbance for each proposed harvest unit. These results were compiled in the table below. The regional standards and guidelines in relation to these proposed activities apply at the individual unit level. Estimates were made as to tillage potential and unit specific mitigations identified where needed to ensure compliance with the soil standards.

List of abbreviations for soils table:

T Tractor
S Skyline
H Horse
NCH No commercial harvest
GP Grapple pile

¹=Tractor units only

Appendix D –Soil Condition Analysis

Unit	Size (acres)	Alt. 2 Logging System	Alt 3 Logging System	Slopes >35% (acres) ¹	Existing Soil Disturbance (%)	Tillage Potential	Tillage Estimate (acres)	Post Activity Soil Disturbance (%)	Dormant Landslide Terrain (acres)	Unit-specific Analysis
2	110	T	NCH		10	Low	0	16	104	Keep disturbance below 20%. Meets standard.
3	21	S	NCH		5	Low	0	10		Skyling system will meet standard.
4	142	T-GP	NCH		10	Moderate	0	15	15	Keep disturbance below 20%. Meets standard.
4	2	T-winch	NCH		10	Moderate	0	15		Class IV RHCA. Keep machinery out of RHCA. Winch line to tractor. Meets Standard.
5	61	T	NCH	3	5	None	0	10		Slopes >35% adjacent to RHCA. Keep machinery off slopes > 35% and out of RHCA. Winch line. Meets standard.
11	91	GP	GP		10	Low	0	10		Keep disturbance below 20%. Meets standard.
13	54	S	NCH		10	Low	0	15		Skyling system will meet standard.
15	80	T	NCH	2	15	Low	0	15		Slopes >35% adjacent to RHCA. Keep machinery off slopes > 35%. Winch line. Keep disturbance below 20%. Meets standard.
16	84	T-GP	T-GP		15	Low	0	15		Keep disturbance below 20%. Meets standard.
17	46	T-GP	T-GP		15	Low	0	19		Stay on existing trails, no net increase over 20%.
18	30	T	NCH		10	Low	0	15		Keep disturbance below 20%. Meets standard.
21	25	T	NCH	3	10	Low	0	15		Slopes >35% adjacent to RHCA. Keep machinery off slopes > 35%. Winch line. Keep disturbance below 20%. Meets standard.
26	37	T-GP	T-GP		10	Low	0	15		Keep disturbance below 20%. Meets standard.

Appendix D –Soil Condition Analysis

Unit	Size (acres)	Alt. 2 Logging System	Alt 3 Logging System	Slopes >35% (acres) ¹	Existing Soil Disturbance (%)	Tillage Potential	Tillage Estimate (acres)	Post Activity Soil Disturbance (%)	Dormant Landslide Terrain (acres)	Unit-specific Analysis
28	15	T	T		25	Low	0	25		Elkhorn Campground. Stay on existing trails. No net increase. Keep disturbance below 20%. Meets standard.
29	35	T-GP	T-GP		10	Low	0	16		Keep disturbance below 20%. Class II RHCA. Keep machinery out of RHCA. Winch logs. Meets standard.
32.1	32	T-GP	T-GP		15	Moderate	0	18		Stay on existing trails, no net increase over 20%. Meets standard.
32.2	14	T-GP	NCH		15	Low	0	18		Stay on existing trails, no net increase over 20%. Keep disturbance below 20%. Meets standard.
32.3	9	T	T		10	Low	0	15		Keep disturbance below 20%. Meets standard.
33	27	T-GP	T-GP		15	Moderate	0	18	21	Stay on existing trails, no net increase over 20%. Meets standard.
34	49	T	T		15	Moderate	0	18		Keep disturbance below 20%. Meets standard.
35	5	T-GP	T-GP		10	Low	0	15		Keep disturbance below 20%. Meets standard.
36	28	T-GP	T-GP		25	High	2 - 3	15	13	Stay on existing trails. No net increase. Till 2 to 3 acres. Meets standard.
37	15	S	S		10	Low	0	12		Skyling system will meet standard.
39	140	T	T		10	Moderate	0	15		Keep disturbance below 20%. Meets standard.
41	25	T	T		10	Low	0	15		Keep disturbance below 20%. Meets standard.
42	35	T	T		10	Moderate	0	15	55	Keep disturbance below 20%. Meets standard.
45.1	19	T-GP	T-GP		25	High	1 - 2	15	19	Stay on existing trails. No net increase. Till 1 to 2 acres. Meets standard.

Appendix D –Soil Condition Analysis

Unit	Size (acres)	Alt. 2 Logging System	Alt 3 Logging System	Slopes >35% (acres) ¹	Existing Soil Disturbance (%)	Tillage Potential	Tillage Estimate (acres)	Post Activity Soil Disturbance (%)	Dormant Landslide Terrain (acres)	Unit-specific Analysis
45.2	9	T	T		25	High	0.5 - 1	15	9	Stay on existing trails. No net increase. Till ½ to 1 acre. Meets standard.
47	146	S	S		10	Low	0	12		Skyling system will meet standard.
53	135	T-GP	T-GP	1	15	Moderate	0	18		Stay on existing trails, no net increase over 20%. Winch line. Meets standard.
61	42	S	NCH		10	Low	0	10		Skyling system will meet standard.
64	59	S	S		10	Low	0	10		Skyling system will meet standard.
67	85	T	T		25	High	7 - 8	16		Stay on existing trails. No net increase. Till 7 to 8 acres. Meets standard.
68	95	T	NCH	2	22	Moderate	4 - 5	20		Winch line. Stay on existing trails. No net increase. Till 4 to 5 acres. Meets standard.
71	47	T	T	6	22	Moderate	2 - 3	23		Winch line. Stay on existing trails. No net increase. Till 2 to 3 acres. Meets standard.
72	153	T	T		15	Moderate	0	18		Stay on existing trails, no net increase over 20%. Meets standard.
73	40	T	T		22	Low	0	22		Stay on existing trails. No net increase. Meets standard.
74	59	T-GP	T-GP		22	High	2 - 3	20		Stay on existing trails. No net increase. Till 2 to 3 acres. Meets standard.
74	25	T	T		22	High	1 - 2	25		Stay on existing trails. No net increase. Till 1 to 2 acres. Meets standard.
74	8	H	H		10	Low	0	12		Horse logging will meet standard.
76	28	T	NCH		15	High	0	18		Stay on existing trails, no net increase over 20%. Meets standard.
79	140	T-GP	T-GP	3	22	High	4 - 7	20	140	Winch line. Stay on existing trails. Do not place landings in swale bottoms. No net increase. Till 4 to 7 acres. Meets standard.
86.1	138	T	NCH		22	Low	2 - 3	22	16.5	Stay on existing disturbance. No net increase. Till 2 to 3 acres. Meets standard.

Appendix D –Soil Condition Analysis

Unit	Size (acres)	Alt. 2 Logging System	Alt 3 Logging System	Slopes >35% (acres) ¹	Existing Soil Disturbance (%)	Tillage Potential	Tillage Estimate (acres)	Post Activity Soil Disturbance (%)	Dormant Landslide Terrain (acres)	Unit-specific Analysis
87	167	T	T	12	10	Low	0	18		Slopes >35% adjacent to RHCA. Keep machinery off slopes > 35%. Winch line. Keep disturbance level below 20 %. Stay on existing disturbance where possible. Meets standard.
88	76	T-GP	T-GP		22	Low	0	22		Stay on existing disturbance. No net disturbance below 20%. Meets standard.
93	135	T-GP	T-GP		25	High	4 - 7	20	129	Stay on existing trails. No net increase. Do not place landings in swales. Till 4 to 7 acres. Meets standard.
96	76	T-GP	T-GP		25	Low	0	25		Stay on existing trails. No net increase. Meets standard.
97	147	T	T		25	High	4 - 7	20		Stay on existing trails. No net increase. Till 4 to 7 acres. Meets standard.
98	69	T	T	3	22	Low	2 -3	20	23	Keep machinery off slopes > 35%. Winch line. Stay on existing trails. No net increase. Till 2 to 3 acres. Meets standard.
99	100	T-GP	T-GP	4	25	High	5 - 6	20	93	Keep machinery off slopes > 35%. Winch line. Stay on existing trails. No net increase. Do not place landings in swale bottoms. Till 5 to 6 acres. Meets standard.
107	72	S	NCH		10	Low	0	15	71	Skyling system will meet standard. Meets standard.
110	74	T	T	1	25	Moderate	3 - 4	20		Keep machinery off slopes > 35%. Winch line. Stay on existing trails. No net increase. Till 3 to 4 acres. Keep disturbance below 20%. Meets standard.
111	68	T-GP	T-GP		25	Low	2 - 3	21		Stay on existing trails. No net increase. Till 2 to 3 acres. Meets standard.
112	79	T-GP	T-GP		25	Low	2 - 3	21		Stay on existing trails. No net increase. Till 2 to 3 acres. Meets standard.

Appendix D –Soil Condition Analysis

Unit	Size (acres)	Alt. 2 Logging System	Alt 3 Logging System	Slopes >35% (acres) ¹	Existing Soil Disturbance (%)	Tillage Potential	Tillage Estimate (acres)	Post Activity Soil Disturbance (%)	Dormant Landslide Terrain (acres)	Unit-specific Analysis
113	57	T/H	H		22	Moderate	0	22	34	Stay on existing trails. No net increase. Keep machinery out of RHCA. Meets standard.
114	24	T	T	2	25	Low	0	25		Keep machinery off slopes > 35%. Winch line. Stay on existing trails. No net increase. Meets standard.
119	144	T-GP	T-GP		25	Moderate	5 - 6	22	125	Stay on existing trails. No net increase. Do not place landings in swales. Till 5 to 6 acres. Meets standard.
121	255	T-GP	T-GP		25	Low	5 - 6	23	258	Stay on existing trails. No net increase. Do not place landings in swales. Keep machinery out of RHCA. Winch logs. Till 5 to 6 acres. Meets standard.
124	97	T	T		22	Moderate	4 - 5	22	97	Stay on existing trails. No net increase. Till 4 to 5 acres. Meets standard.
125	119	T-GP	T-GP		25	Moderate	4 - 5	21		Stay on existing trails. No net increase. Till 4 to 5 acres. Meets standard.
126	123	S	S		10	Low	0	15	119	Skyling system will meet standard. Meets standard.
151.1	44	T	NCH	2	15	Low	0	18		Slopes >35% adjacent to RHCA. Keep machinery off slopes > 35%. Winch line. Stay on existing trails, no net increase over 20%. Meets standard.
151	24	T	T	2	15	Low	0	18		Slopes >35% adjacent to RHCA. Keep machinery off slopes > 35%. Winch line. Stay on existing trails, no net increase over 20%. Meets standard.
153	112	T	T		25	Moderate	2 - 3	22		Stay on existing trails. No net increase. Till 2 to 3 acres. Meets standard.

Appendix D –Soil Condition Analysis

Unit	Size (acres)	Alt. 2 Logging System	Alt 3 Logging System	Slopes >35% (acres) ¹	Existing Soil Disturbance (%)	Tillage Potential	Tillage Estimate (acres)	Post Activity Soil Disturbance (%)	Dormant Landslide Terrain (acres)	Unit-specific Analysis
154	112	T	T		25	Moderate	2 - 3	22	112	Stay on existing trails. No net increase. Do not place landings in swales. Keep machinery out of RHCA. Winch logs. Till 2 to 3 acres. Meets standard.
157	42	T	T		15	Low	0	18	25	Stay on existing trails, no net increase over 20%. Meets standard.
158	45	T-GP	T-GP		15	M	0	18		Stay on existing trails, no net increase over 20%. Meets standard.
161	110	T-GP	T-GP	2	15	Low	0	18	23	Keep machinery off slopes > 35%. Winch line. Stay on existing trails, no net increase over 20%. Meets standard.
164.1	54	T-GP	NCH		22	Moderate	0.5 - 1	20		Stay on existing trails. No net increase. Till ½ to 1 acre. Meets standard.
164.2	34	T-GP	T-GP		22	Low	0	22		Stay on existing trails. No net increase. Meets standard.
164.3	39	T-GP	T-GP		22	Low	0	22		Stay on existing trails. No net increase. Meets standard.
166	135	T-GP	T-GP		24	Moderate	4 - 5	20	99	Stay on existing trails. No net increase. Till 4 to 5 acres. Meets standard.
180	49	T	T		24	Low	0	24	38	Stay on existing trails. No net increase. Meets standard.
181	53	T-GP	T-GP		22	Moderate	1 - 2	20	53	Stay on existing trails. No net increase. Keep machinery out of RHCA. Winch logs. Till 1 to 2 acres. Meets standard.
185	23	S	NCH		5	Low	0	10	22	Skyling system will meet standard.
186	29	S	NCH		5	Low	0	10	21	Skyling system will meet standard.
189	11	S	NCH		5	Low	0	10	10	Skyling system will meet standard.
192	11	S	NCH		5	Low	0	10	11	Skyling system will meet standard.
195	26	S	S		10	Low	0	15	26	Skyling system will meet standard.

Appendix D –Soil Condition Analysis

Unit	Size (acres)	Alt. 2 Logging System	Alt 3 Logging System	Slopes >35% (acres) ¹	Existing Soil Disturbance (%)	Tillage Potential	Tillage Estimate (acres)	Post Activity Soil Disturbance (%)	Dormant Landslide Terrain (acres)	Unit-specific Analysis
196	28	H	H		10	High	0	10		Wiley Flat Campground. Keep disturbance below 20%. Meets standard.
198	49	T-GP	T-GP	1	25	Moderate	1 - 2	23		Keep machinery off slopes > 35%. Winch line. Stay on existing trails. No net increase. Till 1 to 2 acres. Meets standard.
200	70	T-GP	T-GP		25	Moderate	3 - 4	20		Stay on existing trails. No net increase. Till 3 to 4 acres. Meets standard.
202.1	58	T-GP	T-GP		25	Low	0.5 - 1	23		Stay on existing trails. No net increase. Till ½ to 1 acres. Meets standard.
202.3	25	T-GP	NCH		15	Low	0	18		Stay on existing trails, no net increase over 20%. Keep disturbance below 20%. Meets standard.
220	73	T-GP	T-GP	2	22	Low	0	22		Keep machinery off slopes > 35%. Winch line. Stay on existing trails. No net increase. Meets standard.
222	33	H	H		25	Moderate	0	25		Stay on existing trails. No net increase. Meets standard.
222	26	T-GP	T-GP		25	Low	0	25	26	Stay on existing trails. No net increase. Meets standard.
231	64	T	T		25	Low	0	25		Stay on existing trails. No net increase. Meets standard.
232	56	S	NCH	4	10	Low	0	15		Keep machinery off slopes > 35%. Winch line. Keep disturbance below 20%. Meets standard.
233.1	251	T-GP	T-GP		15	Low	0	18		Stay on existing trails, no net increase over 20%. Meets standard.
233.2	69	T-GP	T-GP		22	Low	0	22		Stay on existing trails. No net increase. Meets standard.
233.3	45	T-GP	T-GP		15	Low	0	18		Stay on existing trails, no net increase over 20%. Meets standard.

Appendix D –Soil Condition Analysis

Unit	Size (acres)	Alt. 2 Logging System	Alt 3 Logging System	Slopes >35% (acres) ¹	Existing Soil Disturbance (%)	Tillage Potential	Tillage Estimate (acres)	Post Activity Soil Disturbance (%)	Dormant Landslide Terrain (acres)	Unit-specific Analysis
233.4	66	T-GP	T-GP		22	Low	0	22		Stay on existing trails. No net increase. Meets standard.
238	13	T-GP	T-GP	1	22	Low	0	22		Keep machinery off slopes > 35%. Winch line. Stay on existing trails. No net increase. Meets standard.
243	24	H	H		25	Low	0	25		Stay on existing trails. No net increase. Meets standard.
243	28	T	T	2	22	Low	0	22	28	Keep machinery off slopes > 35%. Winch line. Stay on existing trails. No net increase. Do not place landings in swales. Meets standard.
243.1	140	T	T		25	Moderate	0	25	140	Stay on existing trails. No net increase. Do not place landings in swales. Meets standard.
243.2	48	T	T		25	Low	0	25	48	Stay on existing trails. No net increase. Do not place landings in swales. Meets standard.
244.1	195	T	T	6	25	Low	4 - 5	22	195	Keep machinery off slopes > 35%. Winch line. Stay on existing trails. No net increase. Do not place landings in swales. Till 4 to 5 acres. Meets standard.
244.2	41	T	T		25	Moderate	0.5 - 1	23	41	Stay on existing trails. No net increase. Till ½ to 1 acres. Do not place landings in swales. Meets standard.
249	27	T	T		22	Low	0	22		Stay on existing trails. No net increase. Meets standard.
253.1	46	T-GP	T-GP		15	Low	0	18		Stay on existing trails, no net increase over 20%. Meets standard.
253.2	24	T-GP	T-GP		15	Low	0	18		Stay on existing trails, no net increase over 20%. Meets standard.

Appendix D –Soil Condition Analysis

Unit	Size (acres)	Alt. 2 Logging System	Alt 3 Logging System	Slopes >35% (acres) ¹	Existing Soil Disturbance (%)	Tillage Potential	Tillage Estimate (acres)	Post Activity Soil Disturbance (%)	Dormant Landslide Terrain (acres)	Unit-specific Analysis
258.1	54	T	NCH		22	Low	0	22		Stay on existing trails. No net increase. Meets standard.
258.2	32	T	T		25	Low	0	25	31	Stay on existing trails. No net increase. Meets standard.
259.1	127	T-GP	T-GP		22	Low	0	22		Stay on existing trails. No net increase. Meets standard.
259.2	35	T-GP	T-GP		22	Low	0	22		Stay on existing trails. No net increase. Meets standard.
264	150	T	T		25	Low	0	25	160	Stay on existing trails. No net increase. Do not place landings in swales. Meets standard.
264	44	H	H		25	Low	0	25		Stay on existing trails. No net increase. Do not place landings in swales. Meets standard.
265	151	T	T		22	Moderate	4 - 5	19	151	Stay on existing trails. No net increase. Do not place landings in swales. Till 4 to 5 acres. Meets standard.
269	50	T	T		25	Low	0	25	51	Stay on existing trails. No net increase. Meets standard.
276	184	T/H	T/H		25	Low	0	25	173	Stay on existing trails. No net increase. Do not place landings in swales. Keep machinery out of RHCA. Meets standard.
279	113	T	NCH		25	Low	0	25	113	Stay on existing trails. No net increase. Do not place landings in swales. Meets standard.
281	51	T	T		25	Low	0	25	46	Stay on existing trails. No net increase. Meets standard.
283	17	T	T		25	Moderate	0.5 - 1	19	17	Stay on existing trails. No net increase. Till ½ to 1 acre. Meets standard.

APPENDIX E - EAST MAURY PROJECT MAPS

APPENDIX F - WATER QUALITY BEST MANAGEMENT PRACTICES

Application of Water Quality BMPs, INFISH, and LRMP Standards and Guidelines

A number of the design elements described in Chapter 2 of the EA, and procedural steps done in development of these projects, are identified as Best Management Practices (BMPs). BMPs also include requirements such as Forest Service manual direction, timber sale contract provisions, environmental documents, and Forest Plan standards and guidelines. The Forest Plan was amended by the Inland Native Fish (INFISH) Strategy in July 1995. Applicable INFISH standards are also identified.

The Forest Plan, as amended, guides natural resource management activities and establishes management standards and guidelines for the Ochoco National Forest. The Forest Plan requires compliance with State requirements in accordance with the Clean Water Act through the application of BMPs. The Oregon Forest Practices Act and Rules are considered a Best Management Practices (BMP's) Program. Forest Service practices were compared with the State practices and Forest Service practices meet or exceed State requirements.

The following table describes design elements and other aspects of the project development process and identifies those design elements which are applied as site-specific BMPs and INFISH standards.

East Maury Project - Design Element or Procedural Requirement	BMP/INFISH Reference
<p>Analysis and scheduling timber sale activities to avoid potential effects on water quality.</p> <p>Though not a priority watershed, the Maury Mountains Watershed Analysis was completed in 2001. Water quality was identified as an issue in the watershed analysis and is analyzed in Chapter 3 of the EIS.</p>	<p>T-1: Timber Sale Planning Process Objective: To introduce water quality and hydrologic considerations into the timber sale planning process.</p> <p>INFISH RF-2a: Roads Management Completing watershed analysis prior to construction of new roads or landings in RHCAs within priority watersheds.</p>
<p>Timber harvest units and other activities were evaluated to estimate the response of the watershed. The IDT reviewed each treatment unit including factors influencing potential for impacts to water quality such as EHA, soil erosion hazard, slope, distance to stream, logging method, and effects to forest vegetation. Adjustments were made to silvicultural prescriptions.</p>	<p>T-2: Timber Harvest Unit Design</p> <p>Objective: To ensure that timber harvest unit design will secure favorable conditions of water flow, water quality, and fish habitat.</p>
<p>The potential for erosion and mass wasting for the area was evaluated by examining the soil, topography, rock type, drainage patterns, water conditions, and plant community. Reference Hydrology Resource Report, Geology Report, and Soils Resource Report. Areas with high erosion potential were identified and used to design treatments which reduced erosion potential.</p>	<p>T-3: Use of Erosion Potential Assessment for Timber Harvest Design.</p> <p>Objective: To prevent downstream water quality degradation by the timely identification of areas with high erosion potential and adjustment of harvest unit design.</p>

Appendix F – Water Quality Best Management Practices

East Maury Project - Design Element or Procedural Requirement	BMP/INFISH Reference
<p>Based on data collected during the planning process and sale layout, the location of stream courses, springs, wet meadows, and RHCAs are delineated on the sale area map. In addition, sites identified during implementation will be reviewed by applicable IDT members for protection needs.</p>	<p>T-4: Use of the Sale Area Map for designating Water Quality Protection Needs Objective: To delineate the location of protection areas and available water sources as a guide for both the purchaser and the sale administrator, and to ensure their recognition and proper consideration and protection on the ground.</p>
<p>Per contract provision BT6.31, the timber sale contract would specify the normal operating season for timber harvest operations, during which, operations could generally proceed without resource damage.</p> <p>“Commercial Road Rules” (Ochoco NF, 2006) also describe road conditions which would restrict timber hauling</p> <p>Design elements also describe road conditions (rutting & muddy ditch water) which would restrict timber hauling. Reference EA Chapter 2, Design Elements Common to All Action Alternatives.</p>	<p>T-5: Limiting the Operating Period of Timber Sale Activities</p> <p>Objective: To ensure that purchasers conduct operations in a timely manner and conduct operations within the time period specified in the timber sale contract.</p> <p>INFISH RM-2 c5: Regulate traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives.</p>
<p>Unstable lands that are unsuitable for timber management were identified through satellite imagery, aerial photos, and field reconnaissance. Geology Report.</p>	<p>T-6: Protection of Unstable Lands</p> <p>Objective: To provide for identification and appropriate management prescriptions for unstable lands.</p>
<p>Roads, skid trails, landings, and other timber harvesting facilities would be kept at a prescribed distance from designated stream courses.</p> <p>INFISH RHCAs have been identified for all streams within the East Maury Project Area. Proposed treatments within RHCAs are intended to meet INFISH RMOs. Reference EA, Chapter 2, Design Elements Common to all Action Alternatives, Hydrology Report, and Fisheries Report.</p>	<p>T-7: Streamside Management Unit (SMU) Designation Objective: To designate a riparian area or zone along streams and wetlands where prescriptions are made that will minimize potential adverse effects of nearby logging and related land disturbance activities on water quality and beneficial uses.</p> <p>INFISH: RHCA Designation</p> <p>INFISH TM-1b: 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.</p>

Appendix F – Water Quality Best Management Practices

East Maury Project - Design Element or Procedural Requirement	BMP/INFISH Reference
<p>EIS Design Elements - Water Quality/Fisheries</p> <p>The road system to access sale units was designed to minimize new stream crossings. There are no identified crossings on new temporary roads. The only new crossings are on intermittent streams on system roads with 3 in Alt2 and 1 in Alt3.</p> <p>EIS Design Elements - Soils</p> <p>Skid trails would be designated and approved prior to logging and would be located on already disturbed areas where possible. Where practical, skid trails would avoid ephemeral draws.</p>	<p>T-8: Streamcourse Protection</p> <p>a. Location, method, and timing of streamcourse crossings must be agreed to prior to construction</p> <p>Objective: (1) To protect the natural flow of streams, (2) to provide unobstructed passage of streamflow, and (3) to prevent sediment and other pollutants from entering streams.</p>
<p>Contract Provision</p> <p>Per contract provision BT6.63, the purchaser would remove fill from stream crossings by the close of the sale to permit normal maximum flow of water. This would apply to temporary roads and closed roads opened by the purchaser</p>	<p>T-8: Streamcourse Protection</p> <p>b. Purchaser shall repair all unavoidable damage to a stream course, including damages to banks and channel, to the extent practicable.</p> <p>Objective: (1) To protect the natural flow of streams, (2) to provide unobstructed passage of streamflow, and (3) to prevent sediment and other pollutants from entering streams.</p>
<p>EIS Design Elements - RHCAs</p> <p>Ground-based machinery for logging and slash piling operations would not be used within RHCAs except on existing roads. Other exceptions would be evaluated on a case-by case basis by the hydrologist or fish biologist.</p> <p>No temporary road stream crossings were identified during analysis in any of the action alternatives.</p>	<p>T-8: Streamcourse Protection</p> <p>d. Equipment shall not operate within SMUs (RHCAs) or protected streamcourses, as identified on the sale area map.</p> <p>Objective: (1) To protect the natural flow of streams, (2) to provide unobstructed passage of streamflow, and (3) to prevent sediment and other pollutants from entering streams.</p> <p>LRMP S&G: No more than 10% of an activity area (Riparian MA-F15) can be compacted or displaced to a degree which degrades vegetative productivity.</p>
<p>EIS Design Elements - Water Quality/Fisheries</p> <p>Adequate drainage would be established on roads. Filter strips below drainage structures would be of sufficient size to catch sediment before runoff enters streams.</p> <p>New native surface and temporary roads would be designed with relief drainage (drivable dips, outslope, no berms). Drainage would be maintained during operations and be fully functional going into the winter and when roads are decommissioned or inactivated.</p> <p>Per contract provision BT6.63, the purchaser would employ measures as necessary such as outsloping, drainage dips, and water-spreading ditches.</p>	<p>T-8: Streamcourse Protection</p> <p>f. Water bars and other erosion control structures will be located so as to prevent water and sediment from being channeled into streamcourses, and to dissipate concentrated flows.</p> <p>Objective: (1) To protect the natural flow of streams, (2) to provide unobstructed passage of streamflow, and (3) to prevent sediment and other pollutants from entering streams.</p>

Appendix F – Water Quality Best Management Practices

East Maury Project - Design Element or Procedural Requirement	BMP/INFISH Reference
<p>EIS Design Elements – Soils</p> <p>On slopes exceeding 35%, winch lining would be required to minimize soil impacts.</p> <p>Proposed units were evaluated by the IDT during planning for suitability for tractor logging based on slope, soil erosivity, geologic stability, and distance from streams.</p>	<p>T-9: Delineating Tractor Loggable Ground</p> <p>Objective: To protect water quality from degradation caused by tractor logging ground disturbance</p>
<p>EIS Design Elements - RHCAs</p> <p>No new landings would be placed in RHCAs or ephemeral draws. Existing landings may be reused after coordination with the fisheries biologist or hydrologist.</p>	<p>T10: Log Landing Location</p> <p>Objective: To locate landings in such a way as to minimize creation of hazardous watershed condition.</p>
<p>EIS Design Elements - Soils</p> <p>Skid trails would be designated and approved prior to logging and would be located on already disturbed areas where possible. Skid trails, landings, and roads would be designed to minimize the aerial extent of the activity. Objective is 20% or less of activity area in a detrimental soil condition. Skid trails may be tilled if greater than 20% of the area.</p>	<p>T-11: Tractor Skid Trail Location and Design</p> <p>Objective: To minimize the area compacted, erosion, and runoff water.</p>
<p>EIS Design Elements - Soils</p> <p>For tractor yarding units, the leading end of logs would be suspended above the ground during skidding operations where practical to limit soil displacement. If slopes should exceed 35%, winch lining would be required to minimize detrimental soil impacts.</p>	<p>T-12: Suspended Log Yarding in Timber Harvesting</p> <p>Objective: 1. To protect soils from excessive disturbance, and 2. to maintain the integrity of SMU (RHCA) and other sensitive watershed areas.</p>
<p>Contract Provisions</p> <p>Per contract provision BT6.6 Equipment would not be operated when ground conditions were such that excessive damage would result. Erosion control work would be kept current immediately preceding expected seasonal periods of precipitation or runoff.</p> <p>An erosion control plan would be developed that incorporates applicable erosion control actions for all action alternatives and made part of the timber sale contract.</p>	<p>T-13: Erosion Prevention and Control Measures During Timber Sale Operations</p> <p>Objective: To ensure that the purchaser's operations shall be conducted to minimize soil erosion.</p>
<p>EIS Design Elements</p> <p>Water Quality/Fisheries – Landings, main skid trails within 300’ of landings, and decommissioned temporary roads would be scarified and seeded.</p> <p>Noxious Weeds - Temporary & new system roads, primary skid trails, and landings would be revegetated as part of the final sale contract work to reduce the potential for weed establishment and soil erosion.</p>	<p>T-14: Revegetation of Areas Disturbed by Harvest Activities</p> <p>Objective: To establish a vegetative cover on disturbed sites to prevent erosion and sedimentation.</p>

Appendix F – Water Quality Best Management Practices

East Maury Project - Design Element or Procedural Requirement	BMP/INFISH Reference
<p>EIS Design Elements - Water Quality/Fisheries, RHCAs & Weeds</p> <p>Landings, primary skid tails and temporary roads would be scarified, water barred, and seeded as needed to prevent and control erosion and prevent the spread of weeds.</p>	<p>T-15: Log Landing Erosion Prevention and Control</p> <p>Objective: To reduce the impacts of erosion and subsequent sedimentation, on log landings, by use of mitigation measures.</p> <p>T-16: Erosion Control on Skid Trails</p> <p>Objective: To protect water quality by minimizing erosion and sedimentation derived from skid trails.</p>
<p>Meadows, seeps, and springs have been identified through satellite imagery, aerial photos, and field verification. Wet meadows are afforded protection by the application of INFISH RHCAs & Executive Order 11990. Dry meadows are protected from impacts from harvest and road activities. See contract provision BT5.61. Aspen restoration is proposed to improve stand vigor.</p>	<p>T-17: Meadow Protection During Timber Harvesting</p> <p>Objective: To avoid locating roads, landings, and skid trails in meadows.</p>
<p>EIS Monitoring Common to All Action Alternatives</p> <p>Timber sale administration would include monitoring for implementation of activities as planned including: harvest operations, road work, erosion control, and fuels treatment.</p>	<p>T-18: Erosion Control Structure Maintenance</p> <p>Objective: To ensure that constructed erosion control structures are stabilized and working.</p> <p>INFISH RF-2 c4: Requirements for pre-, during, and post-storm inspections and maintenance.</p>
<p>These BMPs are included in the action alternatives for TS activity. T-19 and T-21 are considered normal operating procedures and are included in timber sale contract language. T-20 is required per Forest Service Manual requirements. T-22 is provided for through monitoring and evaluation of conditions throughout the life of the timber sale contract.</p>	<p>T-19: Acceptance of TS Erosion Control Measures Before Sale Closure T-20: Reforestation T-21: Servicing and Refueling of Equipment T-22: Modification of TSC</p> <p>INFISH RA-4: General Riparian Area Management Prohibit storage of fuels and other toxicants within RHCAs.</p>
<p>EIS, Chapter 2, Alternatives</p> <p>There are key differences among the alternatives for transportation system development and road management and are evaluated in the EIS. Alt 2 propose building 10.3 miles of new and temporary road and reconstructing 17.6 miles, Alt 3 proposes building 0.4 miles of new and temporary road and reconstructing 12.4 miles. Alternatives 2 and 3 propose inactivation and decommissioning 4.5 & 2.1 miles of existing road respectively. The road management proposed under Alternatives 2 and 3 would reduce the potential for sediment delivery in streams in the long-term.</p>	<p>R-1: General Guidelines for the Location and Design of Roads</p> <p>a. Basic requirement for transportation facility development which best meets management objectives with least effect on environmental values.</p>

Appendix F – Water Quality Best Management Practices

East Maury Project - Design Element or Procedural Requirement	BMP/INFISH Reference
<p>Road construction, reconstruction, inactivation, decommissioning temporary roads, and use affects on water quality and fish habitat are evaluated in the EIS.</p> <p>During development of the EA the design and location of existing and proposed roads was evaluated by the IDT.</p>	<p>R-1: General Guidelines for the Location and Design of Roads</p> <p>b. Interdisciplinary team evaluates effects of transportation system design and road location.</p> <p>INFISH RF-2 c1: Road design criteria, elements, and standards that govern construction and reconstruction are identified.</p>
<p>EIS Design Elements - Water Quality/Fisheries</p> <p>An erosion control plan is required.</p>	<p>R-2: Erosion Control Plan</p> <p>Objective: To limit and mitigate erosion and sedimentation through effective planning to initiation of road construction activities and through effective contract administration during construction.</p>
<p>Contract Provision</p> <p>Instream work would be accomplished per Oregon Guidelines for Timing of In-Water Work to protect Fish and Wildlife Resources (7/1-10/31). Other road construction in the planning area would be accomplished during the normal operating season specified in the timber sale contract (Contract Provision BT6.31).</p>	<p>R-3: Timing of Construction Activities</p> <p>Objective: To minimize erosion by conducting road construction operations during minimal runoff periods.</p>
<p>Dormant and active landslide areas were identified by the Forest Geologist during planning and road locations were modified to avoid activating slope failures.</p>	<p>R-4: Road Slope Stabilization</p> <p>Objective: To reduce sedimentation by minimizing erosion from road slopes and minimizing the chances for slope failures along roads.</p>
<p>EIS Design Elements - Water Quality/Fisheries, RHCAs & Weeds</p> <p>New system and temporary roads would be seeded to prevent and control erosion and prevent the spread of weeds.</p>	<p>R-5: Road Slope and Waste Area Stabilization (Preventive)</p> <p>Objective: To prevent soil erosion from cut slopes, fill slopes, and waste areas.</p>
<p>EIS Design Elements - Water Quality/Fisheries</p> <p>Road associated sediment was identified as a major source of sediment delivery to streams in the soils, hydrology and fisheries reports. Design Elements & “Commercial Road Rules” (Ochoco NF, 2006) contains elements aimed at reducing the potential for sediment delivery from roads.</p>	<p>R-7: Control of Surface Road Drainage Associated with Roads</p> <p>Objective: 1. To minimize the erosive effects of water concentrated by road drainage features, 2. to disperse runoff from or through the road, and 3. to minimize the sediment generated from the road.</p> <p>INFISH RF-2d: avoiding sediment delivery to streams from the road surface.</p>
<p>Alt 2 – Temporary stream crossings on Stewart Creek & Unnamed Trib. Wiley Creek will be left in over winter. Will be accomplished using temp. bridge (gabion/cattle guard) to reduce risk of flood damage & discourage ORV use when pulled.</p>	<p>R-9: Timely Erosion Control Measures on Incomplete Roads and Stream Crossing Projects</p> <p>Objective: To minimize erosion of and sedimentation from disturbed ground on incomplete projects.</p>

Appendix F – Water Quality Best Management Practices

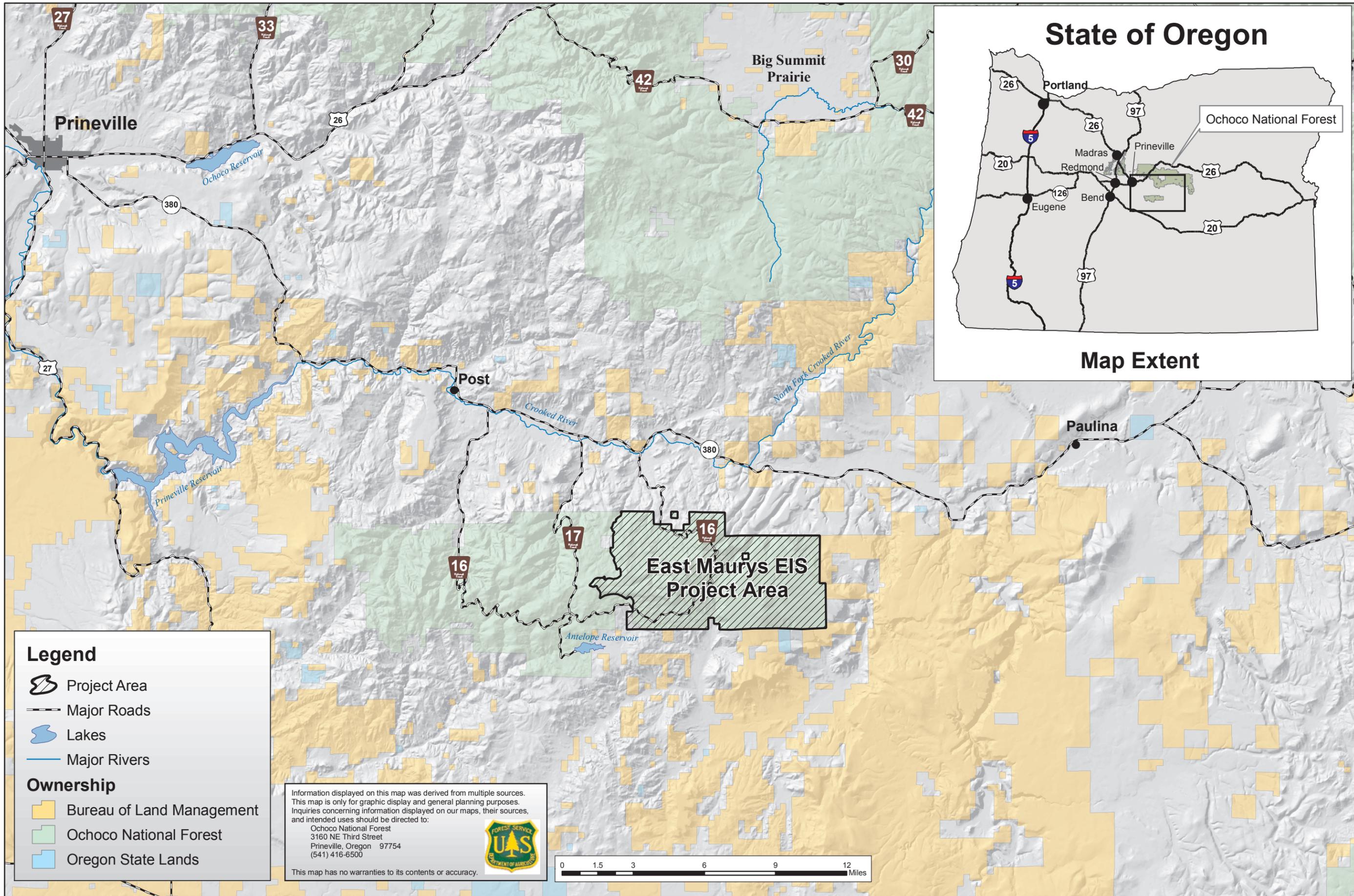
East Maury Project - Design Element or Procedural Requirement	BMP/INFISH Reference
<p>EIS Alternative Development, Chapter 2</p> <p>Alternatives 2 and 3 reduce the amount of open road miles within 400 feet of streamcourses. Hydrologic function would be restored on these roads. Miles of currently open road closed within 400 ft: Alt2 – 0.8, Alt3 – 0.7</p> <p>Miles of currently open & closed road decommissioned within 400 ft: Alt2 – 0.9, Alt3 – 0.1</p>	<p>R-12: Control of Construction in Streamside Management Units (RHCAs)</p> <p>Objective: To reduce the adverse effects of sediment from nearby roads on slope stability, vegetation, and aquatic resources along a designated stream zone.</p> <p>INFISH RF-3c: Closing and stabilizing or obliterating, and stabilizing roads not needed for future management activities.</p>
<p>EIS Design Elements - Water Quality/Fisheries</p> <p>A water conservation plan was developed for the forest to maintain base flows. This plan would be followed under the action alternatives.</p>	<p>R-17: Water Source Development Consistent with Water Quality Protection</p> <p>Objective: To supply water for roads and fire protection while maintaining existing water quality.</p>
<p>EIS Design Elements - Water Quality/Fisheries</p> <p>Decommissioning of temporary roads, primary skid trails, and landings is included in Alternatives 2 & 3.</p>	<p>R-23: Obliteration of Temporary Roads and Landings</p> <p>Objective: To reduce sediment and restore productivity of the land at the completion of intended use.</p>
<p>EIS Design Elements - Water Quality/Fisheries</p> <p>Newly constructed and reconstructed roads with stream crossings would adequate relief drainage installed prior to runoff reaching the stream channel.</p>	<p>INFISH RF-3a: reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards, or do not protect the watershed from increased sedimentation.</p>
<p>Fire severity regimes are described for the area in the Maury Mountains Watershed Analysis and in the Fire/Fuels Resource Report. The effects of the alternatives are described for fire, fuels, and fire ecology in the EIS, Chapter 3.</p>	<p>F-1: Fire and Fuels Management</p> <p>Objective: An objective of fire management activities is to reduce the potential public and private losses which could result from wildfire and/or subsequent flooding and erosion, by reducing the intensity and destructiveness of wildfire.</p>
<p>EIS Design Elements - Water Quality/Fisheries</p> <p>Alternatives 2 and 3 include design elements which reduce the effects of prescribed fire and fire line on water quality.</p>	<p>F-2: Consideration of Water Quality in Formulating Prescribed Fire Prescriptions</p> <p>Objective: To provide for water quality protection while achieving the management objectives through the use of prescribed fire.</p>
<p>EIS Design Elements – RHCAs</p> <p>Low intensity fire within RHCAs would provide for a mosaic of burned and unburned areas to retain sufficient soil cover for infiltration with 10 to 50% burned and less than 5% bare soil.</p> <p>Fire ignition would not occur within 50 feet of the stream channel, but the fire would be allowed to back into the 50 foot buffer. Exceptions would be allowed after coordination with the fisheries biologist, or hydrologist and botanist where this would better meet RMOs.</p>	<p>F-3: Protection of Water Quality During Prescribed Fire Operations</p> <p>Objective: To maintain soil productivity, minimize erosion, and prevent ash, sediment, nutrients, and debris from entering water bodies.</p>
<p>EIS Design Elements - Soils</p> <p>If slopes should exceed 35 percent on portions of tractor units, winch lining would be required to minimize detrimental soil impacts.</p>	<p>VM-1: Slope Limitations for Tractor Operations</p> <p>Objective: To reduce gully and sheet erosion and associated sediment production by limiting tractor use.</p>

Appendix F – Water Quality Best Management Practices

East Maury Project - Design Element or Procedural Requirement	BMP/INFISH Reference
<p>EIS Design Elements - Water Quality/Fisheries</p> <p>Wetlands and meadows are delineated within the project area. Springs, seeps, streams, and wet meadows have associated RHCAs applied. No off road tractor harvest operations are proposed within RHCAs. Reuse of existing landings would be evaluated on a case by case basis.</p>	<p>VM-2: Tractor Operation Excluded from Wetlands and Meadows</p> <p>Objective: To limit turbidity and sediment production resulting from compaction, rutting, runoff concentration, and subsequent erosion.</p>
<p>EIS Design Elements - Water Quality/Fisheries – Landings, main skid trails within 300’ of landings, and decommissioned temporary roads would be scarified and seeded.</p> <p>Noxious Weeds - Temporary & new system roads, primary skid trails, and landings would be revegetated as part of the final sale contract work to reduce the potential for weed establishment and soil erosion.</p>	<p>VM-3: Revegetation of Surface Disturbed Areas</p> <p>Objective: To protect water quality by minimizing soil erosion through the stabilizing influence of vegetation.</p>
<p>Wetlands and meadows are delineated within the project area. Springs, seeps, streams, and wet meadows and associated RHCAs are shown on the sale area map.</p>	<p>W-3: Protection of Wetlands</p> <p>Objective: To avoid adverse water quality impacts associated with destruction or modification of wetlands.</p>
<p>Contract Provisions</p> <p>Contract Provision BT6.341 states that if a total of more than 1320 gal of oil or oil product are stored or a single container of more than 660 gal, the purchaser shall prepare a SPCC Plan.</p>	<p>W-4: Oil and Hazardous Substances Contingency Plan and Spill Prevention Control & Countermeasure (SPCC) Plan</p> <p>Objective: To prevent contamination of waters from accidental spills.</p>
<p>Cumulative effects of proposed actions, past actions, and reasonably foreseeable future actions are included in the analysis. Reference Hydrology Report, Fisheries Report, and EIS Chapter 3.</p>	<p>W-5: Cumulative Watershed Effects</p> <p>Objective: To protect the beneficial uses of water and streams from the cumulative effects of multiple management activities which may result in adverse (degraded) water quality or stream habitat conditions.</p>
<p>EIS Monitoring Common to All Action Alternatives</p> <p>Implementation monitoring and Water Quality monitoring to evaluate the effectiveness of BMPs and INFISH standards and guidelines is included for all the action alternatives.</p>	<p>W-7: Water Quality Monitoring</p> <p>Objective: To determine effects of land management activities on the beneficial uses of water; to monitor baseline watershed conditions for comparison with State Water Quality standards, Forest Plan standards, and estimation of long-term trends; to ensure the health and safety of water users; to evaluate BMP effectiveness; and to determine the adequacy of data, assumptions, and coefficients in the Forest Plan.</p> <p>INFISH Monitoring: Monitoring is an important component of the proposed interim direction. The primary focus is to verify that the standards and guidelines were applied during project implementation.</p>

Appendix F – Water Quality Best Management Practices

East Maury Project - Design Element or Procedural Requirement	BMP/INFISH Reference
<p>Maury Mountains Watershed Analysis</p> <p>A watershed analysis was completed for the Marks Creek Watershed in 2001. Hydrologic character, stream channel condition, and water quality are key issues and receive emphasis in the report.</p>	<p>INFISH Watershed Analysis</p> <p>Watershed analysis is a systematic procedure for determining how a watershed functions in relation to its physical and biological components. This is accomplished through consideration of history, processes, landform, and condition.</p>
<p>EIS, Alternative Description, Chapter 2</p> <p>Alternatives 2 and 3 include riparian restoration actions: Aspen Treatment: Alternative 2: 248 acres, Alternative 3: 183 acres</p> <p>Long-term improvement in water quality is also expected, under Alternatives 2 and 3, due to the proposed road inactivation and decommissioning.</p>	<p>INFISH Watershed Restoration</p> <p>Watershed restoration comprises actions taken to improve the current conditions of watersheds to restore degraded habitat, and to provide long-term protection to natural resources, including riparian and aquatic resources.</p> <p>INFISH WR-1: Watershed and Habitat Restoration Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves genetic integrity of native species, and contributes to attainment of RMOs.</p>



Legend

-  Project Area
-  Major Roads
-  Lakes
-  Major Rivers

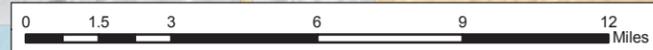
Ownership

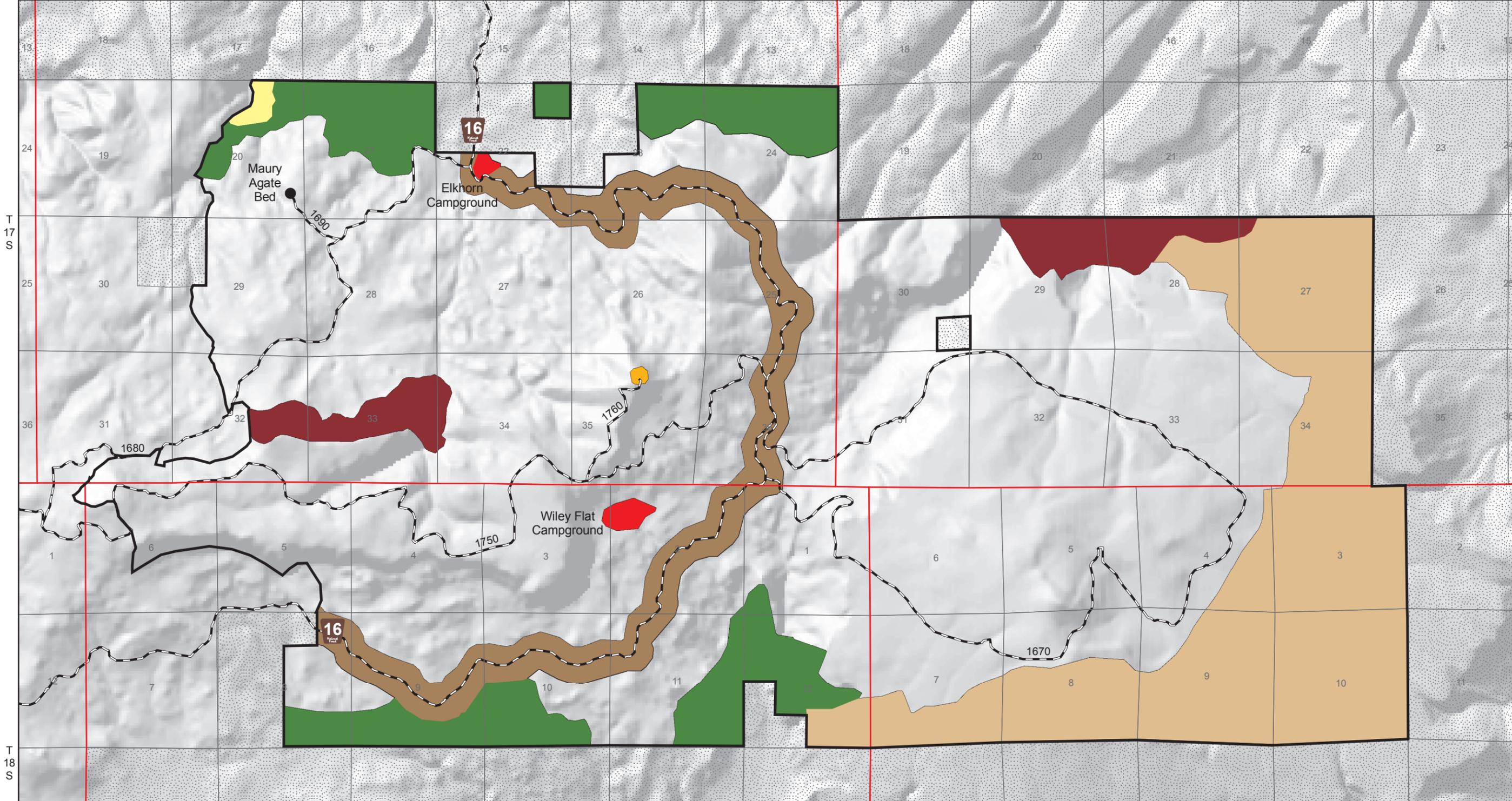
-  Bureau of Land Management
-  Ochoco National Forest
-  Oregon State Lands

Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500



This map has no warranties to its contents or accuracy.





Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500

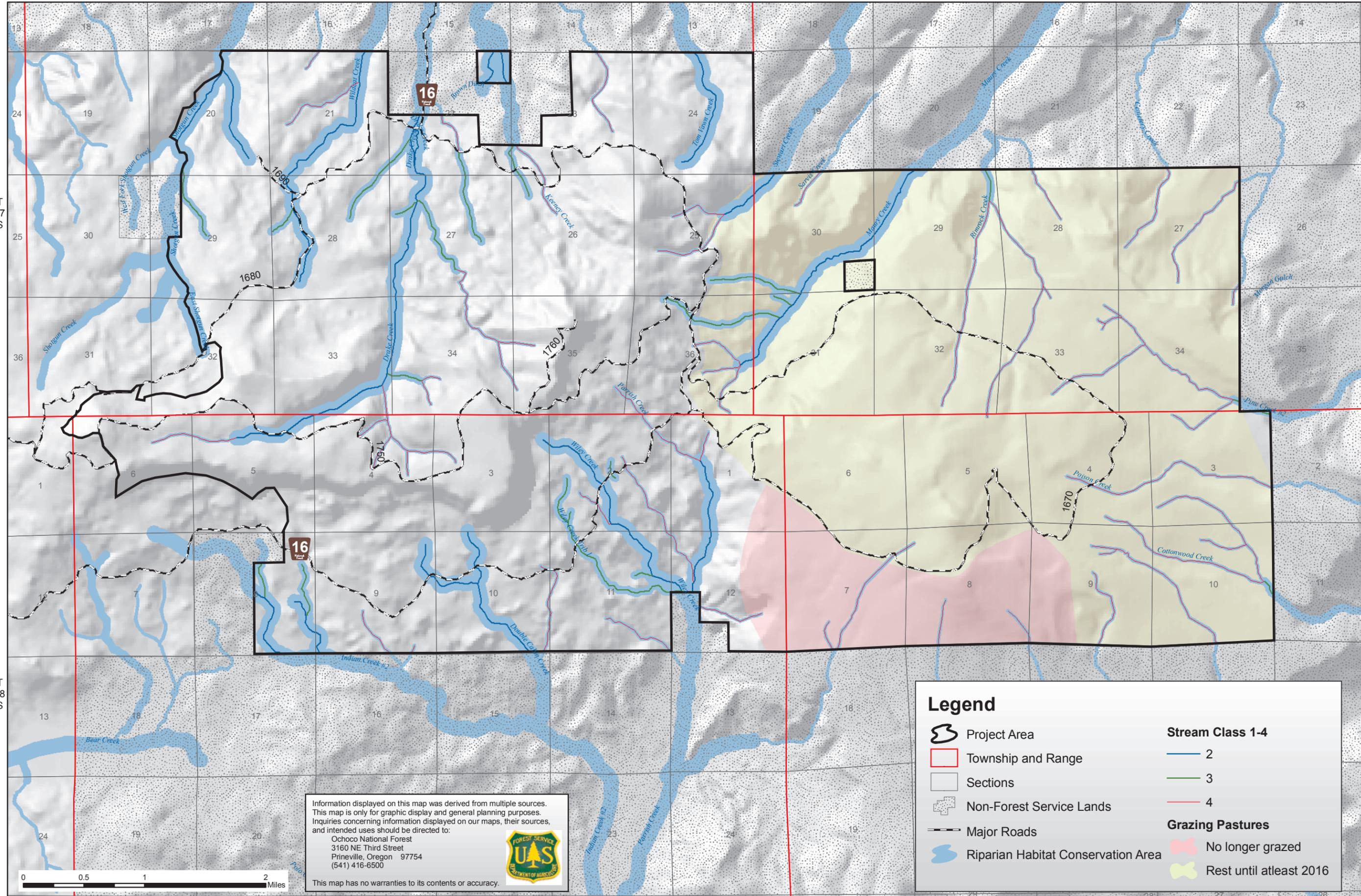


This map has no warranties to its contents or accuracy.

Legend

Project Area	Management Areas	General Forest
Township and Range	Eagle Roosting Area	General Forest Winter Range
Sections	Lookout (Tower Point)	Old Growth Management Area
Major Roads	Visual Management Corridors (Partial Retention)	Winter Range
Non-Forest Service Lands	Campgrounds	





Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500

This map has no warranties to its contents or accuracy.



Legend

- Project Area
- Township and Range
- Sections
- Non-Forest Service Lands
- Major Roads
- Riparian Habitat Conservation Area

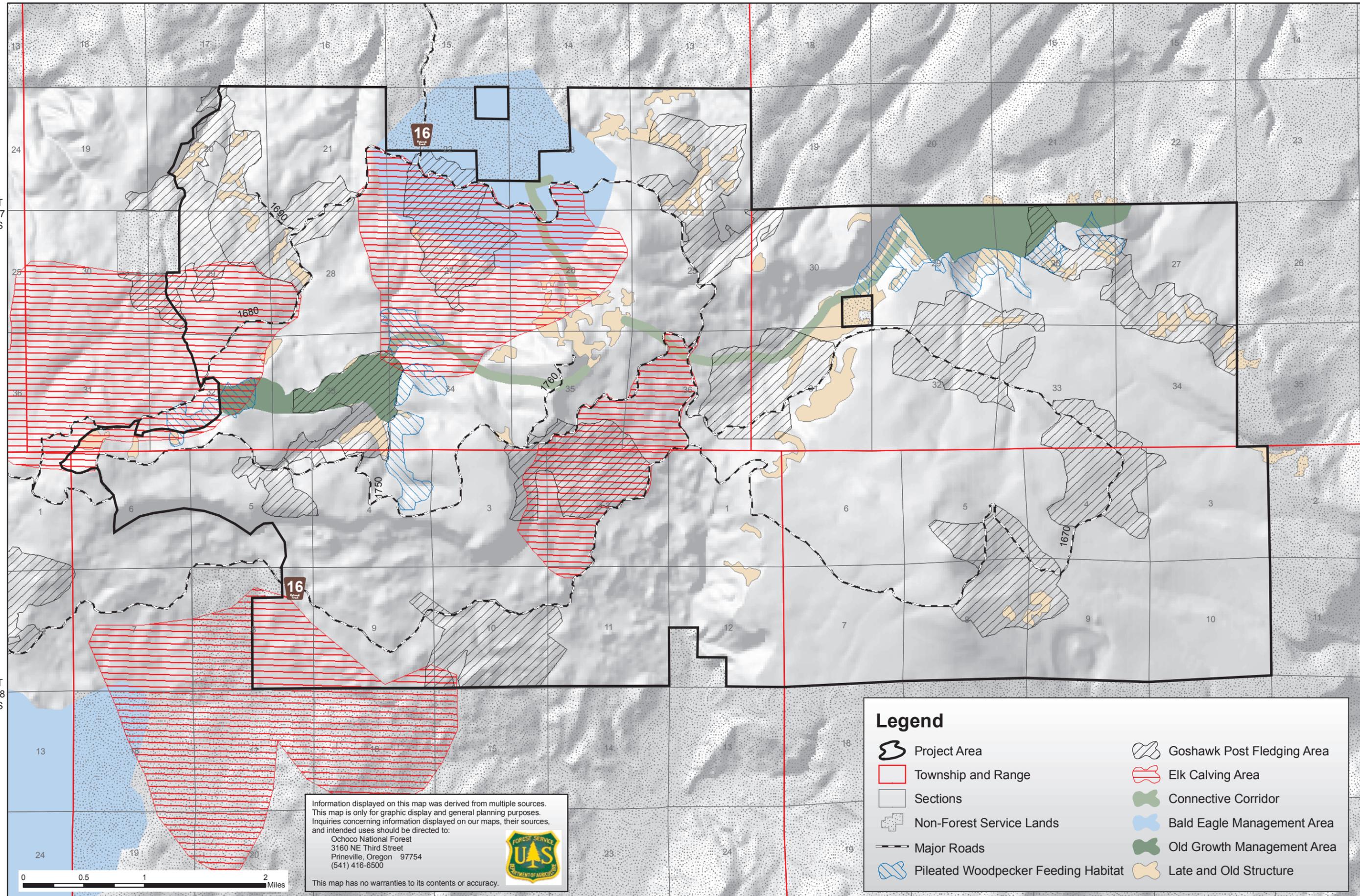
Stream Class 1-4

- 2
- 3
- 4

Grazing Pastures

- No longer grazed
- Rest until at least 2016





Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500

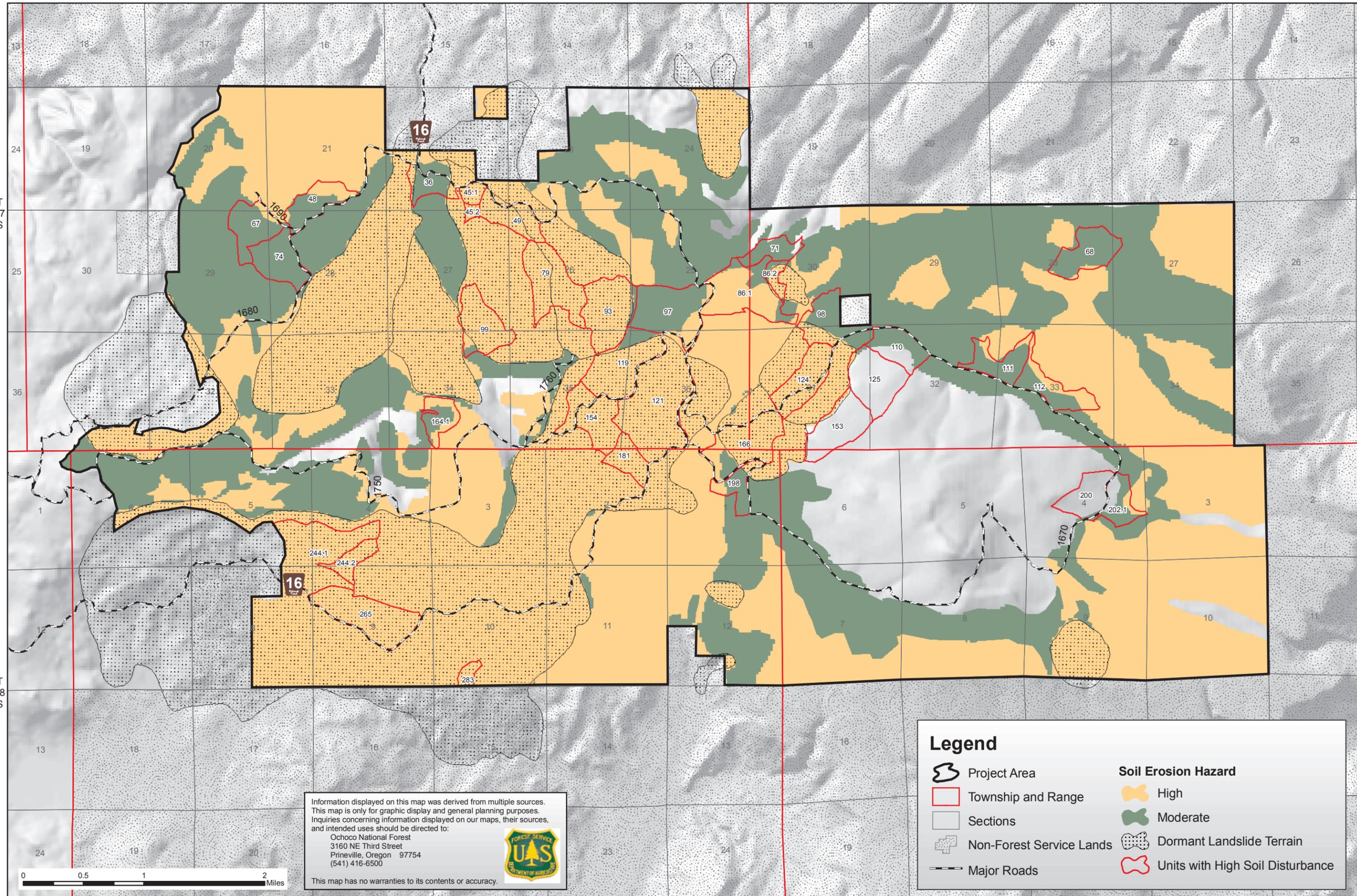
This map has no warranties to its contents or accuracy.



Legend

	Project Area		Goshawk Post Fledging Area
	Township and Range		Elk Calving Area
	Sections		Connective Corridor
	Non-Forest Service Lands		Bald Eagle Management Area
	Major Roads		Old Growth Management Area
	Pileated Woodpecker Feeding Habitat		Late and Old Structure





Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500

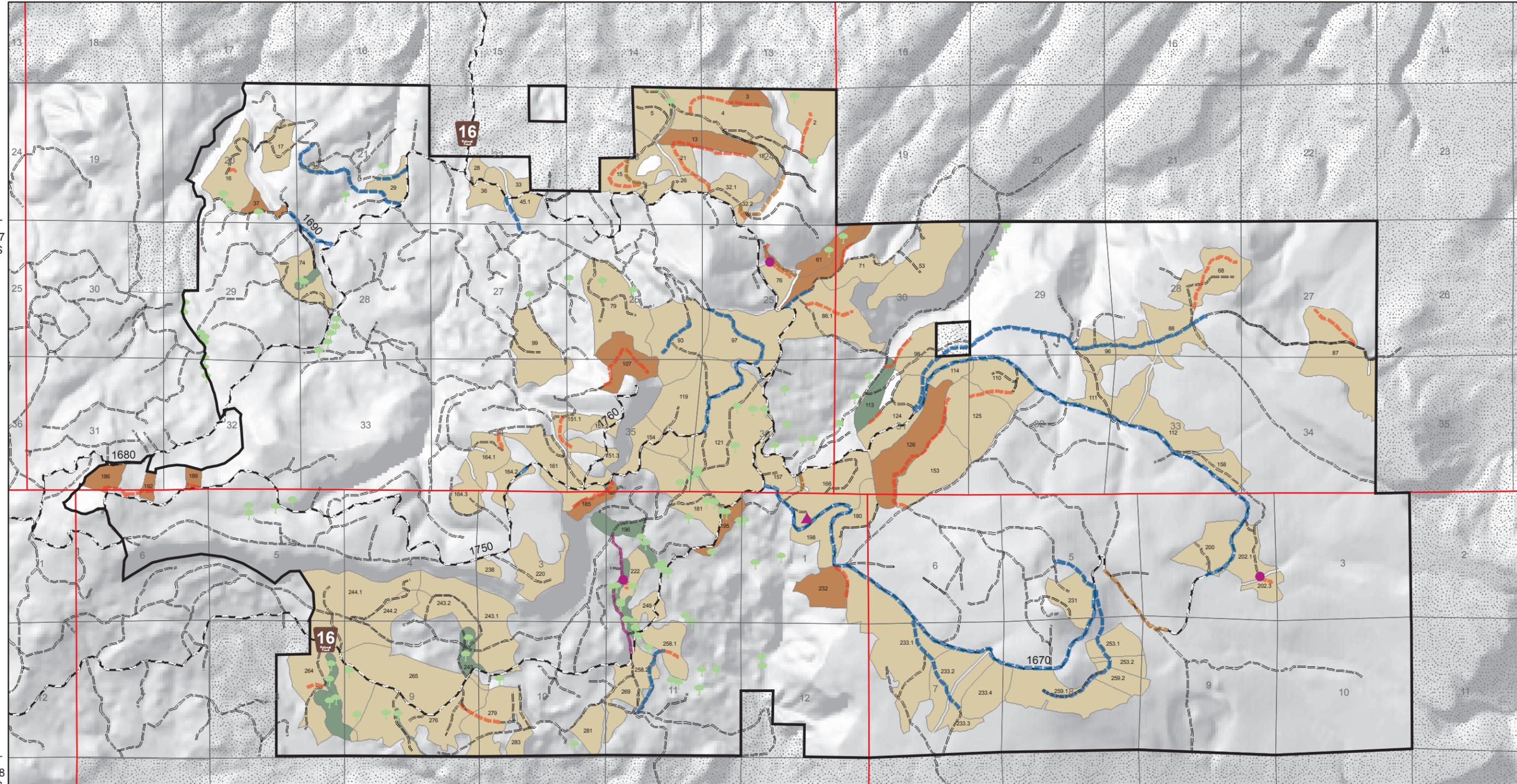
This map has no warranties to its contents or accuracy.



Legend

	Project Area		High
	Township and Range		Moderate
	Sections		Dormant Landslide Terrain
	Non-Forest Service Lands		Units with High Soil Disturbance
	Major Roads		





Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500

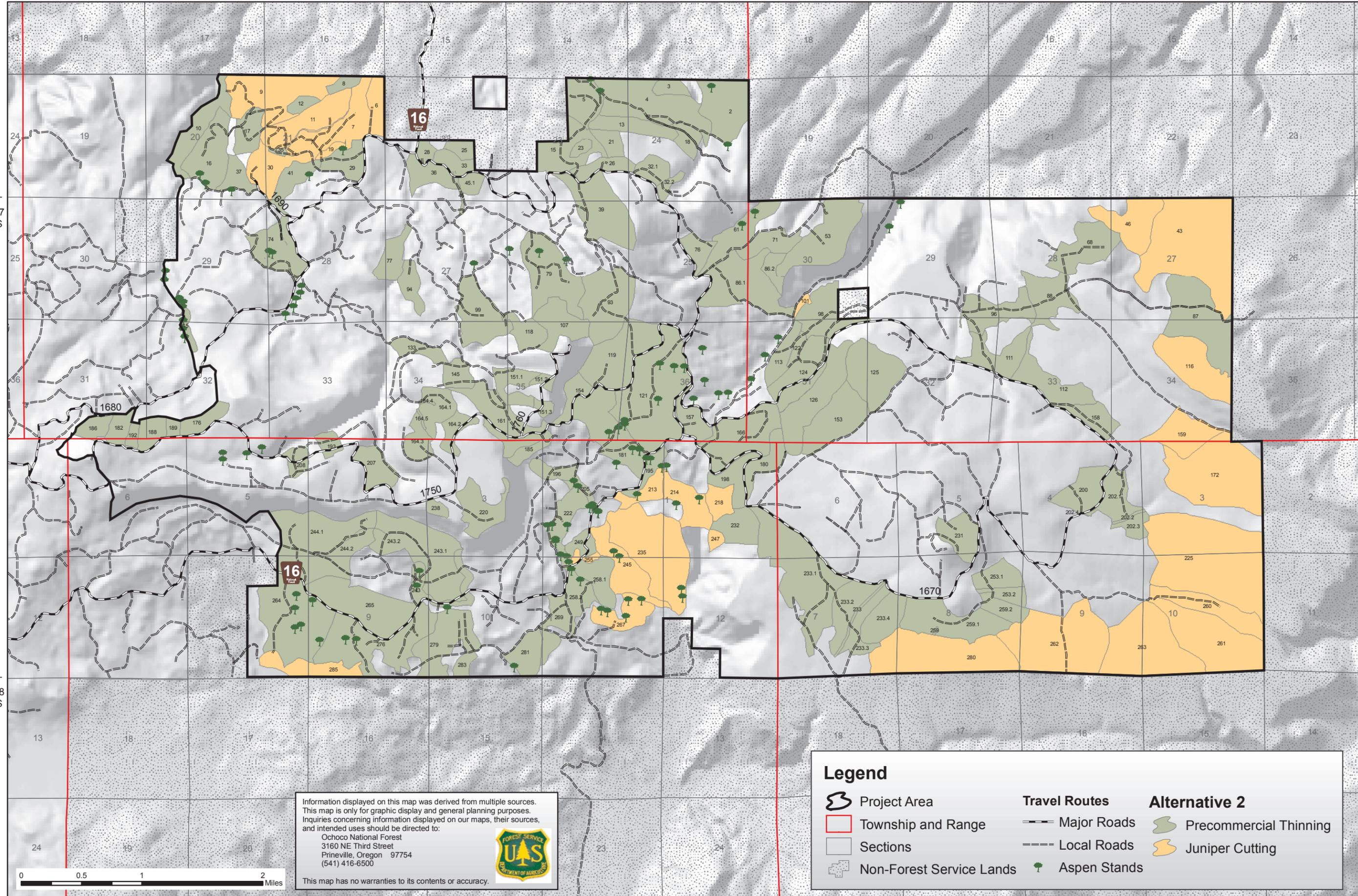


This map has no warranties to its contents or accuracy.



Legend

Project Area	Travel Routes	Alternative 2	Road Proposals
Township and Range	Major Roads	Commercial Harvest	New Road
Sections	Local Roads	Horse	Reconstruction
Non-Forest Service Lands	New Stream Crossings	Tractor	Decommission
Aspen Stands	Soap Material Source	Skyline	Close



Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500

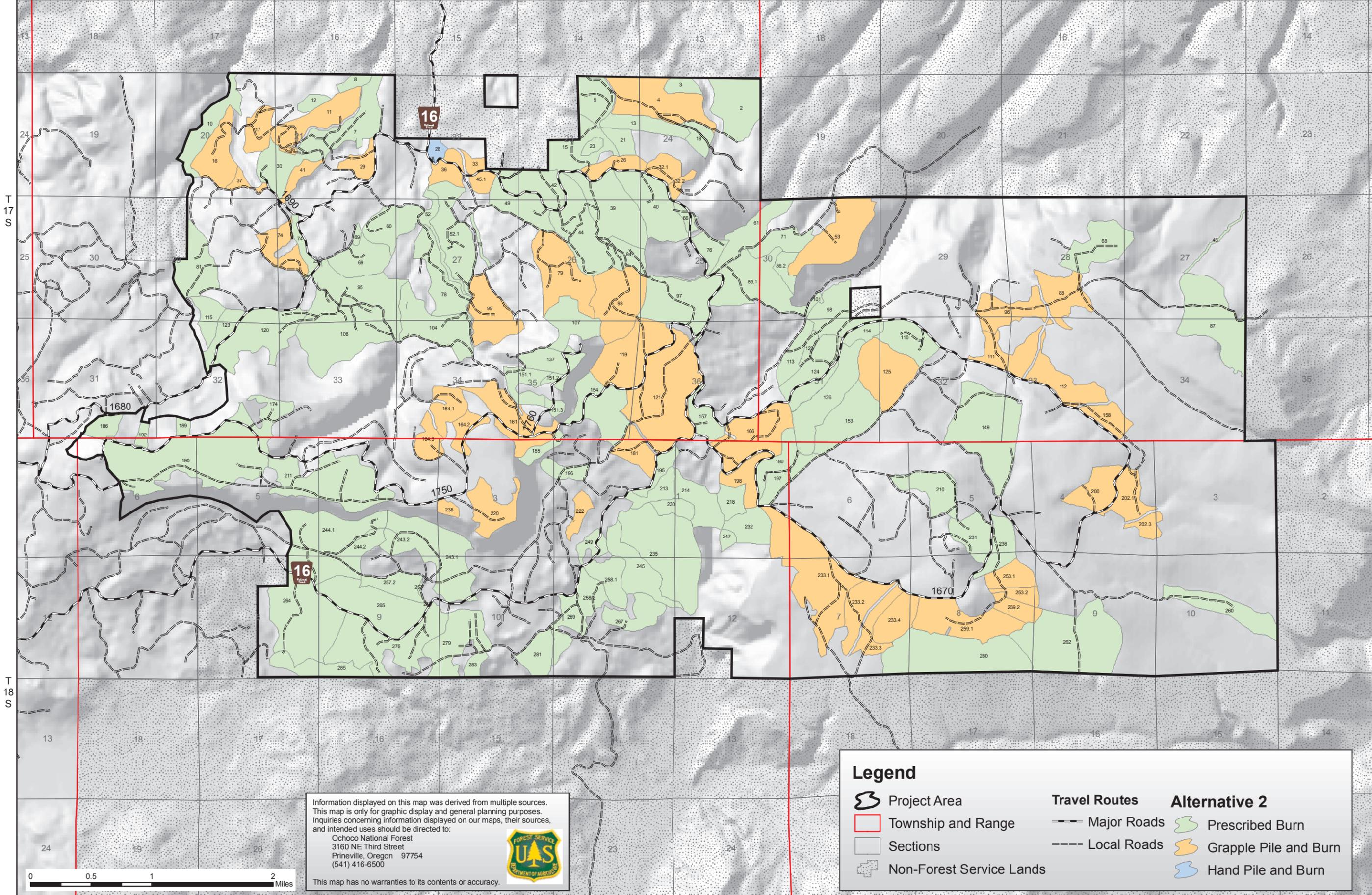


This map has no warranties to its contents or accuracy.



Legend

Project Area	Travel Routes	Alternative 2
Township and Range	Major Roads	Precommercial Thinning
Sections	Local Roads	Juniper Cutting
Non-Forest Service Lands	Aspen Stands	



Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500



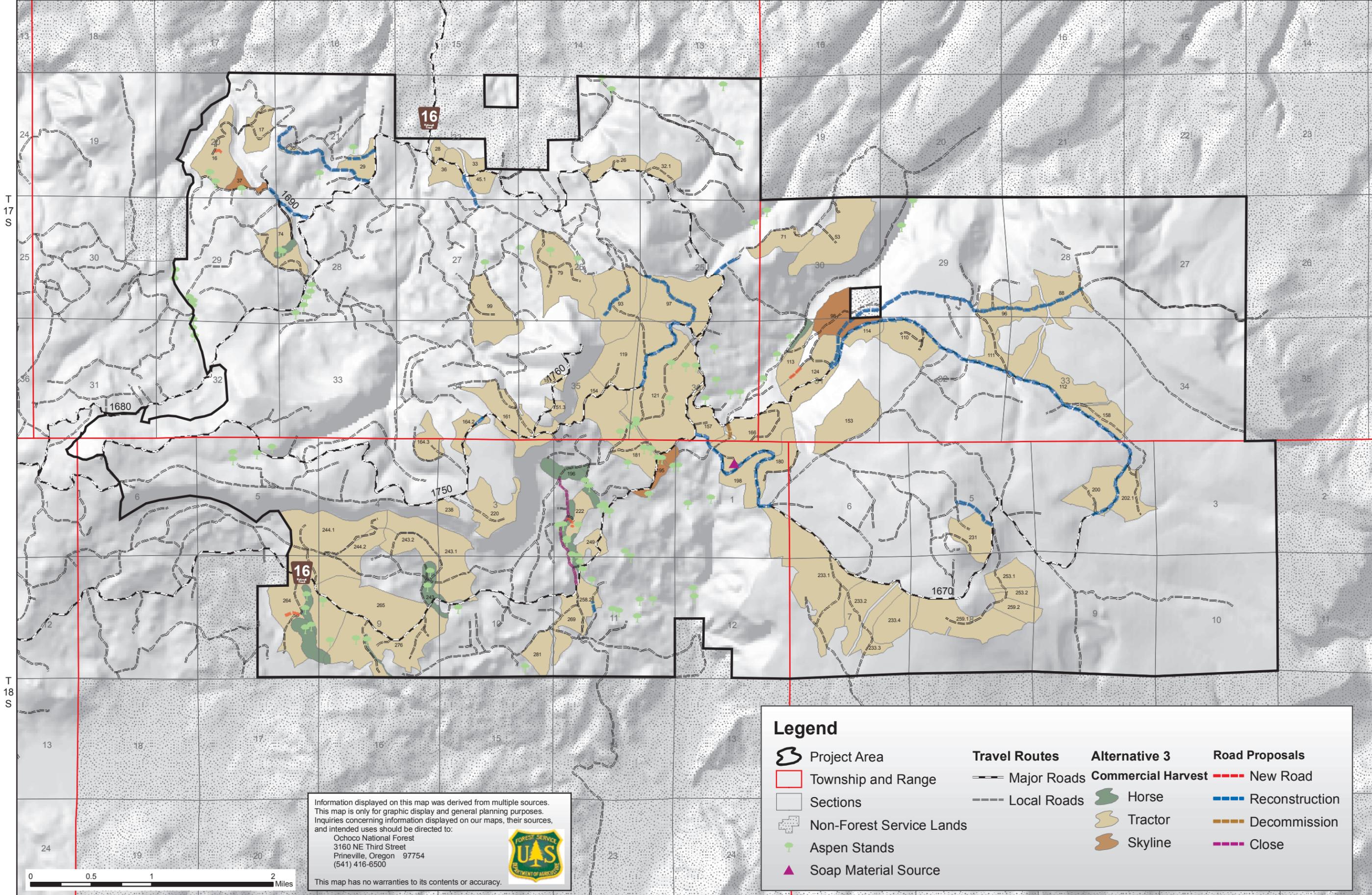
This map has no warranties to its contents or accuracy.



Legend

Project Area	Travel Routes	Alternative 2
Township and Range	Major Roads	Prescribed Burn
Sections	Local Roads	Grapple Pile and Burn
Non-Forest Service Lands		Hand Pile and Burn



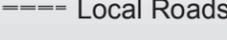
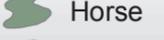
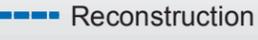
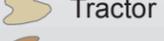
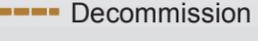
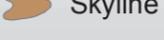
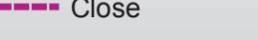


Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500

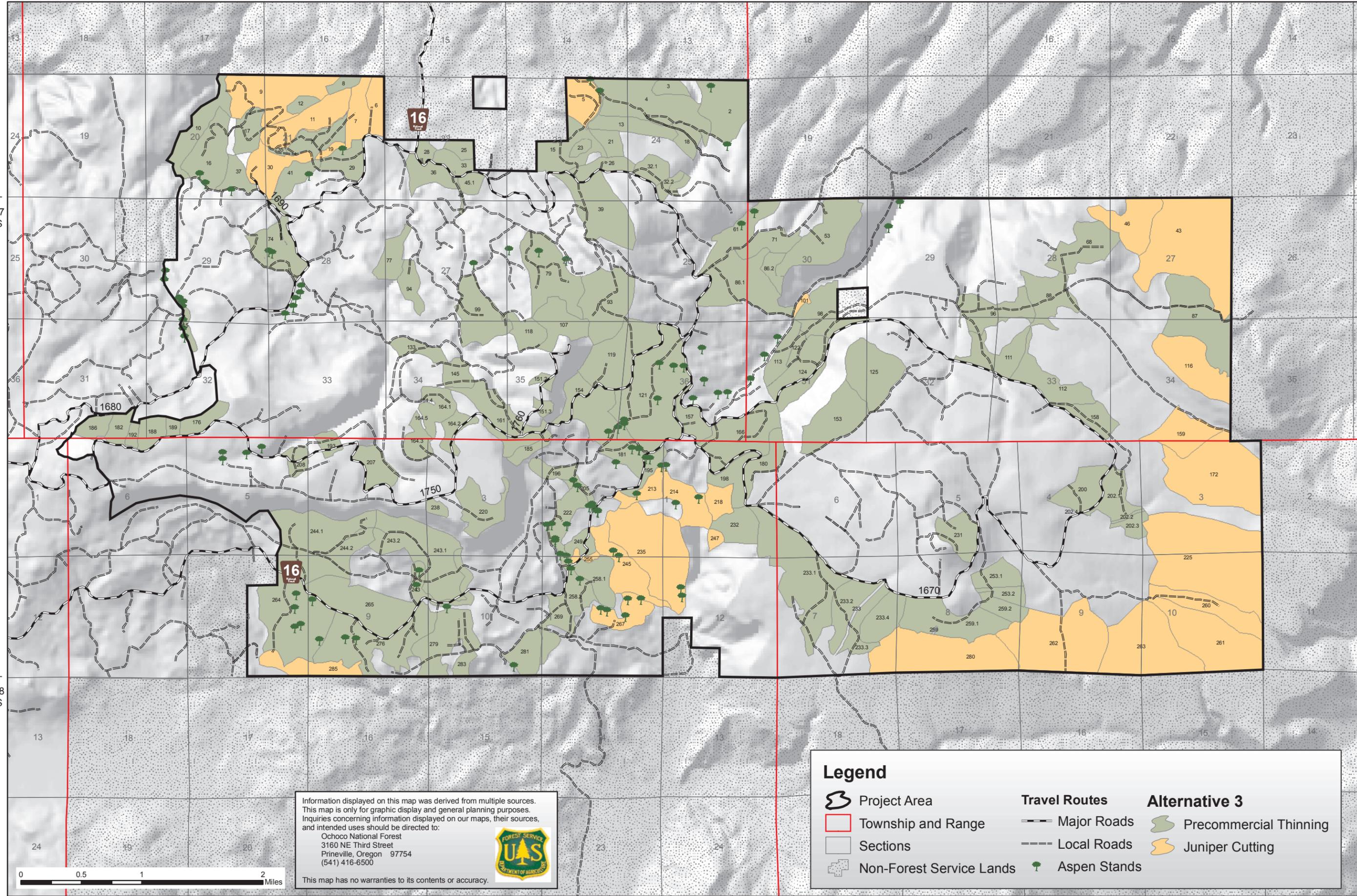


This map has no warranties to its contents or accuracy.

Legend

 Project Area	Travel Routes	Alternative 3	Road Proposals
 Township and Range	 Major Roads	Commercial Harvest	 New Road
 Sections	 Local Roads	 Horse	 Reconstruction
 Non-Forest Service Lands		 Tractor	 Decommission
 Aspen Stands		 Skyline	 Close
 Soap Material Source			





Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500

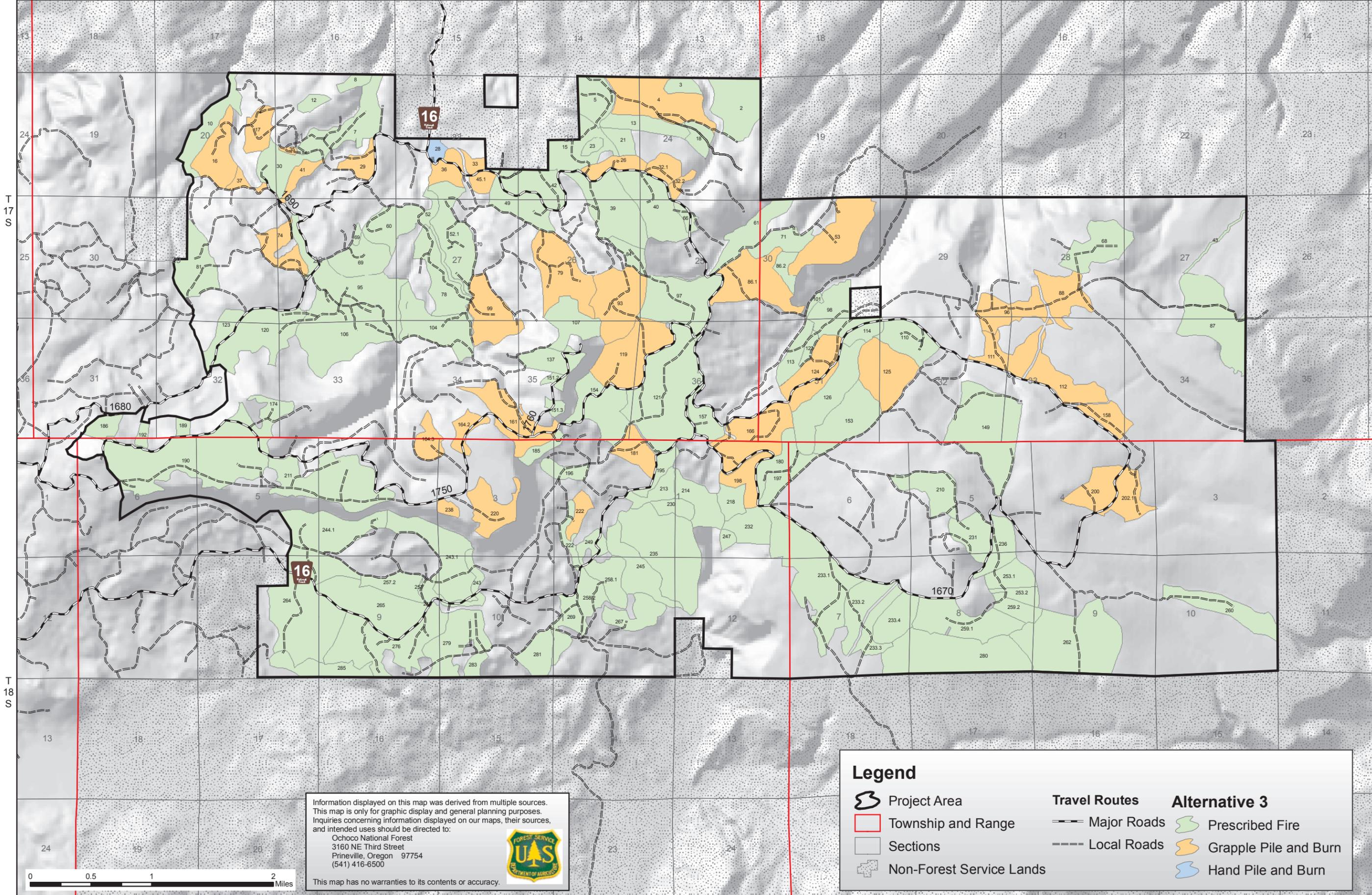


This map has no warranties to its contents or accuracy.

Legend

Project Area	Travel Routes	Alternative 3
Township and Range	Major Roads	Precommercial Thinning
Sections	Local Roads	Juniper Cutting
Non-Forest Service Lands	Aspen Stands	





Information displayed on this map was derived from multiple sources. This map is only for graphic display and general planning purposes. Inquiries concerning information displayed on our maps, their sources, and intended uses should be directed to:
 Ochoco National Forest
 3160 NE Third Street
 Prineville, Oregon 97754
 (541) 416-6500



This map has no warranties to its contents or accuracy.



Legend

Project Area	Travel Routes	Alternative 3
Township and Range	Major Roads	Prescribed Fire
Sections	Local Roads	Grapple Pile and Burn
Non-Forest Service Lands		Hand Pile and Burn

