



United States
Department of
Agriculture

Forest
Service

March, 2007



Environmental Assessment

Willow Pine Vegetation Management

Paulina Ranger District, Ochoco National Forest

Grant County, Oregon

**T.16S., R.26E., Sections 3-4, 8-11, 13-18, 19-24, 25-30, 31-35
T.17S., R.26E., sections 2-6, 8-10**

Mike Lawrence, District Ranger
Paulina Ranger District
7803 Beaver Creek Road
Paulina, Oregon 97751

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (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 to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W. Washington, D.C. 20250-9410, or call (800)759-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

SUMMARY

The Paulina Ranger District proposes to thin approximately 7,154 acres of trees to develop stand conditions and fire regimes that more closely reflect their historic range of variability. Commercial and noncommercial thinning is proposed to increase growth and vigor of residual trees, enhance forest health by removing trees damaged by insect or disease, reduce the risk of insects and disease, lower the risk of high-intensity crown fire, and reduce potential mortality resulting from inter-tree competition. The project area is located in the Southeast corner of the Paulina Ranger District, Ochoco National Forest, approximately 60 air miles east of Prineville, Oregon. The planning area is entirely within Grant County, is approximately 20,461 acres in size; and extends into two different watersheds. This action is needed to improve forest health conditions, reduce hazardous fuels, and provide wood products and opportunities for jobs as a byproduct of vegetation management.

The proposed action may remove trees between 9” and 20.9” dbh through commercial ground based logging systems from 3,211 acres. Noncommercial thinning would remove trees between 5” and 8.9” dbh from approximately 3,943 acres. Approximately 7,069 acres of prescribed fire is proposed to reduce accumulations of forest fuels. Implementation of the proposed action would also require the construction of approximately 4.5 mile of new temporary roads.

In addition to the proposed action, the Forest Service also evaluated the following alternatives:

- *No Action – There would be no change in management direction in the project area.*
- *Alternative 3 – Reduces the commercial harvest by 660 acres and noncommercial thinning by 630 acres. It also reduces the fuels reduction activities, temporary road construction, and Level 1 roads being open or closed.*

Based upon the effects of the alternatives, the responsible official will decide:

- *The specific areas, if any, that would be treated to reduce hazard-fuels and/or improve forest health.*
- *The specific activities that would occur on areas selected for treatment. These specific activities include the silvicultural systems, logging methods, and fuel treatment methods.*
- *The specific design elements included with the selected alternative.*
- *The specific monitoring included with the selected alternative.*

TABLE OF CONTENTS

Summary	1
Table of Contents.....	2
List of Tables	4
List of Figures.....	6
List of Photographs.....	6
List of Maps.....	6
Chapter 1 – Purpose of and Need for Action	7
Introduction.....	7
Background.....	8
Location of Project	8
Forest Plan Direction	9
Purpose of and Need for Action	10
Proposed Action.....	13
Decision Framework.....	14
Public Involvement.....	14
Issues	14
Chapter 2 – The Proposed Action	17
Alternatives, Including the Proposed Action	17
Alternatives Considered but Eliminated from Detailed Study	17
Alternatives Considered in Detail.....	17
Alternative 1 – No Action.....	17
Alternative 2 – The Proposed Action	17
Alternative 3	23
Comparison of Alternatives.....	27
Summary of Effects by Alternative	28
Project Design Criteria and Monitoring Requirements	29
Wildlife.....	29
Soils	30
Water Quality and Fisheries	31
Botany.....	32
Sensitive Plants.....	32
Noxious Weeds.....	32
Fuels.....	34
Range.....	36
Heritage Resources	36
Chapter 3 – Affected Environment and Environmental Consequences	37
Issue #1: Activities Proposed Within Three Core Goshawk Nesting Stands	37
Issue #2: Project Activities and the Potential to Contribute Sediment to Streams	69
Hydrology.....	69
Soils	90
Fisheries and Aquatic Resources.....	111
Wildlife Other Concerns: Big Game Habitat.....	130
Wildlife Other Concerns: National Forest Management Act Consistency – Management Indicator Species: Primary Cavity Excavators	140

Wildlife Other Concerns: Forest Plan Consistency – Connectivity.....	166
Wildlife Other Concerns: Migratory Bird Treaty Act – Migratory Birds.....	177
Wildlife Other Concerns: Public Concern: Wild Turkeys.....	181
Botany.....	186
Sensitive Plants.....	186
Noxious Weeds.....	201
Fuels Reduction Activities.....	209
Vegetation and Forest Health.....	215
Range and Grazing.....	251
Heritage Resources.....	254
Forest Wood Products and Jobs.....	258
Chapter 4.....	264
List of Preparers.....	264
Consultation and Coordination.....	265
Index.....	267
Glossary of Acronyms, Abbreviations, and Terms.....	269
Bibliography.....	281
Appendices	
Appendix A: Past Activities within the Willow Pine Vegetation Treatment Project Area.....	291
Appendix B: Estimated Soil Conditions in Proposed Units.....	293
Appendix C: Tillage Methods and Guidelines.....	297
Appendix D: Checklist for Documenting Environmental Baseline Conditions for Sunflower Creek.....	303
Appendix E: List of Federally Endangered, Threatened, and Candidate Plant Species’ Habitats and Ranges.....	309
Appendix F: Noxious Weeds Risk Assessment and Prevention Measures.....	315
Appendix G: Vegetation Effects Analysis Summary.....	317
Appendix H: Upper and Lower Management Zones for all Units in the Action Alternatives (2 and 3).....	319
Appendix I: Willow Pine Treatment Descriptions.....	321
Appendix J: Projections with the Forest Vegetation Simulator (FVS) that Model Commercial Thinning Treatments.....	323
Appendix K: Habitat Needs: The Pileated Woodpecker and Other Primary Cavity Excavators.....	325
Appendix L: Application of Water Quality BMPs, INFISH, and LRMP Standards and Guidelines.....	331
Appendix M: Willow Pine Alternative 2 and 3 Proposed Treatment Units.....	339

LIST OF TABLES

1. Alternative 2 – Proposed Action, Proposed Treatments	20
2. Alternative 3, Proposed Treatments.....	24
3. Comparison of Alternatives	27
4. Summary of Effects by Alternatives.....	28
5. Stand Exam Summary, Stand 153	42
6. Stand Exam Summary – Stand 209	43
7. Stand Exam Summary – Stand 749b	44
8. Acres of Commercial and Non-Commercial Thinning in PFA Habitat by Territory, Alternative 2	56
9. Acres of Commercial and Non-Commercial Thinning in PFA Habitat by Territory, Alternative 3	61
10. Summary of Changes in Nesting Habitat Components over Time for Alternatives 1 and 3	64
11. Summary of Changes in Nesting Habitat Components over Time for Alternative 2	64
12. Equivalent Harvest Area (FS Administered Land).....	71
13. Forested Area within Willow Pine Watersheds.....	73
14. Harvest Unit Slopes > 35% Which Would Require Pulling Cable.....	78
15. Stream Crossing on New and Reopened Roads.....	78
16. Harvest Unit Slopes >35% Which Would Require Pulling Cable.....	79
17. Stream Crossing on New and Reopened Roads.....	80
18. Willow Pine Planning Area 7 Day Average Max Water Temperatures	86
19. Soil Resource Inventory Landtype Hazard Ratings.....	91
20. Existing Detrimental Disturbance Classes by Proposed Activity Units	94
21. New Temporary Roads within Proposed Units for Alternative 2.....	98
22. Estimated Soil Loss/Acre/Year for SRI Erosion Hazard Ratings.....	103
23. Acres of Commercial Harvest Units Immediately Adjacent to RHCAs.....	103
24. Alternative 2 <u>Potential</u> Soil Loss Reaching RHCA Buffer Boundaries.....	104
25. New Temporary Roads within Proposed Units for Alternative 3.....	107
26. Acres of Commercial Harvest Units Immediately Adjacent to RHCAs.....	109
27. Alternative 2 Potential Soil Loss Reaching RHCA Buffer Boundaries.....	110
28. Determination for Threatened, endangered, Sensitive, and Proposed and Management Indicator Species or Designated Critical Habitat.....	114
29. Baseline Conditions on Named Representative Streams with the Project Area	116
30. Miles of Road within RHCA under Alternatives 2 and 3	123
31. Comparison Between Alternatives 2 and 3 for Selected Project Elements	128
32. Population Statistics from 2001 to 2006 for the Ochoco Wildlife Management Unit.....	131
32. Management Standards for HEI and Open Road Density, and Corresponding Values for Percent Area Cover and Cover Quality for General Forest (MA-F22) and Winter Range (MA-F20) in the Project Area, Decade Two.....	131
34. Habitat Effectiveness Index Values for Alternative 1/Existing Condition	133
35. Habitat Effectiveness Index Values for Alternative 2	136

LIST OF TABLES, CONT.

36. Habitat Effectiveness Index Values for Alternative 3 137

37. Summary by Alternative and Comparison to Forest Plan Standards for HEI 139

38. Snag Retention Rates for Plant Association Groups on the Ochoco National Forest..... 142

39. Dedicated Old Growth Habitat in the Willow Pine Project Area 142

40. Seral Stage, Abundance, Dominant Tree Species, and Departure from HRV for
Each PAG 150

41. List of Harvest Units by Treatment Type Affecting Connectivity Habitat for
Alternative 2 172

42. List of Harvest Units by Treatment Type Affecting Connectivity Habitat for
Alternative 3 173

43. Sensitive Plant Species with Suitable Habitat or Known Locations within the
Willow Pine Project Area 187

44. Sensitive Plant Species That Do Not Have Potential Habitat within the Willow
Pine Area 189

45. Suitable Habitat for Sensitive Species in the Willow Pine Project Area 190

46. Summary of Proposed Activities By Alternative..... 190

47. Past Harvest Activity in the Willow Pine Project Area 193

48. Alternative Effects Summary to Sensitive Plant Populations and Habitat for
the Willow Pine Area..... 200

49. Noxious Weeds within the Willow Pine Project Area 202

50. Past Harvest Activity in the Willow Pine Project Area 204

51. High Risk Actions for the Introduction and Spread of Noxious Weeds 207

52. Fire Regimes 212

53. Historic and Current Condition of Fire Regimes in Willow Pine, and the Effects by
Alternative on Fire Regimes 213

54. Viable Ecosystems Seral/Structural Matrix 216

55. Plant Association Groups within the Willow Pine Project Area 220

56. Seral Stage, Abundance, Dominant Tree Species, and Departure from HRV
for each PAG 220

57. Tree Size and Abundance by PAG for Stands Classified as Overly Dense (“a”)
(suitable lands only) Compared to HRV..... 223

58. Acres That Contain Various Levels of Large-Diameter Ponderosa Pine Growing
Under Dense Conditions within the Sunflower Project Area 223

59. Historic Ranges and Existing Condition for Both Multi and Single-Stratum
LOS Conditions 224

60. Acreage Susceptible to Insects and Diseases Because of High Stand Densities by
Hazard Rating and PAG 225

61. Acres Affected by Two Pine Bark Beetle Species Between 2002 and 2004 in the
Sunflower Project Area as Determined from Aerial Insect Detection Surveys..... 226

62. Vegetation and Forest Health Standards and Guidelines Applicable to the Project
Area 229

63. Past Harvest Activity in the Willow Pine Project Area 235

64. Acreage of Mechanical Treatments (HTH, HIM,NCT) for each Alternative by
PAG and Seral Stage 237

LIST OF TABLES, cont.

65. Seral Stage Departure by PAG for Each Alternative.....	238
66. Acreage and HRV Departure of Stands Classified as Overly Dense for Each Alternative Following Proposed Treatments	239
67. Treatment Acreage of Late or Old Structure (LOS) Stands by Alternative and Acreage of LOS Immediately Following Treatment and After 30 Years.....	241
68. Late or Old Structure (LOS) HRV Departure Acres by Alternative.....	242
69. Mechanical Thinning Treatment (HTH, HIM, NCT) Acreages and Percentages of the Total Hazardous Stand Conditions	243
70. Summary of Selected Attributes by Alternative	250
71. Central Oregon Population Growth	258
72. Total Employment and Income.....	261

LIST OF FIGURES

1. Representative Turbidity	75
2. Representative Suspended Sediment	75
3. Willow Pine Direct Sediment Potential	77
4. Wildfire/PNF Delivered Sediment.....	81
5. Wildfire Surface Erosion Curve	81
6. Willow Pine Planning Area RER.....	83
7. Sunflower Creek Temperatures	87
8. Wildcat Creek Temperatures	87
9. Sensitive Plant Locations within the Willow Pine Project Area.....	188
10. Noxious Weed Locations within the Willow Pine Project Area.....	203
11. Distribution of Plant Association Groups (PAGs) Across the Willow Pine Project Area	219

LIST OF PHOTOGRAPHS

1. Overly dense small (9-20.9” dbh) sized ponderosa pine stand that was previously non-commercially thinned to a narrow spacing and is typical of many stands within the Project Area.	222
2. Desired condition immediately following treatment for a mesic ponderosa pine stand dominated by 100 year old trees. Most trees are 12-21” dbh and stand density ranges from 35 to 60 TPA.	231

LIST OF MAPS

1. Willow Pine Vicinity Map.....	9
2. Willow Pine Fuels and Vegetation Management Project EA, Alternative 2	21
3. Willow Pine Fuels and Vegetation Management Project EA, Alternative 3	25
4. Northern Goshawk Post Fledgling Areas and Nest Stands.....	39
5. Pileated Woodpecker Habitat and Dedicated Old Growth	144
6. Dedicated Old Growth, LOS, and Connectivity Corridors.....	168
7. Alternative 2: Dedicated Old Growth, LOS, and Connectivity Corridors.....	171
8. Alternative 3: Dedicated Old Growth, LOS, and Connectivity Corridors.....	175

CHAPTER 1 PURPOSE OF AND NEED FOR ACTION

Introduction

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

Chapter 1

- *Introduction*: This section includes information on the history of the project proposal, the Purpose of and Need for Action; a brief description of the agency's proposal for achieving that purpose and need, the Proposed Action; and provides details as to how the Forest Service informed the public of the Proposed Action and the public's response.

Chapter 2

- *Comparison of Alternatives, including the Proposed Action*: This section provides a more detailed description of the agency's Proposed Action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on key issues raised by the public and other agencies. This discussion also includes possible design criteria. Finally, this section provides a summary table of environmental consequences associated with each alternative.

Chapter 3

- *Environmental Consequences*: This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized first by issues and then by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.

Chapter 4

- *List of Preparers*
- *Consultation and Coordination*: This section provides a list of individuals and agencies consulted during the development of this environmental assessment.
- *Index*
- *Glossary*
- *Bibliography*
- *Appendices*: The appendices provide more detailed information to support the analyses presented in the environmental assessment.

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

Background

Organized and effective fire suppression began with the establishment of the National Forest System in the early 1900s. Although some fires occurred within the Willow Pine Project Area, records indicate that from 1970 to 2001, 83 fires occurred and affected 25 acres. 86% of the fires were lightning caused.

The reduction in the amount of area affected by fire as a disturbance process is substantial. For the same time period noted above (1970 to 2001 approximately 30 years), expected burn acres under historic conditions would be about 34,000 acres. About 60% of these historic burn acres would have been at low, non-lethal intensities that maintained the dominance of early seral species.

During the summer of 2002, dry lightning storms occurred over the Willow Pine Project Area, resulting in the Murray Flat fire. This fire was approximately 341 acres of high severity, stand replacement. Stand conditions before the fire included overstocking by small diameter, understory trees. Bark beetles had been thinning clumps of these smaller diameter trees leaving high levels of down wood. These conditions contributed to the severity of the fire.

The effect of the reduction in fire occurrence has been to allow forest vegetation succession to advance, increasing the amount of mid- and late-seral species in forest stands, increasing the density of stands and development of multi-layer forest canopies. These vegetative changes have resulted in increased inter-tree competition-related mortality as well as insect and mistletoe related mortality. This in turn has contributed to increased levels of surface fuels and organic material. Vegetation and fuel conditions now support higher levels of more severe wildfire than 150 years ago.

During the later 1800s and early 1900s large herds of domestic livestock used the area for grazing. Livestock grazing use has continued to the present but under an evolving management regime. In general, livestock grazing influences the occurrence of fire by reducing the amount of fine fuels such as grasses and forbs that may reduce the spread potential of fires. However, under today's stand conditions, many stands no longer have the historical levels of the grass and forb understory component due to relatively closed tree canopies and needle duff build-up.

Logging has also affected the stand conditions influencing fire behavior and occurrence. Past logging tended to concentrate on large mature ponderosa pine trees that dominated the Willow Pine Project Area. Early timber management focused on reducing the threat of insect damage to these trees by removing those exhibiting characteristics of insect susceptibility. Later, timber management focused on the maintenance of younger, fast growing, and healthy stands of even-aged trees while removing the larger, slower growing trees. Understory thinning of poles and saplings were limited. Stands of young, small diameter trees are more susceptible to fires at lower intensities than the large tree dominated open stands. Young, small trees also act as ladder fuel thus increasing the risk of crown fires.

Location

The Willow Pine Project Area is located in the southeast corner of the Paulina Ranger District, approximately 60 air miles east of Prineville, Oregon. The planning area is entirely within Grant County; is approximately 20,461 acres in size; and extends into two different watersheds. These watersheds are the Middle South Fork of the John Day River and Upper Beaver Watersheds. The Willow Pine Planning Area is located in T.16 S., T.17 S., R.26 E. Elevations within the planning area range from approximately 3,920 to 5,760 feet.

Together, these documents are referred to as the amended Forest Plan. Additional guidance for the project area is provided by Viable Ecosystems Model (Simpson et al. 1994), the Joint Aquatic and Terrestrial Programmatic Biological Assessment for Federal Lands within the Deschutes Basin Administered by the Bureau of Land Management Prineville Office and all lands within the Deschutes and Ochoco National Forest (2006), and the Final Environmental Impact Statement for the Pacific Northwest Region Invasive Plan Program (2005).

Forest Plan Management Areas and acreages within the project area are described below:

- **General Forest MA-F22:** The majority of the Willow Pine Project Area, approximately 17,914 acres or about 87% of the area is allocated to General Forest Land Management. Management emphasis is to produce timber and forage while meeting Forest-wide standards and guidelines for all resources (Forest Plan, p. 4-86).
- **Winter Range MA-F20:** A relatively small portion of the Willow Pine Project Area, approximately 212 acres or about 1% of the area is allocated to Winter Range Land Management. Emphasis is to manage for big game winter range habitat (Forest Plan, p. 4-83).
- **Visual Management Corridor MA-F26:** A small portion of the Willow Pine Project Area, approximately 436 acres or about 2% of the area, is allocated to the Visual Management Corridor Land Management Allocation, Prescription Area A. This consists of the area alongside Forest Road 58. The objective for this area is retention of visual quality. Emphasis is to maintain the natural appearing character where management activities are usually not evident (Forest Plan, p. 4-95).
- **Old Growth MA-F6:** All or portions of three allocated old growth areas, approximately 674 acres or 3% of the area are located within the Willow Pine Project Area. Emphasis is to provide habitat for wildlife species dependent on old growth stands (Forest Plan, p. 4-58).
- **Riparian Habitat Conservation Areas:** Approximately 1,581 acres or about 8% of the area within the Willow Pine Project Area is within Riparian Habitat Conservation Areas (RHCAs). The Forest Plan was amended in the 1990s by the Inland Native Fish Strategy (INFISH) and Interim Strategies of Managing Anadromous Fish-producing Watersheds in Eastern Oregon, Washington, Idaho, and portions of California (PACFISH). These amendments are described above. Streams within the project area are managed according to this direction.

Purpose of and Need for Action

The purpose of and need for the Willow Pine Project is to improve forest health conditions, reduce hazardous fuels, and provide wood products and opportunities for jobs as a byproduct of vegetation management. The purpose and need is based on a comparison of the existing conditions found in the Willow Pine project area and the desired future conditions provided in management and guidance for the area (a description of which can be found in Forest Plan Management Area goals and objectives, Forest-wide and Management Area standards and guidelines, as amended by INFISH and Regional Forester Amendment #2, and the affected environment section of this document). 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. The following describes in more detail the elements needing change.

Vegetation/Forest Health

There is a need for seral and structural conditions of forest stands to more closely reflect their historic ranges of variability, maintaining and increasing late and old structured stands; and increased resistance of forest stands to insects and disease. Removing diseased trees, reducing stand density, and modifying tree species composition would improve tree growth and vigor, reduce tree and stand susceptibility to damaging insects and diseases, and improve the distribution of stand structures across the forest landscape, including late and old structure.

Discussion: 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.

Excess structural stages include stands dominated by trees from 5 to 20.9 inches dbh, often with dense stocking in the understory. These stands are crowded and highly susceptible to a variety of pathogens. These include bark beetles, defoliating insects, dwarf mistletoe, and root diseases. As a result of these and other forest pathogens, tree mortality is occurring across the project area is occurring and without stand improvements, there is a high probability of it continuing and perhaps increasing in the future. Stand treatments (commercial thinning, noncommercial thinning, and prescribed fire) are needed to remove diseased trees, reduce tree density and competition between trees and to increase the vigor of the remaining trees. Tree vigor is a major factor in the overall health of the forest. If the majority of the trees in a given area have high 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 co-dominant trees (Cochran 1993). This is important given the existing low amount of large trees and the time and growth needed to develop large structure. Treatment would move these stages towards the development of deficient stages dominated by large trees.

The historic amount of area dominated by large trees is estimated to have ranged from 7,100 acres to 12,000 acres (amounts do not include western juniper plant associations). At present, there are approximately 750 acres dominated by late and old structure, and almost of all of this acreage has dense understories. 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 understories of fir (520 acres) would result in the reduction of the amount of shade-tolerant species and move the stands towards early-seral species conditions.

Fuels

There is a need for the distribution of fire regimes to be more representative of their historic ranges of variability by reducing the area susceptible to high-intensity fire conditions, maintaining existing areas with low-intensity fire conditions, and isolating areas maintained with high-intensity fire conditions by treating fuels adjacent to them

Discussion: Historically, the dominant fire regime in the Willow Pine project area was a regime of low-intensity fire with an average fire return interval of less than 25 years. This was typical of the low-elevation, semi-arid, ponderosa pine-dominated forests of the American west. The frequent

return interval of fire kept forest stands open and surface fuels light. In the absence of frequent, low-intensity fires, many forested stands have developed multi-canopy conditions, increased stocking levels, increased ladder fuels, increased surface fuels, and increased abundance of fire-intolerant and shade-tolerant species. These changes have resulted in more forested stands being susceptible to high-intensity wildfire, increasing the potential for an unwanted loss of trees, soil productivity, wildlife habitat, and other forest resources. High-intensity fire conditions also limit the suppression options available to firefighters, often forcing firefighters to employ suppression tactics with increased costs and lower success rates.

The desired condition for low-intensity fire regime ranges from approximately 8,600 to 12,800 acres with the existing condition at approximately 3,200 acres. 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. The desired condition for mixed-intensity fire regimes ranges from approximately 5,300 to 8,400 acres with the existing condition at approximately 8,500 acres. There is a need to reduce the amount of mixed intensity fire regimes by reducing surface and ladder fuels. The desired condition for high intensity fire regimes ranges from approximately 400 acres to 2,500 acres with the existing condition at approximately 8,700 acres.

Also, forested stands that currently have low-intensity fire conditions require periodic treatment to maintain those conditions. Without treatment, surface fuels accumulate, multiple canopy layers develop, fire-intolerant species become more abundant, and the potential for high-intensity fires increases.

The purpose of creating these vegetative and fuel conditions across the landscape is to decrease the possibility of high-intensity wildfire occurring across the Willow Pine project area.

Forest Wood Products and Jobs

There is a need for sustainable local and regional social and economic systems. Providing wood products and other forest management opportunities would help contribute to sustaining these systems.

Discussion: The Forest Service has a multiple-resource mission that includes provision for a sustainable supply of wood products from the National Forests. The Multiple-Use Sustained Yield Act as amended by the National Forest Management Act (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 been identified where the primary emphasis is to produce wood products for the local and regional economies. These management area allocations within the project area are General Forest (17,914 acres) and General Forest Winter Range (212 acres) and constitute approximately 18,126 acres of the 20,461 acre project area. In addition, other management area allocations, when meeting applicable standards and guidelines, can also produce wood products as a secondary result 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.

The counties, (Grant, Harney, Wheeler and Crook) surrounding the project area with the most potential to benefit from the activities and products created by the Proposed Action have consistently had unemployment rates significantly higher than the State average. For instance, Grant County, where the project is located, had a January unemployment rate of 12.2 percent, as compared to a State wide average of 6 percent. In addition, Grant was one of only five Oregon Counties with a decline in non-farm employment in 2005. Although many local economies are less dependent on wood products than they have been in the past, wood products remain an important source of jobs and income. Timber harvest and the manufacture of lumber and wood products, road work, noncommercial thinning, piling of small woody debris (slash), and prescribed fire 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.

Proposed Action

The following is a summary of the Proposed Action that was mailed to interested individuals, organizations, and other agencies, along with maps, during December 2006. Commercial and noncommercial thinning is proposed to increase growth and vigor of residual trees, enhance forest health by removing trees damaged by insect or disease, reduce the risk of insects and disease, lower the risk of high-intensity crown fire, and reduce potential mortality resulting from inter-tree competition. Trees between 9” and 20.9” dbh would be commercially harvested from 3,211 acres. Ground based logging systems would be used to remove commercial timber from harvest units. Noncommercial thinning would remove trees between 5” and 8.9” dbh from approximately 3,943 acres. Noncommercial thinning would occur on many of the acres proposed for commercial harvest as well as 1,340 acres outside of harvest units. Approximately 7,070 acres of prescribed fire is proposed to reduce accumulations of forest fuels. This would include underburning to reduce fuels from commercial and noncommercial thinning (activity fuels – 4,551 acres), and underburning other stands to reduce naturally occurring fuels (natural fuels – 2,519 acres). Prescribed fire would be used to regenerate grass, forbs, and shrubs; and reduce encroachment of grand fir, Douglas-fir, and western juniper into pine stands. In addition, approximately 640 acres of grapple and hand piling is proposed to reduce concentrations of heavy surface fuels in commercial and noncommercial thinning units where prescribed fire alone is not feasible.

Implementation of the Proposed Action would require the construction of approximately 4.5 miles of new temporary road and the use of approximately 20 miles of presently closed Level 1 roads. Temporary roads would be decommissioned and Level 1 roads closed following the completion of harvest activities. Approximately 2.0 miles of existing system roads within or accessing treatment units would be reconstructed to restore the road for timber hauling. No new system road would be constructed.

A Forest Plan Amendment would be required to implement the Proposed Action because commercial harvest is proposed in 3 stands (units 12, 55, & 94) where active or historical goshawk nest-sites are known to occur.

For a more detailed description of the Proposed Action refer to Chapter 2, page 17-20. For a listing of units proposed for activities under Alternatives 2 and 3 refer to Appendix M, page 339.

Decision Framework

Based upon the effects of the alternatives as they relate to the Purpose and Need and Issues, the responsible official will decide:

The specific areas, if any, that would be treated to reduce hazard-fuels and/or improve forest health.

The specific activities that would occur on areas selected for treatment. These specific activities include the silvicultural systems, logging methods, and fuel treatment methods.

The specific design elements included with the selected alternative. Specified project design elements associated with actions such as road reconstruction and temporary road construction, and specific provisions such as Best Management Practices and design criteria.

The specific monitoring included with the selected alternative.

Public Involvement

The proposal was listed in the Ochoco National Forest Schedule of Proposed Actions beginning with the Winter, 2004 issue through present.

The initial proposal was developed by the Forest Service and was provided to the public, other agencies and the Tribes on July 12, 2005.

A field trip was conducted on July 28, 2005 for those interested in helping the Paulina Ranger District develop treatments for Willow Pine Project. Individuals representing the National Wild Turkey Federation, the US Fish and Wildlife Service, the Confederated Tribes of the Warm Springs Reservation, private landowners as well as the Forest Service attended this field trip.

A Proposed Action was provided to the public, other agencies and the Tribes for a scoping period that began December 16, 2005.

Issues

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

The Forest Service assessed the project issues and determined that there two were “significant” issues, otherwise known as key issues. Key issues were defined as those directly or indirectly caused by implementing the proposed action, which along with the purpose and need would be the primary factors used in making the project decision. In addition to key issues, a number of other resource topics were addressed in the effects analysis.

As for key issues, the Forest Service identified two that were raised during scoping. These issues include:

Issue #1

Activities (pre-commercial and/or commercial thinning) proposed within three core goshawk nesting stands could adversely affect the quality of nesting habitat, by reducing stand structure and altering canopy closure, thereby negatively affecting reproductive success of goshawk pairs.

Measures:

- Changes to density and structure of the nest stand over time.

Issue #2: Soil disturbance from roads used as haul routes (the activities of opening existing non-system roads, the resurfacing of open roads, new temporary road construction), and harvesting and fuel treatment activities have the potential to contribute sediment to streams, thereby affecting water quality and fish habitat.

Measures:

- Miles of new road construction and miles of non-system roads opened within 400 feet of streams.
- Acres of harvest and fuel treatment activities in units 400 feet from streams.
- Number of stream crossings by all new/existing roads used as haul routes.

This page intentionally left blank.

CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Alternatives, Including the Proposed Action

This chapter describes and compares the alternatives considered for the Willow Pine 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. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., the number of acres treated) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e., the amount of erosion or miles of Level 1 road opened and re-closed).

Alternatives Considered But Eliminated From Detailed Study

An alternative was considered that limited commercial harvest to trees between 9 and 12 inches dbh. This alternative would have retained much of the noncommercial thinning, fuels management activities, and road work described under the Alternatives 2 and 3. It would have partially met the purpose and need by reducing natural fuel levels and stand densities in the 5 to 12 inches dbh size class and by providing a limited amount of wood products and opportunities to sustain local and regional social and economic systems. However, this alternative would not have addressed significant elements of the purpose and need related to improving forest health and providing opportunities for jobs as a byproduct of vegetation management.

The Forest Vegetation Simulator, a stand growth and yield model, was used to project commercial thinning treatments with a 12" dbh upper cutting limit constraint. These projections indicate that residual density objectives that would not be achieved on approximately 30% of a stands' acreages. In addition, a 12" dbh upper diameter cutting limit would render units with that restriction non-viable from a commercial standpoint because of the small average cut tree size and the small volume per acre to be removed. To accomplish the thinning as a noncommercial project would require the same equipment and result in the same environmental effects as a commercial sale but would require payment to a contractor of \$200-\$300 per acre instead of a return to the Government of \$100-\$200 per acre that would result from a timber sale.

Alternatives Considered In Detail

Alternative 1 – No Action

Alternative 1 is the No Action Alternative. This alternative serves as a baseline for comparison of the effects of all the alternatives. There would be no change in current management direction.

There would be no stand density management treatments. Stands would continue to incur mortality and trees would continue to be at risk of loss due to competition among trees. Current levels of insects would probably increase due to the high-density conditions, leaving trees vulnerable to attack. Late and old structured (LOS) stands would remain multi-strata with dense stand conditions resulting in competition for resources among trees. Trees, including large diameter trees, would remain at a high risk of mortality due to overly dense stand conditions coupled with the increased risk of stand replacement fire events.

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. Fuel regimes would not be representative of historic conditions.

Local and regional social and economic systems would not be sustained through timber sale activities or service contracts for noncommercial thinning and fuels treatment contracts. There would be no jobs supported through management activities or economic benefit to local and regional economies.

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

Alternative 2 – Proposed Action

This alternative was developed to respond to the purpose and need for action described in Chapter 1. Commercial and noncommercial thinning, prescribed burning, grapple piling, and hand piling are designed to develop stand conditions and fire regimes that more closely reflect their historic range of variability. Proposed treatments would reduce stand densities, reduce surface and ladder fuels, and reduce the risk of stand loss due to high fuel loadings. In addition, this alternative would maintain existing desired fuel levels that currently exist, increase forested stands' resiliency to insects and disease, and accelerate the development of forested stands towards late and old structured stand conditions. 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 noncommercial vegetative treatment reflect several structural seral stages and are focused in stands with a large component of pole and small sized (under 21 inches dbh) trees with dense stocking conditions. A number of these stands (units 3, 17, 22, 23, 55, 62, 86, & 87) contain smaller diameter shade-tolerant species that have increased in numbers in the absence of fire and would not normally be found at these high densities if fire suppression had not occurred over the last several decades. A majority of the stands proposed for treatment contain large amounts of small diameter ponderosa pine under overstories of ponderosa pine and are a result of fire suppression. Reducing the stocking of the stands to the recommended stocking level allows remaining trees to capture most of the site resources without competition between trees. This reduced competition increases the rate of tree growth, both in diameter and height, increases trees' resiliency to insect and disease attacks, and increases the trees' ability to survive during adverse conditions such as drought. The objective of these treatments is to also move stands towards late and old structural stage conditions in a more rapid timeframe than would occur with no treatment. Commercial vegetative treatments would occur on slopes less than 35 percent and would be accomplished with ground-based harvest systems. Refer to the maps of Alternative 2 for the locations of treatments associated with Alternative 2.

Stands selected for fuels reduction activities are (1) stands that have undergone some type of management and fuels are present as a result (activity fuels), (2) stands that exhibit a high level of fuels resulting from the natural accumulations of material from mortality, or (3) stands that exhibit low-intensity fire conditions that require periodic treatment to maintain that condition. Increased natural fuel loadings have resulted from years of fire suppression allowing shade-tolerant seedlings and saplings to increase creating a ladder for wildfire to reach into the crowns of larger trees. In addition, fire suppression has resulted in increased down wood levels, especially in the smaller

diameter size classes and deeper duff layers. In the event of a wildfire, all these factors contribute to a higher intensity fire resulting in a decreased ability for successful fire suppression activities. Additionally, in areas of higher fuel loadings, uncontrolled fire could result in damage to residual trees. The objective of these treatments is to move stands towards conditions with lower fuel loadings to approximate conditions when fire occurred in lower intensities and higher frequencies. Naturally occurring and the activity fuels would be treated using a combination of prescribed fire, grapple piling, hand piling, or lopping.

In most cases, the objective of treatment in Alternative 2 is to approximate more historical structural stage conditions, species compositions, and fire regimes that would have resulted if fire suppression over the last several decades had not occurred. The resulting conditions would reflect fire-adapted systems with more open stands; less seedling, sapling and pole sized trees; and more large-diameter, fire-tolerant species such as ponderosa pine and Douglas-fir.

The proposed action includes road work. Approximately 4.5 miles of temporary roads would need to be constructed to reach stands identified for commercial harvest. Temporary roads would be decommissioned after use. Approximately 2.0 miles of existing road would be reconstructed by doing spot rocking, erosion control measures, or brush clearing within the road prism to reduce resource impacts and facilitate timber haul. Approximately 20 miles of presently closed Level 1 roads would be reopened and used for commercial harvest. Following the completion of harvest activities these roads would be closed.

For a listing of units proposed for activities under Alternatives 2 refer to Appendix M, page 339.

Forest Plan Amendment

During the evaluation of the proposed action against current management direction it was determined that certain treatments were not consistent with Forest Plan direction. The following is a discussion of the direction, the treatment considered inconsistent, and the potential need for a Forest Plan amendment.

1. The Eastside Screens (Wildlife Standards, Screen 3, Scenario A) require protection of every known active and historically used goshawk nest-site from disturbance and harvest to be deferred within 30 acres of the most suitable nesting habitat surrounding all active and historical nest(s). A Forest Plan Amendment would be needed to implement the Proposed Action because commercial harvest is proposed in 3 stands (units 12, 55, & 94) where active or historical goshawk nest-sites are known to occur. The proposed commercial thinning is designed to reduce potential loss of large overstory ponderosa pine trees which function as nest trees, replacement trees, and roosts for the adult and fledgling goshawks. One nest stand has already experienced such mortality, with over a third of the larger, over-story ponderosa pine trees dying in the past five years due to insect activity. Additional large pine trees show signs of stress and may also succumb to the insect attacks in the near future. The two remaining stands are showing signs of stress that could also lead to tree mortality. Reducing the stocking density and managing for a more appropriate species composition would reduce that risk of mortality to nest and replacement nest trees.

Table 1. Alternative 2 – Proposed Action, Proposed Treatments

Fuels Treatments and Reductions (acres)	
Underburn Activity Fuels	4,551
Underburn Natural Fuels (outside of commercial and noncommercial thinning units)	2,519
Grapple/Hand Pile	640
Lop	3,303
Total	11,013
Commercial Harvest (acres)	
Improvement Cut	460
Commercial Thin	2,651
Total	3,211
Noncommercial Vegetative Treatments (acres)	
Noncommercial Thinning (overlapping harvest units)	2,603
Noncommercial Thinning (outside of harvest units)	1,340
Total	3,943
Logging Systems (acres)	
Tractor	3,211
Total	3,211
Road Management (miles)	
Temporary Road Construction/Decommissioning	4.5
Road Reconstruction	2.0
Level 1 Roads Opened and Re-closed	20.0
Estimated Volume Associated with Commercial Harvest (million board feet)	
	6.5
Estimated Seasonal Jobs Associated with Timber Harvest (including road work)	
	104.2
Estimated Seasonal Jobs Associated with Noncommercial Thinning and Slash Treatments	
	13.7
Total	117.9

Note: Many of the acres in Table 1 are actually overlap acres. As an example, a commercial thinning unit may have noncommercial thinning, burning, lopping, and grapple piling all occurring within the same unit.

Map 2.

Willow Pine Fuels and Vegetation Management Project EA, Alternative 2 (electronic version Willow11x17_Alt2.pdf).

This page intentionally left blank.

(place holder for insertion of map into hard copy of document)

Alternative 3

Similar to Alternative 2, Alternative 3 was developed to provide a more balanced approach in responding to the purpose and need for action (Chapter 1) as well as the two key issues identified

by the interdisciplinary team. The key issues are: Issue #1- Activities (pre-commercial and/or commercial thinning) proposed within three core goshawk nesting stands could adversely affect the quality of nesting habitat, by reducing stand structure and altering canopy closure, thereby negatively affecting reproductive success of goshawk pairs and Issue #2 - Soil disturbance from roads used as haul routes (the activities of opening existing non-system roads, the resurfacing of open roads, new temporary road construction), and harvesting and fuel treatment activities have the potential to contribute sediment to streams, thereby affecting water quality and fish habitat. Like Alternative 2, the objective of proposed treatments is to approximate more historical structural stage conditions, species compositions, and fire regimes that would have resulted if fire suppression over the last several decades had not occurred. The resulting conditions would reflect fire-adapted systems with more open stands; less seedling, sapling and pole sized trees; and more large-diameter, fire-tolerant species such as ponderosa pine and Douglas-fir.

Alternative 3 addresses the two key issues identified above and in Chapter 1 by reducing commercial harvest by 660 acres and noncommercial thinning by 630 acres. Under Alternative 3 noncommercial and commercial thinning is not proposed within three core goshawk nest stands therefore the quality of nesting habitat would not be adversely affected by management activities and a non-significant Forest Plan Amendment would not be required.

In addition, Alternative 3 reduces the potential for soil disturbance and the potential to contribute sediment to streams by reducing the amount of proposed commercial and noncommercial harvest, fuels reduction activities, temporary road construction, and Level 1 roads opened and closed. Underburning (activity and natural fuels) is reduced by a total of 495 acres, and natural fuels underburning increases by 245 acres. In addition grapple/hand piling is reduced by 279 acres and lopping is reduced by 351 acres under Alternative 3.

The miles of temporary road that would be constructed to access commercial harvest units would be reduced by .6 of a mile under Alternative 3. Temporary roads would be decommissioned after use. The miles of Level 1 roads that would be opened and re-closed following commercial harvest would be reduced by approximately 8.7 miles under Alternative 2. Following the completion of harvest activities these roads would be closed. Approximately 2.0 miles of existing road would be reconstructed by doing spot rocking, erosion control measures, or brush clearing within the road prism to reduce resource impacts and facilitate timber haul.

For a listing of units proposed for activities under Alternatives 3 refer to Appendix M, page 339.

Table 2. Alternative 3, Proposed Treatments

Fuels Treatments and Reductions (acres)	
Underburn Activity Fuels*	3,810
Underburn Natural Fuels (outside of commercial and noncommercial thinning units)*	2,765
Grapple/Hand Pile	361
Lop	2,952
Total	9,888
Commercial Harvest (acres)	
Improvement Cut	412
Commercial Thin	2,139
Total	2,551
Noncommercial Vegetative Treatments (acres)	
Noncommercial Thinning (overlapping harvest units)	2,054
Noncommercial Thinning (outside of harvest units)	1,259
Total	3,313
Logging Systems (acres)	
Tractor	2,551
Total	2,551
Road Management (miles)	
Temporary Road Construction/Decommissioning	3.9
Road Reconstruction	2.0
Level 1 Roads Opened and Re-closed	11.3
Estimated Volume Associated with Commercial Harvest (million board feet)	5.1
Estimated Seasonal Jobs Associated with Timber Harvest (including road work)	82.0
Estimated Seasonal Jobs Associated with Noncommercial Thinning and Slash Treatments	11.7
Total	93.7

*Note: Many of the acres in Table 2 are actually overlap acres. As an example, a commercial thinning unit may have noncommercial thinning, burning, lopping, and grapple piling all occurring within the same unit.

Map 3.

Willow Pine Fuels and Vegetation Management Project EA, Alternative 3 (electronic version Willow11x17_Alt3.pdf)

This page intentionally left blank.
(place holder for insertion of map into hard copy of document)

Comparison of Alternatives

This section provides a summary of each alternative. Table 3 below compares the alternatives in relation to the activities proposed in Alternative 1 (No Action), Alternative 2 (Proposed Action), and Alternative 3. The major differences between Alternatives 2 and 3 are in the amount of activities proposed under each alternative.

Table 3. Alternative Comparison

Activity	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
Commercial Thinning (acres)	0	3,211	2,551
Noncommercial Thinning (acres)	0	3,943	3,313
Underburning Activity Fuels (acres)	0	4,551	3,810
Underburning Natural Fuels (acres)	0	2,519	2,765
Grapple/Hand Pile (acres)	0	640	361
Lop (acres)	0	3,303	2,952
Temporary Road Construction/Decommissioning (miles)	0	4.5	3.9
Road Reconstruction (miles)	0	2.0	2.0
Level 1 Roads Opened and Closed (miles)	0	20.0	11.3
Tractor Logging Systems (acres)	0	3,211	2,551
Estimated Volume (million board feet)	0	6.5	5.1
Estimated Seasonal Jobs	0	118	93.7

Summary of Effects by Alternative

Table 4. Summary of the Effects of the Alternatives by Issue and Purpose and Need

Issues	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
Issue 1 – Affects To Core Goshawk Nesting Stands	No activities would occur in core goshawk nesting stands.	Three territories (Spur Butte, Porcupine Creek, and Bernard Mill) would be entered with a timber harvest in the form of commercial and non-commercial thinning. A site-specific Forest Plan Amendment would be required in order to implement this alternative. No direct effects from logging operations would occur, as timing restrictions for harvest activities would be initiated as described in the Design Criteria Section of Chapter 2.	No commercial or non-commercial thinning activities would occur within core goshawk nesting stands. No direct effects from logging operations would occur, as timing restrictions for harvest activities would be initiated as described in the Design Criteria Section of Chapter 2.
Issue 2 – Affects To Water Quality and Fish Habitat	Fuel loading and the risk of high intensity wildfire would continue to increase, thereby increasing the risk to water quality and stream bank stability if a wildfire would occur. No new roads would be constructed. No roads would be re-opened and no stream crossings would be used for commercial log hauling.	No new road construction is proposed. Approximately 7.8 miles of roads would be re-opened within 400 feet of streams. Reopened roads would be closed and temporary roads would be decommissioned at completion of the sale. 7,717 acres * of harvest and burning activities would occur 400 feet from streams. Seven stream crossings would be used on haul routes.	No new road construction is proposed. Approximately 2.7 miles of roads would be re-opened within 400 feet of streams. Reopened roads would be closed and temporary roads would be decommissioned at completion of the sale. 1,925 acres* of harvest and burning activities would occur 400 feet from streams. Four stream crossings would be used on haul routes.
P&N: Vegetation and Forest Health	Species composition would continue to be above the Historic Range of Variability (HRV) by 1,275 acres. Stand structure and density would remain above HRV for 25 out of 72 structural stages; 21 would remain below HRV. Approximately 79% of the area would remain imminently susceptible to insect and disease.	Species composition would improve over the current condition by 1,178 acres among three Plant Association Groups (PAGs). Stand structure and density would be within HRV for 28 of 72 structural stages; 26 would be above HRV, and 18 would be below HRV over thirty years. Approximately forty-seven percent of the area would remain imminently susceptible to insect and disease, a reduction of thirty-two percent.	Species composition would improve over the current condition by 1,023 acres among three Plant Association Groups (PAGs). Stand structure and density would be within HRV for 28 of 72 structural stages; 25 would be above HRV, and 19 would be below HRV over thirty years. Approximately fifty-two percent of the area would remain imminently susceptible to insect and disease, a reduction of twenty-seven percent.

Issues	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3
P&N: Fuels Reduction	Approximately 5,705 acres are well below the HRV in the low intensity fire regime; 7,242 acres are approaching the upper limits of the HRV in the mixed intensity fire regime, and 4,334 acres are in the mid-range of the HRV.	Approximately 9,718 acres would be within the HRV for the low intensity fire regime; 6,671 would be within the HRV for the mixed intensity fire regime, and 892 acres would be within the lower limits of the HRV for high intensity fires.	Approximately 9,335 acres would be within the HRV for the low intensity fire regime; 6,597 would be within the HRV for the mixed intensity fire regime, and 1,349 acres would be approaching the lower limits of the HRV for high intensity fires.
P&N: Forest Wood Products and Jobs	No Forest wood products would be harvested, therefore no jobs would be created.	Approximately 6.5 million board feet (MMbf) would be harvested, creating 118 jobs.	Approximately 5.1 MMbf would be harvested, creating 93.7 jobs.

*Note: some acres of fuels and thinning treatment are overlap acres, with some proposed fuels treatments occurring on some of the same acreage after thinning activities..

Project Design Criteria and Monitoring Requirements

Wildlife

Design Elements Common to All Action Alternatives

1. Where possible, lay out landings and skid trails away from large snags or snag concentrations to prevent the need for felling with harvest and loading operations, per OSHA regulations.
2. In the Cougar Creek drainage, T16S R26E Sec 34, survey for northern goshawk territory presence to determine if a new territory exists in this area. In 2004, field surveys identified an unoccupied nest in that section. Further surveys identified presence of juvenile northern goshawks in that vicinity as well. If presence is determined and that nest is occupied by northern goshawks, or an alternate nest is located, modifications to Units 2, 3, 22, 87, 88, and 269 with selection of Alternative 2, and Unit 269 with the selection of Alternative 3 may occur with the designation of a nest stand and PFA around the active nest. Modifications may include the modification of the treatment prescription, or exclusion from treatment portions or entire units, depending upon the location of the nest stand as identified. Timing restrictions for implementation of the remaining unit(s) would be in place, with no harvest or other disturbing activities occurring between March 1 and August 31. If another species is identified occupying that nest, Forest Plan standards for nest protection and timing restrictions would be applied.
3. Specifically for Alternative 2, proposed harvest of Units 12 and 94, harvest prescriptions would be implemented such that an average stand density index (SDI) of 100-120 would be maintained post harvest where existing densities allow. In Unit 55, an average SDI of 140-155 would be maintained post harvest where existing densities allow. The purpose of this retention is to maintain a relatively high canopy closure and upper canopy complexity to support nesting northern goshawks.

Soils

Design Elements Common to All Action Alternatives

1. Soil rehabilitation of identified landings and skid trails would occur within proposed activity areas in order to meet Regional and Forest Plan Standards for detrimental soil disturbance and soil productivity.
2. Tillage mitigation would be utilized in ground-based units to rectify detrimental impacts incurred by the proposed activities where they exceeded 20% after harvest, yarding and fuels treatments were completed or where existing conditions above 20% were increased from proposed activities. Units in which this second condition occurred are expected to be brought back to levels existing prior to this entry.
3. Existing skid trails would be utilized when possible and all skid trails would be designated and approved before logging operations. New skid trails would be laid out diagonally to the slope.
4. No skidding would occur up or down Class V swales or off of designated skid trails.
5. Skid trails would be kept to a minimum along headwater and forest/scab interface areas to maintain an infiltration buffer capable of reducing overland flow volumes and energies that reach drainage way side slopes comprised of less resistant ash.
6. Skid trails would not be placed on slopes exceeding 35%. Soil types with severe erosion hazard ratings (P3, Y2, Y3, Y34, and Y4) would be avoided for placement of skid trails due to excessive slopes or mitigated with tillage and woody debris since they are comprised of moderately deep to deep ash soils. Trails that are not tilled and exceed 10% slope gradient on all soil types would have water control structures installed upon completion of harvest, skidding and fuels piling operations.
7. Harvest machinery would be excluded from scab landtypes (P5, P54 and P85).
8. Leading end of logs would be suspended above the ground during skidding or swing operations to limit soil displacement.
9. Feller-buncher traffic would be allowed off of skid trails for single out and back passes only.
10. Slopes exceeding 35% would be excluded from unit boundaries during layout or limited to feller buncher accumulation and/or line pulling.
11. Waterbars and appropriate drainage of road bed construction in scabland areas would be located to allow water to disperse on rocky apron areas before flowing onto drainage way side slopes. Rounded road crown and French drains or pipes that allow natural drainage are necessary to allow water to flow off them without concentrating flows.
12. Winter logging would be promoted in order to avoid or limit the need for soil tillage operations to rehabilitate detrimental compaction in excess of Regional Standards.

Water Quality and Fisheries

Design Elements Common to All Action Alternatives

See Appendix L for a table with additional design criteria for Water Quality.

1. For all units adjacent to Riparian Habitat Conservation Area (RHCA), no-entry flagging would be reviewed by the District fisheries biologist to protect unique aquatic habitats. Buffer zones would be 50 feet slope distance from springs, wetlands and ephemeral stream channels, 150 feet slope distance from perennial channels and 300 feet slope distance from fish bearing perennial or intermittent channels on each side of the channel before these units are marked, cruised, and harvested. Where trees greater than 12 inches within the RHCA pose a safety hazard to personnel or equipment, trees would be felled into the RHCA to provide for the large woody debris (LWD) component of the RHCA. RHCA buffer widths and locations would be designated as Areas to Protect (ATP) on the timber sale contract maps.

2. During operations, all pile burning within RHCAs would occur a minimum of 50 feet from the outer edge of riparian vegetation although the actual distance may be greater depending on surrounding slope existing ground cover and soil type. Piles would not cover more than five percent of each RHCA and would not be allowed to creep more than ten feet from any pile. Placement of piles would focus on upslope areas outside of “washes” or depressions that may concentrate upslope water run-off, transporting ash and sediments during precipitation to the stream. The Fuels manager would ensure that there will be no sediment delivery to stream channels as a result of piling and burning activities.

3. There would be no landings, new or previously constructed built or used within the RHCA.

4. The District fisheries biologist would review all Level 1 through 3 roads within the RHCA to assess road drainage conditions and needs prior to road construction or maintenance. Post-harvest, Level 1 and new temporary roads and landings would be ripped where necessary and seeded with native grasses prior to closure. Closure would follow harvest activities. Culverts, water bars, and landings would be reviewed by the Fisheries biologist following scarification and seeding.

5. During grapple piling, piles would not be placed within 50 feet of the outside edge of the RHCA. Piles would not be greater than six feet high. Prior to initiating this type of piling, the Fisheries biologist would review the ground in the area of Units 55, 62, 84, 87, 88, 90, 91 and 94 adjacent to unnamed tributaries to Sunflower Creek, Cougar and Porcupine creeks from springs, seeps and wetlands..

6. Fireline built with handtools (handline) would be avoided through seeps, bogs, springs, meadows, and any other wet area. Handline in Riparian Habitat Conservation Areas (RHCA) would not occur within 10 feet of intermittent (Class IV) streams, and within 20 feet of perennial (Class I, II and III) streams. Where it is necessary to limit fire spread near streams, surface fuels would be cleared without disturbance to or exposure of the soil. All prescribed fire within the RHCA would be reviewed by the District fisheries biologist.

7. Fuels within the RHCA greater than twelve inches would be retained to achieve INFISH Riparian Management Objectives.

8. Where prescriptive fire backs into the RHCA sufficiently to come within 50 feet of true riparian vegetation (sedges, alders), firing would be suspended until backpack pumps can control the fire. Further design criteria, (such as requiring greater fuels moistures in units adjacent to RHCAs that may be susceptible to escape), would be developed between the District Fuels specialist and Fisheries biologist.

9. Non-commercial thinning within the RHCA would not remove any conifers greater than seven inches diameter-at-breast-height (DBH) nor vegetation providing shade to the stream. Non-commercial thinning units within the RHCA would be reviewed by the District Fisheries biologist pre-treatment.

10. There would be no refueling or storage of fuels, lubricants or other chemical materials within the RHCA to protect water quality.

11. Water drafting would occur in streams with flows greater than 10 cubic feet per second (cfs) and would not occur for more than eight hours per day for more than three consecutive days.

Botany

Design Elements Common to All Action Alternatives

Sensitive Plants

1. All Threatened, Endangered, and Sensitive plant and animal species would be protected (LRMP Chapter IV, pp. 4-246). If any species are found during project implementation, these species would be protected as described in the policy guidelines found in FSM 2670 regardless of the date of sale.

2. Ground-disturbing activities would not be allowed on non-forest scablands. If scablands must be used for project activities, limit the use to travel on existing roads. Ground disturbing activities include falling trees into the scab, ATV use, equipment use, road and landing construction.

3. Complete the project during periods when the soils are completely dry or are frozen.

4. Limit the amount of new disturbance as much as possible. Keep equipment on existing skid trails, and re-use old landings areas. Provide for on-site review of unanticipated disturbances by appropriate specialists.

5. Non-native plants would not be seeded or planted within 150 feet of sensitive plant habitat or populations.

6. Follow the noxious weed prevention measures included in the weed analysis report. Noxious weed introduction and spread can be a threat to Sensitive plants and their habitat.

Noxious Weeds

1. **Required by Forest Plan Standards:** Actions conducted or authorized by written permit by the Forest Service that would operate outside the limits of the road prism (including public works and service contracts), require the cleaning of all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) prior to entering National Forest System Lands.

2. Use weed-free straw and mulch for all projects, conducted or authorized by the Forest Service, on National Forest System Lands. If State certified straw and/or mulch is not available, individual Forests should require sources certified to be weed-free using the North American Weed Free Forage Program standards or a similar certification process.
3. Inspect active gravel, fill, sand stockpiles, quarry sites, and borrow material for invasive plants before use and transport. Treat or require treatment of infested sources before any use of pit material.
4. Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists.
5. Conduct road blading, brushing and ditch cleaning in areas with high concentrations of invasive plants in consultation with District or Forest-level invasive plant specialists, incorporate invasive plant prevention practices as appropriate.

Prevention Guidelines

1. Minimize soil disturbance and conserve existing topsoil (A and B soil horizons) for replacement whenever possible in situations where ground-disturbing activities are unavoidable.
2. Avoid weed-infested areas for camps, staging, helispots and parking areas; consult District Weed Specialist to locate areas if needed.
3. Reduce disturbance when doing road maintenance. Limit the amount of ditch pulling only to the amount necessary to assure proper drainage. Limit blading to running surfaces and the minimum necessary on road shoulders.
4. Maintain desirable roadside vegetation, if desirable vegetation is removed during blading or other ground disturbing activities revegetate the area.
5. Minimize skid trails and the number and size of landings.
6. Project or contract maps would show known invasive plant infestations as a means to aiding avoidance or monitoring.
7. Conduct post-project monitoring for noxious weed for all activities that have the potential to introduce or spread invasive plants on National Forest Lands, including but not limited to activities such as prescribed burning, timber harvest, road maintenance, and stream restoration projects.
8. Incorporate timber sale provisions C(T)6.6# (weed free seed) and B(T)6.35 (Equipment Cleaning) in all timber sale contracts. C(T)5.12# (Use of Roads by Purchaser), B(T)5.3 (Road Maintenance) and C(T)6.3 I (Sale Operation Schedule) would be used as necessary to keep contract vehicles out of high-risk infestations during peak weed seed dispersal periods. These types of requirements would also be incorporated in Federal Acquisition Regulation (FAR) contracts in Section H — Special Contract Requirements as deemed necessary.

Fuels

Design Elements Common to All Action Alternatives

1. Prescribed fire crews would be instructed to avoid deliberate ignition adjacent to the following features:

- Snags greater than 12" dbh
- Large woody debris
- Old slash piles with no fine fuels (small mammal habitat)
- Scab flats
- Springs, seeps, bogs
- Ant mounds

Air Quality/Private Land Interface

2. Warning signs and public notices would be posted before burning. Signs or other traffic control measures could be used on state highways in accordance with Oregon Department of Transportation permit requirements.

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

4. Burn areas adjacent to private land would be patrolled following ignition and daily thereafter until the prescribed fire manager determines there is no threat to private land.

5. Danger trees created by underburning which are detected along private land boundaries or transportation routes would be felled as soon as possible and treated as imminent hazards.

Heritage Resources

6. If a cultural resource site is discovered during implementation, effort would be made to avoid any further disturbance and the district archaeologist would be notified. Site-specific design criteria would be determined if sites could not be avoided and consultation with the Oregon State Historic Preservation Officer (SHPO) would occur prior to resuming activities.

7. Where it is necessary to limit fire spread near cultural resource sites, surface fuels would be cleared without disturbing the soil.

Noxious Weeds

8. Prescribed fire crews and contractors would be briefed to avoid disturbance within or adjacent to noxious weed infestations.

9. Off-road travel by vehicle would be limited and the exception rather than the rule.

Range

10. Fences, cattle guards and other structural range improvements would be protected and/or returned to their pre-burn condition after underburning operations are completed.
11. Burning would be coordinated with the District Range Conservationist to coordinate between livestock use and prescribed fire activities.

Recreation

12. Burning would be coordinated with holders of special use permits, as needed. Efforts would be made to minimize conflicts between recreation permittees and burning activities. To minimize conflicts during hunting seasons, signs with maps, objectives, and a district contact with phone number would be posted at road junctions on roads that have historically had hunter camps on them. Signing would be accomplished at least 2 days prior to the beginning of the current season.

RHCAs

13. Fireline built with handtools (handline) would be avoided through seeps, bogs, springs, meadows, and any other wet area. Handline in Riparian Habitat Conservation Areas (RHCAs) would not occur within 10 feet of intermittent (Class IV) streams, and within 20 feet of perennial (Class I, II and III) streams. Where it is necessary to limit fire spread near streams, surface fuels would be cleared without disturbance to or exposure of the soil.
14. This project does not include the construction of any machine fireline.
15. To meet riparian vegetation objectives and avoid the possibility of high-intensity fire running up-drainage during prescribed fire operations, fire may be purposely ignited within RHCAs. Ignitions would create a mosaic of burned and unburned ground to maintain effective ground cover in riparian areas. Other ignitions, such as burning within meadow systems adjacent to creeks to retard conifer encroachment, would be coordinated with the District Botanist, Fisheries Biologist, and/or Hydrologist. By reducing conifer encroachment in RHCAs, prescribed fire would encourage the growth of deciduous shrub species.
16. Non-commercial thinning in RHCAs would pose a challenge for underburning and riparian vegetation protection. These operations would require falling away from the creek and pull-back from any riparian vegetation.

Smoke Management

17. Site-specific information (including fuels loads) about all prescribed burning units would be entered into the State of Oregon's regional smoke management database, along with observations of environmental conditions taken during burn implementation. This information would be used to determine the amount of emissions produced, and ensure compliance with Oregon smoke management guidelines and the annual limitation on emissions entered into with the other Oregon Blue Mountain Forests.

Range

Design Elements Common to All Action Alternatives

1. Ensure proposed activities would not damage or negatively impact existing range improvements such as fences, gates, spring developments, reservoirs, and cattle guards (see attached maps for Alternative 2 and Alternative 3). If damage is unavoidable or negative impacts result, activity operators would repair or replace affected improvements to Forest standards.
2. Ensure proposed activities are designed to reduce impacts to livestock management on the allotment (that is, leaving gates open when livestock are present).
3. Coordinate proposed activities with the Rangeland Specialist so that permittees may be notified in a timely manner in the event livestock need to be moved from an area.
4. Coordinate Willow Pine Project underburning activities with grazing management (pasture rotation) on the Sunflower Allotment.

Heritage

Design Elements Common to All Action Alternatives

The following design elements or design criteria are identified for implementation for these Alternatives to reduce the potential for negative impacts from the proposed activities, and to respond to public comments received for this project.

1. For all units that contain archaeological sites within or adjacent to their boundaries, a no-entry/no-ground disturbance 50 foot buffer zone would be posted around these sites by the District Archaeologist before these units are marked, cruised, and harvested. Directional felling would be implemented away from these buffer zones. In addition, these areas would be designated as Areas to Protect (ATP) on the timber sale contract maps.
2. During thinning and burning operations, no piles would be built and burned within the 50 foot buffer zones inside or adjacent to units with archaeological sites.
3. For all units that contain archaeological sites, skid trails and landings would be designated by the District Archaeologist prior to harvesting operations. Post-harvest, these trails and landings would be checked by the District Archaeologist before they would be scarified and seeded.
4. All new temporary road corridors to units would be flagged and/or staked and walked by the District Archaeologist prior to road construction.
5. During thinning, burning, and harvesting activities, no vehicles, harvesting machinery, or ATV's would be driven or staged on rock flats or lithosols; all vehicles must remain on graveled surfaces and/or system roads while traversing these areas.
6. If cultural materials are observed during project implementation from ground disturbances or effects from burning, activities would stop in that unit until further design criteria can be developed by the District Archaeologist for the continuation of this project.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in Table 3 on page 27, Chapter 2. The following discussion of existing conditions and effects analysis are taken from each of the specialists' reports. The full text of each report is available upon request at the Paulina Ranger District Office.

Issue #1

Activities (pre-commercial and/or commercial thinning) proposed within three core goshawk nesting stands could adversely affect the quality of nesting habitat, by reducing stand structure and altering canopy closure, thereby negatively affecting reproductive success of goshawk pairs.

Measures

Changes to density and structure of the nest stand over time.

Northern Goshawk Nesting and Post Fledging Area Habitat

Alternative 2, the Proposed Action, proposes to enter three designated northern goshawk nest core areas in the Project Area. These nest cores are associated with the Spur Butte, Porcupine, and Bernard Mill territories. Entry into these nest stands with Alternative 2 would entail commercial and non-commercial thinnings as well as associated prescribed fire treatments to reduce fuel concentrations created by the thinning activities. There was concern expressed with this alternative and the potential for direct and indirect effects of the proposed activities adversely affecting nesting northern goshawks and the reproductive success and use of the territory. This alternative could change the quality, condition and effectiveness of the nest stands to support nesting efforts. Alternative 1 and Alternative 3 would not enter the designated nest stands with commercial or non-commercial thinnings. Prescribed fire actions would continue in Alternative 3 in the form of a broadcast burn.

Activities are proposed in the Proposed Action and Alternative 3 that would enter Post Fledging Areas (PFA) for six (6) territories in and surrounding the Project Area. Commercial and non-commercial thinnings and prescribed fire/other fuels treatments are proposed to occur. Such activities could also have direct or indirect effects upon mated pairs of northern goshawks and their reproductive success. The thinning activities in particular could change the quality and condition of habitat.

Measures :

Change in vegetation species composition; change in stand density; changes in canopy closure; change in stand structure; acres of northern goshawk habitat affected.

Time Frames:

Short Term – 0-5 years (duration of direct effects expected to last on habitat quality and condition)

Mid Term – 5-30 years (time frame for which many/most of the indirect effects on habitat quality and condition would be realized)

Long Term – 30 plus years (time frame for which mature forest characteristics are expected to develop with the implementation of activities proposed in the action alternatives)

Introduction

The Regional Forester's Eastside Forest Plan Amendment #2, which amends the Ochoco National Forest Land and Resource Management Plan (Forest Plan), identifies specific standards for the management and protection of northern goshawk habitat. The Project Area falls under Scenario A (Standard 6.d.), as one or more late and old structure (LOS) stages falls below HRV for several of the forest types present. Standards 6.d.5)a) directs that every known active and historical northern goshawk nest-site would be protected from disturbance. Standard 6.d.5)b) directs that 30 acres of the highest quality nesting habitat surrounding existing northern goshawk nests would be deferred from harvest. Standard 6.d.5)c) prescribes that harvest may occur within the 400 acre PFA, however existing late and old structure (LOS) stands would be retained and younger stands would be managed for LOS stand conditions.

The Forest Plan identifies timing restrictions for disturbance activities occurring in the vicinity of active raptor nests. Specifically, timing restrictions in the vicinity of the nest (within 5 chains) would be restricted from roughly March 1 through August 1, depending upon the species. In general, timing restrictions used on the Forest for the northern goshawk are between March 1 and August 30.

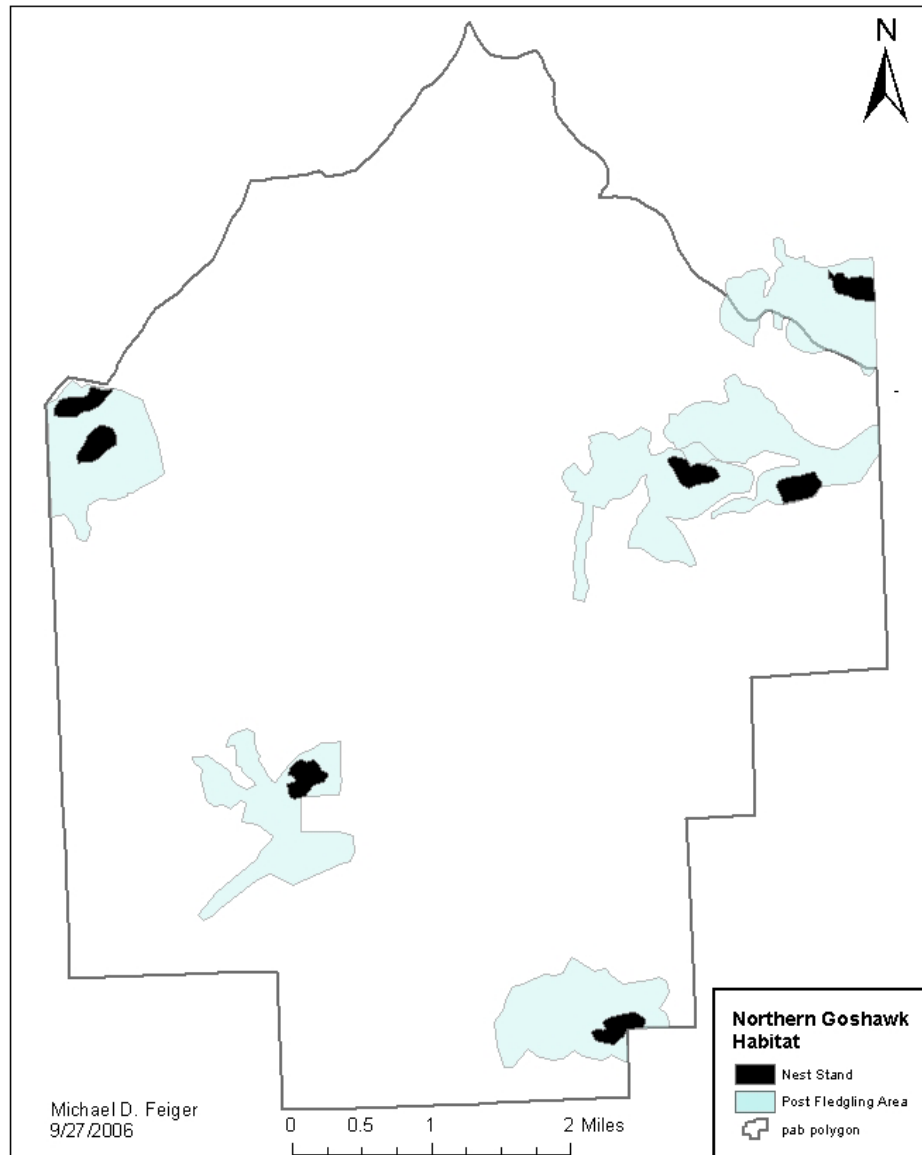
Six (6) territories are partially or fully within the Project Area, with the possibility of a seventh (7th) territory being identified in the Cougar Creek drainage. Map 4 identifies the locations of the known territories. The status of the six (6) known territories is as follows:

- Spur Butte - Active 2003, 2004, 2005. Nestlings fledged, number fledged not known in 2005.
- Porcupine - Active in 2000. Last known monitoring was in 2002, nest was inactive.. Unknown activity in 2003-2005 due to lack of survey effort. Status unknown, assumed active.
- Bernard Mill - Active 2004, 2005. Fledging success not known in 2005.
- South Fork John Day - Inactive 2003, 2004, 2005. Last year active was 2000. The nest stand is located outside the project area.
- Jackass Creek - Active 2000, 2001, 2002. Unknown activity 2003-2005 due to lack of survey effort. Assumed active.
- Bear Creek – Active 1997-2002, 2004. Two adults and three juveniles spotted during field surveys conducted in 2005.

Monitoring of these six territories would be initiated with the selection of either of the two action alternatives. Additional monitoring for a possible 7th territory in the Cougar Creek drainage, in the Project Area, would also be initiated to determine presence/absence of a possible territory. Design Criteria identified in the summary section and Chapter 2 of the EA are to be implemented with such a decision

Map 4.

Willow Pine Fuels and Vegetation Management Project
Northern Goshawk Post Fledgling
Areas and Nest Stands



Habitat Needs

Nesting Habitat

Research on nesting habitat needs for the northern goshawk is relatively extensive, with research being conducted over much of the western United States over the past two to three decades. Some of this research and data collection has occurred within the general geographic region of the Project Area. Specifically, Daw and DeStefano (2001) looked at forest characteristics of nest and PFA habitats in eastern Oregon, their study area located within 10 to 50 air miles of the Project Area. Others, including DeStefano and Meslow (1992), and McGrath (1998), assessed northern goshawk habitat in the southern Blue Mountains which contain similar habitat features and vegetation types to those represented in the project area. Others, such as Marshall (1992), Marshall, Hunter, and Contreras (2003), and Bull and Hohmann (1992) take a broader Oregon or Oregon and Washington geographical context in their description of nesting habitat needs. Additional research outside of the geographic area includes Reynolds (1983), Reynolds et al. (1992) and Block, Morrison, Reiser, Eds. (1993). The research and technical bulletins are generally consistent in their description of nest stands and nest tree structures. The following are summaries of habitat components of northern goshawk nest habitat.

Stand Structure

Research reports a consistent stand structure condition for nest stands that were studied. With few exceptions, a mature, multi-layered canopy condition is described as the most common habitat condition (Daw and DeStefano 2001; Reynolds 1983; Reynolds et al. 1992). The nest stands are generally dominated by large, mature overstory trees, usually ponderosa pine or Douglas-fir (Daw and DeStefano 2001; Reynolds et al. 1992) in what is commonly called old growth or mature forest stand conditions (Reynolds et al. 1992; Marshall 1992; Marshall, Hunter, and Contreras 2003). Density and complexity of understory trees varies from relatively open and simple to very dense and complex (Daw and DeStefano 2001, Reynolds et al. 1992), with most nest stands more towards the denser and more complex end of the spectrum. Marshall (1992) does note that some observations found an association of nest location with breaks in canopy structure and closure, i.e. near small openings.

Species Composition

The selection of vegetation types across the northern goshawk's range is diverse, including most conifer forest types (ponderosa pine, Douglas-fir mixed conifer, grand fir mixed conifer, western larch) as well as some hardwood habitats (aspen, cottonwood) (Marshall 1992; Marshall, Hunter, and Contreras 2003). In Oregon, particularly within the immediate geographic area, ponderosa pine, ponderosa pine dominated mixed conifer and Douglas-fir mixed conifer forest communities were the most common used (Daw and DeStefano 2001; DeStefano and Meslow 1992; McGrath 1998). Large ponderosa pine trees, and to a lesser degree large Douglas-fir were most often selected as nest trees (Daw and DeStefano 2001). Mean diameter at breast height (dbh) for nest trees was found to be around 20" (Marshall 1992), although DeStefano and Meslow found average dbh approaching 28-30" (1992) and Bull and Holmann found average dbh of 25" in northeast Oregon (1992). A general observation of many of the studies indicate the selection of the largest trees available in a nest stand as the host tree for the nest structure (Reynolds 1983).

Stand Density and Canopy Closure

Research indicates a strong association of northern goshawk habitat with higher stand densities. The most common indicator referenced is canopy closure. Daw and DeStefano found average canopy closures in nest stands greater than 50% canopy closure (2001). Likewise, Reynolds

(1983), Reynolds et al. (1992), Marshall (1992) and Marshall, Hunter, and Contreras (2003) found strong associations with high canopy closures and active northern goshawk nest stands. Lilieholm, Long and Patla utilize stand density indexes (SDI) to describe suitable nest habitat conditions (1994). Likewise, stand density index analysis would be used in part to assess the affects of actions proposed.

Post Fledging Area

Less information is available about post fledging area (PFA) habitat. PFA habitat provides forest conditions that are conducive to protecting recently fledged northern goshawk young from predation and providing opportunities to develop hunting skills. The bulk of fledging activity and movement would occur in this area until such time as they are no longer dependent upon parents for food (Reynolds et al. 1992). In general, a mix of forest types, including stand structures, species compositions, densities, and maturity is desired to provide a mosaic of cover and foraging opportunities for fledged young and adults (Reynolds et al. 1992; Marshall, Hunter, and Contreras 2003; Marshall 1992; Daw and DeStefano 2001).

Stand Structure

Reynolds et al. found that a mosaic of mix of mature forest conditions, providing canopy cover and hiding cover for fledglings, mixed with younger forests and openings (< 2 acres) that may be more conducive to important prey species (medium sized birds, rodents, and squirrels) and riparian areas are important to functioning PFAs (1992). Other important features include presence of large snags and pieces of downed wood to attract cavity excavating and dependent forage species and rodents and patches of dense canopy forest that provide forging, nesting and other types of habitats for other forage species (Reynolds et al. 1992).

Species Composition

Similar to Stand Structure, species composition and forest community types varied and were often present in a diverse and mosaic distribution in the PFA. Limited information about specific species compositions in the forest community is available. A more important factor may be associated with how forest communities support prey species and their abundance and distribution.

Stand Density

Reynolds et al found a diversity of stand densities provided in PFAs (1992). Everything from moderately dense mature forest to high density middle aged forest types to open early forest types and small opening (Reynolds et al. 1992; Marshall 1992; Marshall, Hunter, and Contreras 2003). The diversity of stand densities, and a mosaic distribution of different densities, provides for a variety and abundance of prey species as well as hiding cover to protect fledglings from predation.

Affected Environment

(Note: The term “territory” is used to describe an area currently or recently occupied by a pair of northern goshawks. A territory includes a nest stand (as defined by the amended Forest Plan), and post fledging area (PFA – as defined by the amended Forest Plan), and associated habitats outside of these two units that provide forging/hunting opportunities to both young and fledged northern goshawks. Reynolds et al. recommended that a nesting home range (“territory”) to be roughly 6,000 acres (1992). For this analysis, specific nest stands and PFA’s for each of the territories identified would be analyzed for the effects of the proposed alternatives. In addition, northern

goshawk habitat outside the nest stands and PFA's will also be analyzed and assessed for effects from the proposed alternatives.)

Nesting Habitat

(Nesting habitat addressed in this analysis is limited to the three nest stands that are proposed for commercial and non-commercial harvest in Alternative 2. Nest stands are identified for the other three territories (Bear Creek, Jackass Creek, and South Fork John Day [outside project area]), however, nesting habitat would not be affected by the activities proposed in either Alternative 2 or 3. The existing condition of those nest stands would be maintained.)

Spur Butte Territory

The Spur Butte territory is located on Spur Butte (T16S R26E Sec 23). The nest stand and PFA encompasses the west, south, and east slopes of Spur Butte. The overall territory area likely includes the north face of Spur Butte into either side of Sunflower Creek, and south of Spur Butte in the Porcupine Creek drainage. Activity is noted as described above.

Habitat around the nest tree for the Spur Butte territory is primarily composed of ponderosa pine. Small invading western juniper and scattered Douglas-fir are present in the nest stand. The mature tree component in the nest stand is ponderosa pine. On the east end of the nest stand, Douglas-fir and western Juniper become more prominent in the middlestory, with an occasional mature Douglas-fir tree. Stand exam data collected in 2003 is available and is summarized below in Table 5. Note that the stand exam covers approximately 82 acres. The nest stand, at 30 acres, makes up approximately 37% of that stand.

Table 5. Stand Exam Summary – Stand 153; Contains Spur Butte Territory Nest Stand

Size Classification	Species Composition (order of dom.)	Average Diameter, dbh	Age	Trees per Acre	Stand Density Index	Canopy Cover
Overstory (21" dbh +)	PP, DF	26.2"	120-250 years	8	63	Not given
Middlestory (7"-20.9" dbh)	PP, DF, WJ, GF	12.1"	80-180	112	190	Not given
Understory (<7" dbh)	PP, DF, WJ, GF	3.7"	80-120	372	60	Not given
Totals				492	273*	51%

PP – Ponderosa Pine, DF – Douglas-fir, WJ – Western Juniper, GF – Grand Fir

- - Total SDI also includes seedling component that is not displayed on this Table.

The stand exam and silvicultural stand diagnosis indicates substantial tree mortality and western pine beetle activity. Reduced growth rates in the late 1990's and early 2000's indicate higher levels of stress on the stand. A combination of over stocked conditions (SDI exceeds the upper management recommendation by over 3 times [existing SDI – 273; upper management zone (UMZ¹) – 82]) and drought stresses, along with western pine beetle presence and activity has

¹ Upper Management Zone – Defined as the stocking density of a conifer stand that allows for radial growth of 13 annual rings per inch of diameter (1.5 inches of diameter growth per decade) and represents a threshold for which tree mortality begins to occur (insect mortality) (Silviculture Report, Deppmeier 2006)

resulted in substantial mortality in the middle and overstory ponderosa pine canopies. Patches of die-off are noted in the report. Field observations by District Wildlife Biologist Michael Feiger taken since the 2003 stand exams have noted additional mortality, particularly surrounding the nest tree. In 2005, western pine beetle “hits” on the nest tree was noted, but at the time did not show signs of mortality. Visual estimate indicates roughly 40-50% of the mature tree component (>15” dbh) has died around the nest tree over the past 5-7 years. Further to the east, mortality appears less, and limited to the middle and understory canopies. Douglas-fir trees show signs of stress and attack by bark beetles, but mortality is not abundant. Stand exam information indicate a canopy closure of approximately 51% in stand 153. Estimated canopy closure around the nest tree based upon field surveys is around 35-40% with likely continued decline with insect mortality.

Field visits in spring of 2006 indicate possible abandonment/non-use of this nest stand for 2006, and may be linked to further tree mortality that has occurred around the nest tree.

Porcupine Creek Territory

The Porcupine Creek territory is located in the middle Porcupine Creek drainage (T16S R26E Sec 24). The nest is located on the north slope overlooking Porcupine Creek. The nest is approximately one mile from the Spur Butte nest, and the PFA’s of both territories butt up against one another. It is noted that the last year of activity on the Porcupine territory was the year prior to the discovery and documentation of the Spur Butte nest and territory.

The nest stand in the Porcupine Creek territory is a ponderosa pine dominated mixed conifer forest community. The mature component of the nest stand is predominately ponderosa pine (8 trees per acre) with a smaller component of mature Douglas-fir (3 trees per acre). The middle and understory component, however, is predominately Douglas-fir (87% of trees <21” dbh) with a smaller component of ponderosa pine (13% of trees <21” dbh), particularly in the 7-21” dbh (3% of trees less than 21” dbh). Western juniper is a minor component of the canopy less than 7” dbh. A stand exam is available for stand 209 and was completed in 2002. The following Table (Table 6) summarizes the stand exam and silvicultural walk through performed in winter 2004. Stand 209 is approximately 53 acres, 30 of which make up the Porcupine Creek territory nest stand.

Table 6. Stand Exam Summary – Stand 209; Contains Porcupine Creek Territory Nest Stand

Size Classification	Species Composition (order of dom.)	Average Diameter, dbh	Age	Trees per Acre	Stand Density Index	Canopy Cover
Overstory (21” dbh +)	PP, DF	28.3”	Not given	11	84	Not given
Middlestory (7”-20.9” dbh)	DF, PP	10.8”	Not given	103	127	Not given
Understory (<7” dbh)	DF, PP	3.5”	Not given	533	83	Not given
Totals				647	294	58%

PP – Ponderosa Pine, DF – Douglas-fir

Insect activity was not noted in the silvicultural report for this stand. Some Douglas-fir mistletoe is noted in most of the middle story Douglas-fir trees. A look at the SDI and trees per acre notes a dominance of ponderosa pine in the overstory, with a relatively young and recent development of the predominantly Douglas-fir component in the understory. The development of the Douglas-fir understory is a concern relative to the potential stress the overstocked stand condition could have on the mature ponderosa pine component of the stand. The existing SDI is approximately three and a half times greater than the SDI for the UMZ recommendation (existing SDI – 294; UMZ – 86). The bulk of the SDI is in the middle story canopy, which is predominately Douglas-fir. Average diameter of the middlestory canopy is 10.8” dbh. Estimated canopy closure for the nest stand is 58%. The nest tree is a mature ponderosa pine tree.

Bernard Mill Territory

The Bernard Mill territory is located off of the 5870 road north of Suplee Butte. The legal description for the nest stand is T16S R26E Sec 24. An unnamed tributary flows to the NW of the nest stand. The Territory includes a historic mill site (Bernard Mill).

The stand that contains the nest stand is a mixed conifer forest type dominated by Douglas-fir and grand fir in the overstory, and a mix of grand fir, Douglas-fir, and ponderosa pine in the middle and understories. The nest tree is a Douglas-fir tree. Stand exam information is available for stand 749b and is summarized in Table 7 below. Stand 749b is approximately 69 acres, of which 30 acres makes up the nest stand for the Bernard Mill territory.

Table 7. Stand Exam Summary – Stand 749b; Contains Bernard Mill Territory Nest Stand

Size Classification	Species Composition (order of dom.)	Average Diameter, dbh	Age	Trees per Acre	Stand Density Index	Canopy Cover
Overstory (21” dbh +)	DF, GF	24.6	Not given	4	29	Not given
Middlestory (7”-20.9” dbh)	GF, DF, PP	14.5	Not given	90	222	Not given
Understory (<7” dbh)	GF, DF, PP	1.0	Not given	1,253	21	Not given
Totals				1,347	304*	58%

PP – Ponderosa Pine, DF – Douglas-fir, GF – Grand Fir

- - Total SDI also includes seedling component that is not displayed on this Table.

As noted in Table 7, the predominate component of the forest canopy is composed by the middlestory canopy (trees per acre and SDI). The bulk of that middlestory is composed of grand fir (43%), followed by ponderosa pine (38%), and Douglas-fir (19%). Average diameter in that canopy layer is 14.5” dbh. Mature tree structure is lacking, making up less than 1% of the trees per acre, and 9% of the SDI. Past harvest management is the primary culprit for the lack of large tree structure (historic mill site within ½ mile of the nest stand). The SDI for the stand is 312, and is approximately twice the density represented by the UMZ for SDI (154). Canopy closure is estimated at 58%, although this estimate may be high given the amount of insect related mortality that has occurred in the past several years. The silvicultural report for the stand identified bark beetles in the grand fir middle story trees, with approximately 20% of the grand fir present dead in 2004. Mountain pine beetle activity in the ponderosa pine was also noted. Annosus root rot and

Indian paint fungus were noted in the grand fir as well. The Silviculturist noted that the stand is “falling apart”, indicated by the higher levels of insect related mortality in the grand fir and ponderosa pine.

Post Fledging Area (habitat)

Spur Butte Territory

The PFA for the Spur Butte territory is made up of ponderosa pine vegetation communities. Ponderosa pine is the dominant overstory tree species, with scattered Douglas-fir, particularly in the east end east of the nest stand, and western juniper. Douglas-fir and western juniper are generally lower understory canopy components. The PFA has received past harvest management actions over the past 50-70 years in the form of commercial and non-commercial thinnings. Large tree structure (>21” dbh) is generally lacking in the PFA, averaging less than 2-3 trees per acre greater than 21” dbh. Prescribed fire was recently implemented in the western portion of the PFA, with several “holes” burned into the canopy. Openings created are less than an acre in size. This has added to some of the diversity of the stand. In general, structural diversity is lacking. Generally there is only one (1) to two (2) canopies are present in these stands, with very little understory development in trees less than 7” dbh. The stands are roughly 80 to 120 years old, average diameter roughly 10-14” dbh, and evenly spaced across the PFA. Several patches along the southern edge of the PFA are exceptions to this description, with higher densities and closer, more complex canopies. These portions of the PFA, however, are small components of the whole. Canopy closure ranges from 25-45% with several large scab or dry woodland habitats scattered in the PFA. The PFA covers 420 acres.

Stand exams indicate some mountain pine beetle activity in the PFA. Existing mortality is associated with areas of the highest density and in areas where prescribed fire has cause secondary stressors on the existing stand and made trees susceptible for insect attack. Specific acres affected by insect activity were not identified in the stand exams.

Porcupine Territory

The PFA for the Porcupine Creek territory covers 406 acres of diverse habitat. The vegetation communities are dominated by ponderosa pine and Douglas-fir dominated mixed conifer stands. The mature tree component is generally dominated by ponderosa pine and/or Douglas-fir, within occasion large grand fir near Spur Butte. Understories are generally dominated by Douglas-fir and ponderosa pine, with minor components of grand fir and western juniper. Stand densities, canopy closures and stand structure varies in the PFA. Approximately 56 acres of the PFA was treated with a shelterwood harvest that created an open canopy (canopy closure less than 25%). The remaining 344 acres is relatively dense canopy (canopy closure greater than 45% up to 60%) mixed conifer stands. Multiple canopy strata are present in these stands. Large tree structure varies depending upon past harvest management, but generally averages between 10-18 large trees per acre. Understory development varies as well, depending upon past non-commercial thinning actions. Habitat quality for northern goshawks is high, with a good mix of small openings and dense pockets of forest habitat.

Insect and disease activity is generally light in the PFA. Small pockets of western or mountain pine beetle activity was noted in stand exams. However, in general, the PFA is stable relative to disease and insect effects

Bernard Mill Territory

The Bernard Mill PFA covers 416 acres of forested habitat. Diversity of forest types, stand densities, canopy closures, and forest structure is diverse in this PFA. Ponderosa pine, ponderosa pine and Douglas-fir dominated mixed conifer, and juniper woodland habitats are represented in this PFA. Overall canopy closures are generally lower, averaging between 20% and 45%. Past harvest activity (commercial and non-commercial thinning) and lower site potential have influenced this canopy condition. Likewise, stand densities tend to be lower, although stands immediately adjacent to the nest stand are denser and have canopy closures over 50%. Structural stages tend to be middle aged with a noticeable lack of large tree structure in the upper canopies (less than 4 large [>21 " dbh] trees per acre). Stands are generally younger with less complex upper canopies. Understories vary depending upon past understory thinnings. Habitat is diverse in structure and canopy closure variation, but lacks large tree structure.

Insect and disease activity is more prevalent in this PFA. Annosus root rot and Indian paint fungus in the grand fir and pine and bark beetles in the ponderosa pine and grand fir is resulting in substantial mortality in portions of the PFA. Canopy structure is changing, with canopies opening in patches of mortality, along with reductions in stand density in those areas of mortality. This mortality is adding to the diversity of different structural conditions and may be enhancing habitat quality.

South Fork John Day Territory

Twenty-one acres of the South Fork John Day territory is present within the project area. Habitat is a ponderosa pine forest community. Large trees are present in lower densities. Predominant canopy is a middle story of ponderosa pine. Limited western or mountain pine beetle activity was noted, however, substantial mortality has not occurred.

Jackass Creek Territory

The Jackass Creek territory PFA covers 407 acres in the southeast corner of the project area. The PFA is composed of a diversity of vegetation communities, including ponderosa pine, ponderosa pine and Douglas-fir mixed conifer, grand fir dominated mixed conifer, and small portions of juniper woodland. Several stream channels and associated riparian areas pass through the PFA. One that bisects the PFA is wet year around. The densest forest stands are associated with these riparian areas and the nest stand in the territory. Past timber harvest has affected habitat quality, mostly in the form of large tree structure, in the PFA. The extent of effect, however, is less than what is found in other PFA's. Canopy closure in the PFA ranges from 35-55% on average. Most of the area is in a canopy closure of 40-45%. Forest structure is diverse, with most stands demonstrating two to three canopy layers, particularly in the denser forest stands. Habitat quality is good for fledging northern goshawks and for foraging.

No mention of insect or disease activity was noted for this PFA, although it is likely some insect activity is occurring, given trends of other PFA's and the project area in general.

Bear Creek Territory

The Bear Creek territory is located on the NW corner of the project area. It is located in the headwaters of Bear Creek. The PFA covers a total of 402 acres with a portion of that PFA spilling into the Columbus Creek drainage to the southeast. The PFA is made up of primarily ponderosa pine forest communities. Most of these are relatively open stands with canopy closures in the 30-40% range. Western juniper and scattered Douglas-fir trees are components of the understory. Large tree structure is generally lacking, much of which is due to generally poor growing and site conditions. Some historic harvest has occurred in the PFA stands. A portion of the PFA, on the

north face surrounding the nest stand, a ponderosa pine and Douglas-fir dominated mixed conifer stand condition is present. Canopy closures are higher, averaging 40-50%. Large tree structure, however, is generally absent, although average mean diameter is considerably larger (15-20" dbh) than the remainder of the PFA. Understory structure is generally absent as a result of past commercial and non-commercial thinning actions. Small patches of reproduction (less than 3" dbh) exist in canopy openings adding to some structural diversity. Habitat condition is generally fair to good in the PFA. Higher quality northern goshawk habitat is located to the northeast on private lands along Bear Creek.

Insect activity primarily in the form of western or mountain pine beetle was noted in denser patches of ponderosa pine habitat in the PFA. Mortality is relatively light and patchy, but with continued drought conditions and stresses to existing dense stands, it is likely that insect related mortality would spread through other portions of the PFA.

Habitat Outside Existing Post Fledging Areas and Nest Stands

An assessment of the Project Area for northern goshawk habitat outside existing PFAs and nest stand found approximately 3,083 acres of northern goshawk habitat in the Project Area. Habitat is made up of different vegetation communities and stand structures. The Wildobs definitions provided identified habitat as dry grand fir, Douglas-fir and dry and moist ponderosa pine habitats, most often with large tree structure and various canopy structure conditions.

Direct and Indirect Effects – Alternative 1

Nesting Habitat

Spur Butte Territory

With implementation of this alternative, the existing condition and trend of the nest stand (Stand 153) for the Spur Butte territory would be maintained. The canopy closure, initially estimated at 51% in the associated vegetation stand but lower around the nest tree, would continue to decline as further western pine beetle activity continues to induce mortality in the ponderosa pine. These effects would be anticipated through the short to early mid term (0-20 years) until such time as stand densities have "stabilized" and effects of stressed trees and insect attacks are naturally mitigated. Large tree structure would continue to decline with further losses of large (>21" dbh) trees occurring in the short to early mid term. The SDI would continue to decline as a result of the mortality anticipated, with pockets of the heaviest tree mortality ending with SDI's below the LMZ of 58 and much of the mortality occurring in the largest trees. Canopy closure values would also continue to decline, and may drop below 30% canopy closure in the mid term before stabilizing. Over the long term (30+ years), the stand density of the nest stand would slowly increase, and in 50 to 100 years, without other actions or natural events, the stand may again reach the high stand densities (SDI > 250) that provided the habitat conditions of the past decade. Canopy closure likewise would increase and may approach 50-60% canopy closure. Large tree structure, however, would likely be lacking in the long term. Short to mid term mortality would substantially reduce existing and replacement large trees for the long term. Large tree structure would likely be at or below existing levels of large trees (8 trees per acre) in the ponderosa pine. Large Douglas-fir may develop in other portions of the nest stand may develop in the long term although existing insect activity in Douglas-fir may also limit large tree development as well. The rate of large tree development would be slowed and regulated by density dependent factors.

Nesting habitat quality for northern goshawks would continue to decline with this alternative, and would take many decades to develop important large tree structure, canopy closure, and stand

complexity that are hallmarks of quality nesting habitat. Continued use of the nest stand by a northern goshawk pairs may be indicative of their tolerance for a wider range of nesting habitat conditions. However, it would be expected in the short to mid term that conditions would ultimately be unfavorable and that the nesting pair would abandon the nest stand or territory for more productive nest stand habitat. In the long term, likely 50 years +, suitable habitat conditions would develop with sufficient numbers of large trees along with suitable upper canopy level structure and canopy closure developing. In the short and mid term, into the early long term, the nest stand would likely be abandoned due to poor habitat conditions.

Porcupine Creek Territory

The existing, relatively stable condition of large tree structure and high canopy closure would likely maintain in the short to mid term in the Porcupine Creek territory. Relatively low insect indicators and tree mortality indicate that for the next 5 years or more, this condition would likely be maintained though bark beetle populations can build up rapidly and quickly begin killing trees. However, existing stand densities are high, exceeding the upper management density level by nearly three and one half times (SDI of 294 vs. recommended UMZ of 86). With these high densities, it would be likely that stress effects and mortality in the mature overstory ponderosa pine would begin to occur in the mid term. Likewise, mortality would be expected in the Douglas-fir middle story that is currently at high stand densities in the mid term. Stand densities and densities of large trees would decline with pockets of the highest trees mortality being reduced to SDI's below the LMZ of 58 and much of the mortality occurring in the largest trees. This would reduce the complexity of upper canopy stand structure and reduce canopy closures, perhaps to as low as 30-40%. Of greater concern would be the anticipated loss of large tree structure. Most of the large trees are ponderosa pine, with some Douglas-fir. Replacement large trees, however, are largely absent. Average diameter of the middle story size class is only 10.8" dbh, and is primarily composed of Douglas-fir. The replacement of lost large tree structure would likely take 50-100 years (density dependent limitations to growth and lack of ponderosa pine large tree replacements) and would mostly likely consist of Douglas-fir. While Douglas-fir trees do provide adequate nest trees, ponderosa pine is a preferred species with most northern goshawk nests on the Paulina Ranger District occurring in ponderosa pine, including this territory. Because of the presence of Douglas-fir in the stand, replacement of upper canopy structure and closure would likely develop in the long term, 30-50+ years out after the initial short term loss of those habitat features.

In the absence of a bark beetle outbreak, nesting habitat conditions for the northern goshawk would likely be maintained in this territory over the short to early mid term (0-15 years). Large tree structure would be maintained during that time period, as would canopy closure and upper canopy structure. However, in the mid to long term (15-75/100 years), habitat quality would likely diminish as large tree structure was lost to insect and disease mortality. Likewise, upper canopy structure and canopy closure would likely decline in this time period with that mortality effect. Over the long term (30-50+ years), upper canopy structure and canopy closure would return to high density levels, near to what currently exists. This may provide marginal nesting habitat with the higher stand densities and canopy closure. The lack of large tree structure, however, may limit the effectiveness of that habitat until that structure is replaced. It would be anticipated that nesting habitat in the Porcupine Creek nest stand would be unsuitable for northern goshawks during the mid and early long term (15-75 years).

Bernard Mill Territory

Existing habitat conditions in terms of upper canopy structure and canopy closure would continue to decline with this alternative. Existing levels of mortality identified in the ponderosa pine and grand fir would continue. This would continue the loss of upper canopy level structure and canopy

closure. Existing large tree structure is generally absent, and would continue to be slow in development. Insect and disease activity would limit the number of large trees and may select against preferred species and diameter classes (ponderosa pine, >21" dbh). Future large tree replacements, particularly in ponderosa pine which is already under represented would likely be lost with insect related mortality. In the short term to mid term, further loss of canopy closure and upper level canopy structure would likely occur. Current SDI levels are approximately twice the UMZ. These would decline, with area of highest tree mortality being reduced to SDI's below the LMZ of 103 and most of the mortality occurring in the largest trees. Canopy closure at this stage would likely be around 35-45%. In the mid term, as stand densities stabilize and stresses like drought and insect activity are less adverse, stand densities and canopy structure would begin to increase. Existing average diameter of the middle story canopy is around 14.5" dbh. With reduced competition from lower stand densities, surviving larger trees would develop into suitable nesting trees relatively quickly, likely within the following 30-40 years out, or around year 60-70. At that time, upper canopy structure and canopy closure would likely also reach levels conducive to northern goshawk nesting habitat. Canopy closures would reach the existing 50-65% closures, with upper level structure also developing. However, continued development of lower level canopies with trees less than 7" dbh may to some degree hamper habitat quality (Reynolds et al. 1992; Marshall 1992).

Nesting habitat quality for the northern goshawk would change over time in the short to long term with this alternative. Habitat quality would decline over the short to mid term, as canopy closures and large tree structure habitat continues to decline. Habitat would no longer be suitable for nesting as this decline continues. As mortality and stand densities stabilize in the mid term, habitat quality would likely begin to improve. Over time, replacement large tree structure would develop. With existing size classes present in the middle story, suitable densities of potential nest trees and large tree structure would likely develop in the following 30-40 years (years 60-70). Likewise, upper canopy level structure would also develop, providing those habitat features. SDI levels would likely return to near existing conditions of 270 or more. Habitat would likely be once again suitable for nesting northern goshawks in the long term. In the short to early long term, habitat in the nest stand would not be suitable nesting northern goshawks.

Post Fledging Area

The PFA's for the six (s) territories are relatively similar in their composition of forested plant communities, structural and canopy closure conditions. Some, like Spur Butte and Bernard Mill are more open, while others like Porcupine Creek and Jackass Creek are denser and have more canopy development. However, all would be affected similarly by Alternative 1, and thus the effects are considered together. Relative to the quality of northern goshawk PFA habitat, there would be little difference between effects to the different PFA's.

Implementation of Alternative 1, the No Action alternative, would not result in any direct effects to the PFA's for each of the six (6) territories in or apart of the Project Area. Indirect effects would result from the lack of thinning and stocking level reductions. In the short to mid term, this would leave existing ponderosa pine stands that are currently at very high stocking densities at risk of further insect mortality. This would result in changes to stand densities, structure conditions and canopy closures in the PFA. Typical patches of mortality are relatively small, from an eighth (1/8) to a quarter (1/4) acre in size. The mortality and the patchy nature it would occur in would not necessarily be detrimental to northern goshawk fledging habitat as long as the tree mortality clumps were small. A mosaic and diverse forest and opening conditions in a PFA are preferred and provide higher quality fledging habitat (Reynolds et al. 1992; Marshall, Hunter, and Contreras

2003; Marshall 1992; Daw and DeStefano 2001). The presence of abundant snags, most in the smaller diameter classes of 7-14" dbh class, would provide a food source to several different woodpecker species. This in turn would provide a prey source for northern goshawk adults and fledglings in the PFA, which would be beneficial and provide good quality habitat.

In the long term, sporadic insect and disease outbreaks would continue to alter existing canopy conditions and diversity in the PFA. Existing diversity in different structural, stand density, and canopy closures would be maintained. Sporadic outbreaks of pine and bark beetles would spur woodpecker recruitment which would provide prey opportunities for the northern goshawk adults and fledglings.

Recruitment of large tree structure with this alternative would be hampered. With the exception of patches of insect induced mortality, stand densities would remain relatively high in the most productive stands. Existing large trees would be at risk for insect induced mortality. Development of large tree structure would be delayed the longest with this alternative, with PFA stands developing that structure well into the long term (70-100 years out). This would delay at some level the development of alternate nesting habitat and other northern goshawk habitat features associated with large tree structure.

Habitat Outside Existing Post Fledging Areas and Nest Stands

Implementation of Alternative 1 would not result in any direct or indirect effects to northern goshawk habitat outside the existing PFA and nest stand habitat. The Project Area would maintain northern goshawk habitat as it currently exists in the short to mid term. Some additional habitat would develop over the long term in the absence of a major beetle outbreak.

Cumulative Effects – Alternative 1

Past timber harvest actions, suppression of natural fire disturbance regimes, livestock grazing, and road building have affected the vegetation condition of the three nest stands addressed in this analysis. Appendix A of the EA lists and briefly describes all known past, present and reasonably foreseeable actions that have occurred in the Willow Pine Project Area. As noted in Appendix A, much of the past harvest activity is not well documented in either GIS or other mapping sources. Much of the harvest occurred on ground that was originally under private ownership, and managed during that time frame. Thus, specific acres affected or the locations of specific actions are not well documented. Assessment of the project area indicates that nearly all of the conifer forested habitats have received some level of past timber harvest management. The Silviculture Report and sections of the EA that describe forest vegetation condition describes the changes in forest vegetation, and specifically, the departure of the Project Area in its current condition from what it was like historically (HRV). Late seral habitats make up the bulk of high quality northern goshawk habitat. Table 3 in the Silviculture Report (Appendix G) lists late seral mesic ponderosa pine as 2,862 acres below HRV. Mesic ponderosa pine communities make up 42% of the forested portion of the Project Area (Table 2, Silviculture Report, Appendix G). Across all suitable forest communities, late seral habitat is 3,105 acres below HRV for the Project Area.

Past timber harvest has occurred in each of the three nest stands, as well as PFA and other northern goshawk habitat in the Project Area. Some of this harvest activity also includes understory thinnings. Most of the harvest is over 20 years old, and may also date back 50-60 years. Several small mills, including the Bernard Mill and Ellingson Mill were supplied timber from these harvest actions. Harvest was generally ground based, and typified by single tree or group selection cuts.

This resulted in partial harvest of overstory and middle story canopies, but maintained some level of canopy structure. Spur Butte and Porcupine Creek nest stands received relatively light overstory harvests historically across the entire nest stand, allowing them to maintain 8 and 11 larger trees (>21" dbh) per acre respectively. The Bernard Mill nest stand, due to its proximity to the mill site, had considerably more of the overstory removed in past harvests across the nest stand, resulting in a much lower density of large trees (>21" dbh; 4 trees per acre). Subsequent understory thinnings across all three nest stand have further altered and shaped the quality of nesting habitat.

Similarly, the PFA habitats and the surrounding suitable northern goshawk habitat outside identified nest stands and PFA's have been affected by past timber harvest. Field reconnaissance indicates that nearly all of the PFA habitat, and most of the other suitable northern goshawk habitat has been affected by some form of timber harvest or vegetation management. Because these habitats have generally higher canopy closures and more complex canopy structures (per their definition of suitable northern goshawk habitat), cumulative effects of timber harvest were less than in those habitats that are not identified as suitable habitat. The loss of large tree structure as a result of timber harvest may be the biggest cumulative effect on habitat quality in these suitable habitats. Multiple harvests in these habitats over the past 50-60 years has reduced or eliminated large tree structure in these stands.

Fire suppression and what has essentially been the change in fire regimes in these three nest stands has allowed the development of higher stand densities, and the presence of Douglas-fir and grand fir to develop in two of the three nest stands. In the Spur Butte nest stand, a dense ponderosa pine understory developed, resulting in a SDI nearly three (3) times the maximum level considered stable for the site conditions. The Porcupine Creek nest stand SDI exceeds a maximum stable level by nearly three and ½ (3 ½) times. The Bernard Mill nest stand SDI exceeds the maximum stable level by two (2) times. Relative to northern goshawk habitat, and in particular nesting habitat needs, these changes in stand density due to fire suppression, and other factors, has likely improved habitat conditions when compared to pre-fire suppression habitat conditions. Reynolds et al. (1992) and others identify specifically the importance of complex upper canopy layers and high canopy closures (greater than 50%). Such conditions would not have existed prior to fire suppression activities in the Spur Butte and Porcupine Creek nest stands, and may not have existed in the Bernard Mill nest stand as well.

The grazing of livestock compounded the effects of fire suppression actions and policies. Intense livestock grazing in the later 1800's and early 1900's contributed to the suppression and prevention of larger scale fires that shaped these forests.

Roads have played a minor role in the shaping of these nest stands. For Porcupine Creek and Bernard Mill nest stands, roads border or intersect the nest stand proper. To a small degree, these roads fragment the nest stand, creating openings in the nest stand. Reynolds et al. (1992) identified that small openings generally exist in productive nest stands. The effect these roads have had on nesting success is not well known. A more probably indirect effect would center on disturbances associated with those roads, including public access and use of the road system, as well as administrative use. The effect such disturbance may have on these nests is not known.

Post Fledging Area

The activities described above have cumulatively affected nearly the entire PFA habitat in the project area. With the exception of the ponderosa pine and juniper woodland areas where merchantable trees did not exist, the remaining conifer habitat has received some level of timber harvest over the past 50 to 75 years. As a result of past harvest, most of the PFA habitat is absent or limited in large tree structure. Intermediate thinning treatments also maintained lower stand density levels in many of these stands. They have also simplified many of the canopies in those stands, reducing overall stand complexities. Exceptions to this description exist. This is particularly true with the Porcupine Creek and Jackass Creek territories, where topography and other factors have limited the impact of harvest activity in the past.

Fire suppression and changes in fire regime, as well as secondary effects of livestock grazing have also influenced stand densities in many of the PFA's. Portions of some of the PFA's, whether due to topography or other factors, have not received extensive harvest manipulations. In these areas, including some riparian areas, stand densities have increased, influenced by the changes to fire regimes in those stands. However, as noted above, harvest actions have done more to mitigate those effects, keeping stand densities and canopy closures low and canopy structure relatively simple through most of the PFA. This is true of some PFA's more than others.

Regardless of the effects or lack thereof, the above actions have shaped the condition and effectiveness of the existing PFA habitat. With the exception of the lack of large tree structure, these changes and manipulations and created habitat conditions are generally good for northern goshawk PFA habitat. As noted, limited research and discussion by Reynolds et al. (1992), Daw and DeStefano (2001), and Marshall (1992), PFA habitat ideally contains a variety and diversity of different habitat conditions, from dense younger forest, to small openings within the canopy, to different forest vegetation communities to late and old structure forest to sources of water. The diversity of forest types provide for an abundance and variety of prey sources and hunting habitats and areas of security and protection for fledged northern goshawks. All of this provides for successful reproductive efforts. Much of the harvest activity, along with the effects of past and present fire management and fire regime change, has created much of that diversity in the existing PFAs.

Implementation of Alternative 1 would not add additional direct effects to the existing PFA's in the Project Area. Indirect effects would entail the continued evolution and change of stand conditions influenced by past harvest actions and past, present and future fire management actions. The cumulative effects described above from those actions would continue to work in changing and evolving the function of these habitats. Cycles of insect and disease outbreaks would continue to alter forest vegetation in stand density, canopy closure, species composition, and large tree structure. The mosaic, diverse stand conditions that currently exist would be maintained and continue to evolve over time, through the short, mid, and long term time periods.

Large tree structure development would continue to be hampered with this alternative, with the lack of intermediate treatments to open up stands, reducing densities and competition, resulting in the slower development of future large tree structure and late and old structure stands. These effects would be cumulative to the effects of fire suppression and changes to fire regimes in these habitats.

Habitat Outside Existing Post Fledging Areas and Nest Stands

The activities described above have resulted in cumulative effects to northern goshawk habitat across the Project Area. A query of vegetation data indicates approximately 3,083 acres of suitable northern goshawk habitat exists in the Project Area. As described for existing nest stands and PFA's, past timber harvest has reduced large tree structure in the forested habitats in the Project Area. This has reduced the quality of northern goshawk habitat on the 3,083 acres of suitable habitat, and has likely moved other habitats out of a suitable habitat condition. Conversely, fire suppression and changes to effective fire regimes have counter-acted some of the timber harvest effects by allowing the development of denser, more complex forest habitats. Much of the 3,083 acres have developed as such. Overall, habitat quality has likely improved over the long term with the effects of fire suppression and changes to fire regime.

Alternative 1 would not contribute additional direct or indirect effects to the cumulative effects of past, present or reasonably foreseeable future actions. As such, Alternative 1 would not contribute cumulative effects to northern goshawk habitat. The existing condition would be maintained over the short to mid term. Over the long term, limited large tree structure would develop in portions of the 3,083 acres of habitat that is outside existing PFA's and nest stands. This would result in gradual improvements to the quality of habitat. Canopy closures would remain relatively high and would gradually increase over time on the 3,083 acres, as would canopy structure complexity. The loss of small openings that may result from increasing stand densities may reduce forage habitat quality over time.

Direct and Indirect Effects – Alternative 2

Nesting Habitat (habitat and activity of territory)

Spur Butte Territory

The activities proposed for Unit 12, which contains the Spur Butte territory nest stand, would result in indirect effects to nesting northern goshawks through reductions in stand density and upper canopy complexity as a result of proposed commercial harvest and non-commercial thinning. All 30 acres of the nest stand would be treated. Likewise, overall canopy closure would also decrease with the harvest and removal of trees in the stand. The prescription for harvest would result in the SDI decreasing from the current level of 273 to approximately 100-120. The range in final SDI allows for some variance in retained density of middlestory trees. Stand density would be reduced by roughly two-thirds (2/3). Canopy closure percentage would decrease by approximately 15-17% to roughly 35-40% depending upon the varying density retained. Existing large tree structure would be maintained as no trees over 21" would be harvested.

The effects to northern goshawk nesting habitat would be a decline in habitat suitability over the short term. The reduction in stand density and canopy closure would move these stands below the quality habitat descriptions provided by Daw and DeStefano (2001), Marshall (1992), Marshall, Hunter, and Contreras (2003), Reynolds (1982) and Reynolds et al. (1992). This may result in abandonment of the nest stand, at least in the short to mid term until such time as suitable habitat conditions develop. It is important to note, however, that Daw and DeStefano (2001) found successful nesting northern goshawks in nest stands with open, low density, low canopy closure. Personal experience with Daw and DeStefano's study, as well as other personal observations in their study areas and on the Paulina Ranger District, show that successful nesting attempts do occur in nest stands comparable to what this stand would look like after implementation of this alternative. The prescription to be implemented would be 122-146% of the UMZ and would retain

a moderate canopy closure. More importantly, large tree structure in the form of the nest tree and replacement nest trees would be maintained. The mosaic of retention densities would also help maintain some upper canopy level structure that is important to nesting habitat.

In the mid to long term, without future stocking control actions (commercial and non-commercial harvests), stand densities and canopy closure would increase as the stand develops and matures. Remaining trees would mature, and with the lower stand density, canopies would fully develop. This would improve habitat conditions by increasing upper stand structure conditions and higher canopy closures. In the mid to long term, canopy closures would be expected to reach 45-50%. Current policy of enhancing and maintaining fire adapted forest systems is expected to continue. Implementation of such policy would likely prevent this nest stand from reaching the canopy closures that the stand currently exhibits. Tree species composition would be primarily ponderosa pine in the upper canopy levels with an occasional Douglas-fir.

With this alternative, large tree structure would be maintained throughout the short, mid and long term time periods. The prescription for stand 12 would leave all trees greater than 21" dbh and favor the largest trees below 21" dbh that are healthy and resilient. By reducing stand densities, the risks of insect mortality in the remaining stand would be reduced substantially. This would insure that these larger trees persist throughout the short to long term. By maintaining the large tree structure, suitable nest trees and replacement nest trees would be maintained over time. Reducing stand densities would also allow for quicker development of large tree structure in that stand with the expected increase in growth rate after harvest. Abundant large tree structure and the development of a late and old structure stand condition would be expected in 25- 35 years for this stand.

Northern goshawks would be expected to continue to nest in the Spur Butte nest stand post treatment. The maintenance of large tree structure, along with maintaining a middle story structure, would maintain canopy closures of roughly 35-40%. Over the mid to long term, habitat quality would improve as existing tree canopies expand with the increased growing space and trees mature. Canopy closures would eventually achieve nearly 50% and upper canopy levels would enhance structure diversity. Large tree structure would be maintained throughout that time period, with the density of large trees expanding later into the mid term as retained trees reach mature size classes.

No direct effects from logging operations would occur to nesting northern goshawks, as timing restrictions for harvest activities would be initiated as described in the Design Criteria Section of Chapter 2.

Porcupine Creek Territory

The harvest actions proposed in units 94 and 144 would result in indirect effects to the entire nest stand associated with the Porcupine Creek territory. The commercial and non-commercial thinning proposed under Alternative 2 would reduce stand densities (measured in SDI) and canopy closure, as well as reduce some of the complexity of upper canopy levels. Understory trees would also be thinned. Large tree structure (>21" dbh) would be maintained with this alternative. The prescription proposed with Alternative 2 would reduce the existing SDI of 294 to approximately 100-120. The range of the final SDI allows for some variance in retained density in the middlestory providing northern goshawk habitat. This would reduce the density of the stand by roughly two-thirds (2/3). Canopy closure would decrease approximately 18-23% to a canopy closure of 35-40%, depending upon retained stand density. Existing large tree structure would be maintained as no trees greater than 21" dbh would be cut.

The effects to northern goshawk nesting habitat would be similar to those experienced in the Spur Butte territory. In the short term, nesting habitat effectiveness would be reduced with the decline in stand density and canopy closure. As noted in the Spur Butte discussion, however, this may not necessarily preclude successful nesting attempts by nesting pairs of northern goshawks. The prescription to be implemented would be 116-140% of the UMZ and would retain a moderate canopy closure. More importantly, large tree structure in the form of the nest tree and replacement nest trees would be maintained. The mosaic of retention densities would also help maintain some upper canopy level structure that is important to nesting habitat.

As with the Spur Butte territory, habitat conditions would improve over the mid to long term. Canopy closures would increase from the post harvest percentage of 35-40% towards 45-50%+ over the following 30 to 50 years as retained middle story trees develop fuller canopies as they grow, and natural reproduction in-growth fills canopy spaces. As with the Spur Butte territory, current policy and direction to maintain fire adapted communities in a relative open, fire resilient condition; would likely prevent development of existing stand densities and canopy closures. Tree species composition would be a mix of dominant ponderosa pine and subdominant Douglas-fir.

With Alternative 2, large tree structure would be maintained throughout the short, mid, and long term time periods. Large tree structure is an important component of northern goshawk nesting habitat (Daw and DeStefano 2001; Marshall 1992; Marshall, Hunter, and Contreras 2003; Reynolds 1982; Reynolds et al. 1992). The prescriptions for stands 94 and 144 would remove competing middlestory trees surrounding larger mature trees (>21" dbh), allowing for additional growing space and reducing the risk of density dependent stresses and insect related mortality. This would maintain the nest tree and suitable nest tree replacements throughout the short to long term time periods. In addition, the thinning proposed would increase the development of additional large tree structure by reducing stand densities and inter-tree competition for resources. Additional large trees would develop within 30 to 50 years in this stand.

No direct effects from logging operations would occur to nesting northern goshawks, as timing restrictions for harvest activities would be initiated as described in the Design Criteria Section of Chapter 2.

Bernard Mill Territory

The harvest actions proposed in Alternative 2 for stand 55 would result in indirect effects to the entire nest stand for the Bernard Mill territory. Commercial and non-commercial thinning proposed with this alternative would reduce stand densities and canopy closure, as well as reduce at some level the complexity of the middle and upper canopy levels. Understory thinning would reduce the small tree (<7" dbh) component of the canopy as well. Large tree structure (>21" dbh), which is already low due to past harvest actions would be maintained at their existing levels. The existing SDI of 312 would be reduced by over one half (1/2) to approximately 144. Some variance in the final SDI would be likely based upon the variable nature of the harvest to maintain some complexity in the existing middlestory canopy. Canopy closure would be reduced roughly 10-15% with a final canopy closure of approximately 40-45%, again dependent upon site specific stand densities that are maintained.

The effects to northern goshawk nesting habitat in the short term would be similar to those experienced in the Spur Butte and Porcupine Creek territories. In the short term, nesting habitat effectiveness would decrease with the reduction in stand density and canopy closure. Again, as noted with the analysis of the Spur Butte nest stand, this may not necessarily preclude nesting use by northern goshawk pairs. Canopy closures of 40-45%, along with the retention of the largest

available trees would likely provide a habitat condition suitable for successful nesting (Daw and DeStefano 2001; personal observations). Retained complexity in the middlestory canopy through the variable density retention prescription would also help in maintaining suitable habitat. However, there would be an increased risk of non-use or territory abandonment from changes to habitat conditions.

As with the other two territories; habitat conditions, reflected in stand densities and in canopy closure, would improve over the mid to long term. The nest stand in this territory is a relatively high productivity site (UMZ SDI of 154, as compared to Spur Butte and Porcupine Creek which have UMZ levels of 82 and 86 respectively) and would be expected to infill and develop increased canopy closure in the mid term. Canopy closures of 50% could be reached by year 30. Existing policy and direction relative to fire adapted vegetation systems would likely limit the extent of canopy closure development and complexity. The existing condition, with the high SDI and canopy closure would not likely be realized in the future. However, suitable habitat conditions of higher canopy closures would be achieved in that mid term. Species composition would be a mix of ponderosa pine and Douglas-fir in the developing canopy.

Because of historic harvest, large tree structure in the existing stand is largely absent. Only 4 large trees per acre are noted in the existing stand condition. With the proposed thinning treatment, development of additional large tree structure would be expected in the late mid term to long term. Current average diameters in the middle story canopy are around 14.5” dbh. With the thinning proposed, additional large tree structure (>21” dbh) would develop within 25 to 40 years, species being a mix of favored ponderosa pine and Douglas-fir. While not ideal, existing large tree structure and larger middlestory trees (15-21” dbh) would provide suitable nest trees through the short, mid, and long term time periods until additional large trees develop. The existing nest tree is a 17” Douglas-fir.

No direct effects from logging operations would occur to nesting northern goshawks, as timing restrictions for harvest activities would be initiated as described in the Design Criteria Section of Chapter 2.

Post Fledging Area

Alternative 2 proposes to enter each of the PFA’s for the six (6) northern goshawk territories in the watershed. Table 8 identifies the number of acres of commercial thinning and non-commercial thinning that would occur in each territory’s PFA for Alternative 2.

Table 8. Acres of Commercial and Non-Commercial Thinning in PFA Habitat by Territory for Alternative 2.

Territory	Commercial Thinning (acres)	Non-Commercial Thinning (acres)	Percent of PFA
Bear Creek	13	109	27%
Bernard Mill	190	212	51%
Jackass Creek	16	0	4%
Spur Butte	65	73	17%
Porcupine Creek	72	102	25%
South Fork John Day	0	21	5%

There would be no direct effects associated with commercial and non-commercial thinning actions proposed in Alternative 2. Harvest activities as well as those associated with the haul of timber, road construction or reconstruction, or any other mechanical disturbance would not occur during restricted time periods as outlined in the Project Design Criteria.

Indirect effects to PFA habitat associated with the actions proposed in Alternative 2 would center on the changes to PFA habitat as a result of commercial and non-commercial thinning actions, and to a lesser degree prescribed fire and fuels treatments. Where commercial and/or non-commercial thinning occurred, stand densities and complexities would be reduced. Canopy closures would be reduced, resulting in a more open canopy conditions. These changes to stand condition would be maintained in the short to mid term.

Large tree structure in the short, mid and long term would be enhanced in these PFA's. In the short term, existing large trees (>21" dbh) and larger middle story trees (15-21" dbh) would be less at risk to insect induced mortality and wildfire. Greater numbers of these trees would persist in the short term. Over the mid to long term, growth in the 15-21" dbh trees, enhanced by reduced stocking levels, would grow and develop into large tree structure. Expected time frames for this development would be years 25-40 beyond project implementation. Development of this large tree structure would enhance northern goshawk PFA habitat in that time frame, as most PFA are deficient in this structure. This would also add to potential nesting habitat within the territory. Large trees, as identified in the Forest Plan Amendment 2, would not be harvested with this alternative.

The magnitude of these effects in each PFA would be dependent upon the amount of area treated (Table 8). The Bernard Mill PFA would have roughly 51% of the PFA treated with commercial and/or non-commercial thinning (this includes treatments to the nest stand as well). Bear Creek and Porcupine Creek PFA's would be treated on 27% and 25% respectively. Spur Butte PFA would be treated on 17% of the area, while Jackass Creek and South Fork John Day PFA would have little treatment, at 4% and 5% respectively.

Changes to the PFA habitat would be of benefit to northern goshawks in that large tree structure would be developed in the mid to long term in these stands where this habitat feature is largely lacking. This would be consistent with Forest Plan direction. The proposed treatments would provide some additional diversity in the habitats provided by the PFA's.

An adverse effect, however, would be associated with the loss of potential snag habitat provided by the overstocked stands that would be treated. By reducing the risk of insect and disease mortality, opportunities for snag habitats, and thus populations of some woodpecker species (see MIS discussion) would affect potential prey sources for northern goshawks in the PFA. The overall effect to northern goshawk reproductive success may be negligible, as research indicates foraging habitat/territory area for a pair of goshawks often exceeds 5,000 acres (Marshall 1992; Marshall, Hunter, and Contreras 2003; Reynolds et al. 1992). However, suitable prey habitat would be reduced in the PFA, and may affect fledged juveniles.

Habitat Outside Existing Post Fledging Areas and Nest Stands

With implementation of Alternative 2, there would be indirect effects on northern goshawk habitat outside existing PFA's and nest stands. A reduction in suitable habitat would occur in the short to mid term, with total acres of suitable habitat reduced to 2,497 acres (19% reduction from the existing condition). A combination of commercial and non-commercial thinning would cause this

reduction. Over the long term, however, northern goshawk habitat would increase to 3,337 acres of suitable habitat. This habitat would also be higher quality with a greater density of large tree structure (>21" dbh) present in the habitat that was treated. In the same time frame, stand densities in the treated stands would increase and provide high canopy closures and stand structure diversity. This would provide for a higher overall habitat quality when compared to the existing condition, where large tree structure is generally absent.

Cumulative Effects – Alternative 2

Nesting Habitat

The cumulative effects section for Alternative 1 describes four past actions and activities that have affected the three identified nest stands. All three nest stands in the Spur Butte, Porcupine Creek, and Bernard Mill territories have been affected by past timber harvest, fire suppression and alteration of fire regimes, livestock grazing, and road building. In essence, the existing condition of those stands described in the Affected Environment section are a function of the effects and influences of these past and present actions and activities. The stand density, canopy closure, large tree structure, tree species diversity, and overall function of these stands as nesting habitat were influenced by those past and present management actions.

Alternative 2 proposes actions that would affect stand density, canopy closure, large tree structure and tree species diversity in some or all of the three nest stands. Most of the actions proposed are designed to reverse or mitigate adverse cumulative effects of past management actions; most notably, either the lack of large tree structure or the high risk of mortality in existing large trees (>21" dbh). Past harvest management has reduced existing large tree densities well below what historically existed in these three nest stands. The Bernard Mill nest stand in particular is well below expected stand densities for large trees (22-4' large trees per acre potential; 4 large trees per acre existing). Spur Butte (12-22 large trees per acre potential; <8 large trees per acre existing) and Porcupine Creek (12-23 large trees per acre potential; 11 large trees per acre existing) nest stands are also deficient, though to a lesser degree. Compounding the cumulative effects of past timber harvest is the effects of fire suppression and changes to fire regimes. Changes to fire regimes have allowed stand densities to greatly exceed sustainable densities in the face of drought stresses and insect attacks (SDI for the three nest stands are two (2) to three and one half (3 ½) times the UMZ

SDI value). In the Spur Butte nest stand, the adverse effects of the over stocked stand are already being seen, with 40-50% mortality in the upper middle story and overstory tree structure in the past 5-7 years. The Bernard Mill nest stand displays similar adverse insect and disease caused mortality in its upper middle story structure. The actions proposed in Alternative 2 would greatly reduce existing stand densities to sustainable levels that are at low risk for further insect induced mortality. This alternative would in turn protect existing large tree structure and maintain that important nest stand habitat in the short, mid, and long term time periods. In the mid to long term, the density reduction would work to replace lost large tree structure in a shorter and quicker time frame, further enhancing northern goshawk nesting habitat.

The actions proposed in Alternative 2 would result in reductions to canopy closure. The cumulative effects of fire suppression and fire regime change and secondary livestock effects have created high canopy closure conditions in each of the three nest stands. Such a condition is conducive to high quality northern goshawk habitat. However, given that the stand densities to provide that high level of canopy closure are two (2) to three and one half (3 ½) times densities considered sustainable for those plant communities, such a high canopy closure is not sustainable.

Indeed, the Spur Butte territory has already seen measurable canopy closure levels as a result of the extensive insect related mortality. Canopy closure around the nest tree is at 35-40%, well below the 50%+ recommended by research. Bernard Mill nest stand is showing similar canopy closure reductions with insect related mortality in the grand fir and ponderosa pine. The Porcupine Creek territory is similarly threatened. The actions proposed would mechanically lower the stand density, and thus canopy closure, to more sustainable levels (40-45% in Spur Butte [outside the immediate nest stand area] and Porcupine Creek territory; 45-50% in Bernard Mill territory). This would essentially reverse the effects of past and present fire suppression and fire regime effects (cumulative effects) on existing stand densities. While not at the preferred level of 50%+, research (Daw and DeStefano 2001) and personal observations indicate habitat will be suitable to support continued successful nesting effort. More importantly, the reduced stand densities and canopy closure will leave the nest stand more resilient to insect attacks and maintain large tree and middlestory trees intact and present throughout the short, mid, and long term time periods. This will perpetuate nesting habitat for the three territories over a longer time period.

Post Fledging Area

The cumulative effects analysis for Alternative 1 describes the past and present actions which have affected the quality and condition of northern goshawk habitat in the PFA's for each territory in the Project Area. Past and present activities that have resulted in timber harvest or vegetation manipulation, fire suppression and changes to fire regimes in forest communities, grazing of livestock, and construction of roads have all cumulatively affected the PFA's present in the Project area. Some have been affected more than others. The results of these effects are essentially the existing condition of PFA habitat described in the Affected Environment section for northern goshawk habitat.

The direct and indirect effects section for Alternative 2 describes the effects expected as a result of this alternative if implemented. Those effects would be cumulative to the effects of past timber harvest actions, fire suppression and fire regime changes, livestock grazing, and road construction. Some of those effects would be additive. Past timber harvest actions have reduced canopy closure in some PFA habitat. Likewise, canopy complexity, particularly in upper canopy levels was reduced. Further commercial and/or non-commercial thinning would add to total acres of lower

density and complex habitat in the PFA's. Some PFA's would be more affected by these treatments cumulatively than others, depending upon the acres treated (Table 8).

Opposite of that, much of the commercial and/or non-commercial thinning and associated fuels treatments would reverse some of the cumulative effects of past actions; in particular, the enhanced development of large tree structure, and the dense stand densities that have hampered replacement of those large trees. Past harvest actions and the suppression of fire/changes in fire regimes have limited the development of large tree structure in the PFA's affected. By implementing Alternative 2, those cumulative effects upon large tree structure would be countered. The level of that change and countered effect would depend upon the number of acres treated within the PFA (Table 8).

Overall, the cumulative effects of the quality and condition of PFA habitat in the six (6) territories in the project area would be relatively negative in the short to early mid term (0-10 years). Stand density, canopy closure, and structure complexity would be reduced. The magnitude of the effect would be dependent upon the number of acres treated. In the mid to long term, however, the cumulative effects would be positive. Large tree structure would develop and do so at a faster rate. Natural development of tree canopies and growth would increase canopy closure and structure

complexity over that time as well, improving habitat conditions and complementing the large tree structure that would develop.

Habitat Outside Existing Post Fledging Areas and Nest Stands

The activities described above have resulted in cumulative effects to northern goshawk habitat across the Project Area. A query of vegetation data indicates approximately 3,083 acres of suitable northern goshawk habitat exists in the Project Area. As described for existing nest stands and PFA's, past timber harvest has reduced large tree structure in the forested habitats in the Project Area. This has reduced the quality of northern goshawk habitat on the 3,083 acres of suitable habitat, and has likely moved other habitats out of a suitable habitat condition. Conversely, fire suppression and changes to effective fire regimes have counter-acted some of the timber harvest effects by allowing the development of denser, more complex forest habitats. Much of the 3,083 acres have developed as such. Overall, habitat quality has likely improved over the long term with the effects of fire suppression and changes to fire regime.

Alternative 2 would contribute additional direct or indirect effects to the cumulative effects of past, present or reasonably foreseeable future actions. The proposed commercial and non-commercial thinning activities would reduce suitable northern goshawk habitat by 19% (586 acres). This would be cumulative to the effects of past timber harvest actions which has reduced the quality and distribution of northern goshawk habitat in the Project Area. The thinning proposed would counteract the effects of past fire suppression and changes to fire regimes by reducing stand densities in the treated stands. The higher stand densities that currently exist are a function of fire suppression effects. Cumulatively, in the short to mid term, northern goshawk habitat would be reduced in the Project Area.

Over the long term, the cumulative effects of the proposed treatments (which will favor development of large tree structure) combined with the cumulative effects of current and likely future fire suppression actions would result in increases in suitable northern goshawk habitat. In years 20-40, 3,337 acres of suitable habitat would exist, with relatively high stand densities and the development of large tree structure on the treated acres. Cumulatively, habitat quality would improve over the long term.

Direct and Indirect Effects – Alternative 3

Nesting Habitat

Effects to nesting habitat with implementation of this alternative would be the same as in Alternative 1, as no activities are proposed in designated northern goshawk stands with Alternative 3.

Post Fledging Area

Alternative 3 proposes to enter each of the PFA's for the six (6) northern goshawk territories in the watershed. Table 9 identifies the number of acres of commercial thinning and non-commercial thinning that would occur in each territory's PFA for Alternative 2.

Table 9. Acres of Commercial and Non-Commercial Thinning in PFA Habitat by Territory for Alternative 3.

Territory	Commercial Thinning (acres)	Non-Commercial Thinning (acres)	Percent of PFA
Bear Creek	13	109	27%
Bernard Mill	160	182	43%
Jackass Creek	4	0	1%
Spur Butte	36	44	10%
Porcupine Creek	31	60	15%
South Fork John Day	0	0	0%

There would be no direct effects associated with commercial and non-commercial thinning actions proposed in Alternative 3. Harvest activities as well as those associated with the haul of timber, road construction or reconstruction, or any other mechanical disturbance would not occur during restricted time periods as outlined in the Project Design Criteria.

Indirect effects to PFA habitat associated with the actions proposed in Alternative 2 would center on the changes to PFA habitat as a result of commercial and non-commercial thinning actions, and to a lesser degree prescribed fire and fuels treatments. Where commercial and/or non-commercial thinning occurred, stand densities and complexities would be reduced. Canopy closures would be reduced, resulting in a more open canopy condition. These changes to stand condition would be maintained in the short to mid term.

Large tree structure in the short, mid and long term would be enhanced in these PFA's. In the short term, existing large trees (>21" dbh) and larger middle story trees (15-21" dbh) would be less at risk to insect induced mortality and wildfire. Greater numbers of these trees would persist in the short term. Over the mid to long term, growth in the 15-21" dbh trees, enhanced by reduced stocking levels, would grow and develop into large tree structure. Expected time frames for this development would be years 25-40 beyond project implementation. Development of this large tree structure would enhance northern goshawk PFA habitat in that time frame, as most PFA are deficient in this structure. This would also add to potential nesting habitat within the territory.

The magnitude of these effects in each PFA would be dependent upon the amount of area treated (Table 9). The Bernard Mill PFA would have roughly 43% of the PFA treated with commercial and/or non-commercial thinning (this includes treatments to the nest stand as well). Bear Creek PFA would have treatment on 27%. Porcupine Creek PFA would be treated on 15% respectively. Spur Butte PFA would be treated on 10% of the area, while Jackass Creek would be affected on 1% of its PFA, and the South Fork John Day would not be treated at all.

Changes to the PFA habitat would be of benefit to northern goshawks, in that large tree structure would be developed in the mid to long term in these stands, where this habitat feature is largely lacking. This would be consistent with Forest Plan direction. The proposed treatments would provide some additional diversity in the habitats provided by the PFA's.

An adverse effect, however, would be associated with the loss of potential snag habitat provided by the overstocked stands that would be treated. By reducing the risk of insect and disease mortality, opportunities for snag habitats, and thus populations of some woodpecker species (see MIS discussion) would affect potential prey sources for northern goshawks in the PFA. The overall

effect to northern goshawk reproductive success may be negligible, as research indicates foraging habitat/territory area for a pair of goshawks often exceeds 5,000 acres (Marshall 1992; Marshall, Hunter, and Contreras 2003; Reynolds et al. 1992). However, suitable prey habitat would be reduced in the PFA and may affect fledged juveniles.

Habitat Outside Existing Post Fledging Areas and Nest Stands

With implementation of Alternative 3, there would be indirect effects on northern goshawk habitat outside existing PFA's and nest stands. An increase in suitable habitat would occur in the short to mid term, with total acres of suitable habitat increasing to 3,213 acres (4% increase). The increase in habitat would be the result of the conversion of currently unsuitable habitat to suitable habitat in the dry grand fir and Douglas-fir plant communities. Over the long term, northern goshawk habitat would increase to 3,713 acres of suitable habitat. This habitat would also be higher quality with a greater density of large tree structure (>21" dbh) present in the habitat that was treated. In the same time frame, stand densities in the treated stands would increase and provide high canopy closures and stand structure diversity. This would provide for a higher overall habitat quality when compared to the existing condition, where large tree structure is generally absent.

Cumulative Effects – Alternative 3

Nesting Habitat

The implementation of Alternative 3 would not result in additional effects to the cumulative effects described above. The three identified nest stands would not be altered as no activities are proposed in designated northern goshawk stands with this alternative. A continued trend of declining habitat condition would continue with each nest stand. This trend would be the result on continued mortality in the middle and overstory canopies, resulting in the decline in large tree structure and replacement trees. Density dependent influences (increased susceptibility to drought stresses and insect and disease related mortality) would continue to affect stand habitat conditions. Large tree structure would slowly develop over the long term. Over the long term (50-70+ years out), suitable nest stand conditions would eventually develop, as lost large tree structure and stand densities increase to suitable habitat levels.

Post Fledging Habitat

Refer to Appendix A for a full detailed list of known past, present or reasonably foreseeable activities that have or will occur in the project. Past and present activities that have resulted in timber harvest or vegetation manipulation, fire suppression and changes to fire regimes in forest communities, grazing of livestock, and construction of roads have all cumulatively affected the PFA's present in the Project area. Some have been affected more than others. The results of these effects are essentially the existing condition of PFA habitat described in the Affected Environment section for northern goshawk habitat.

The direct and indirect effects section for Alternative 3 describes the effects expected as a result of this alternative if implemented. Those effects would be cumulative to the effects of past timber harvest actions, fire suppression and fire regime changes, livestock grazing, and road construction. Some of those effects would be additive. Past timber harvest actions have reduced canopy closure in some PFA habitat. Likewise, canopy complexity, particularly in upper canopy levels was reduced. Further commercial and/or non-commercial thinning would add to total acres of lower

density and complex habitat in the PFA's. Some PFA's would be more affected by these treatments cumulatively than others, depending upon the acres treated (Table 9).

Opposite of that, much of the commercial and/or non-commercial thinning and associated fuels treatments would reverse some of the cumulative effects of past actions; in particular, the enhanced development of large tree structure and the dense stand densities that have hampered replacement of those large trees. Past harvest actions and the suppression of fire/changes in fire regimes have limited the development of large tree structure in the PFA's affected. By implementing Alternative 3, those cumulative effects upon large tree structure would be countered. The level of that change and countered effect would depend upon the number of acres treated within the PFA (Table 9).

Overall, relative to the cumulative effects of the quality and condition of PFA habitat in the six (6) territories in the project area, effects would be relatively negative in the short to early mid term (0-10 years). Stand density, canopy closure, and structure complexity would be reduced. The magnitude of the effect would be dependent upon the number of acres treated. In the mid to long term, however, the cumulative effects would be positive. Large tree structure would develop and do so at a faster rate. Natural development of tree canopies and growth would increase canopy closure and structure complexity over that time as well, improving habitat conditions and complementing the large tree structure that would develop.

Habitat Outside Existing Post Fledging Areas and Nest Stands

The activities described in the cumulative effects section for Alternative 1 have resulted in cumulative effects to northern goshawk habitat across the Project Area. A query of vegetation data indicates approximately 3,083 acres of suitable northern goshawk habitat exists in the Project Area. As described for existing nest stands and PFA's, past timber harvest has reduced large tree structure in the forested habitats in the Project Area. This has reduced the quality of northern goshawk habitat on the 3,083 acres of suitable habitat and has likely moved other habitats out of a suitable habitat condition. Conversely, fire suppression and changes to effective fire regimes have counteracted some of the timber harvest effects by allowing the development of denser, more complex forest habitats. Much of the 3,083 acres have developed as such. Overall, habitat quality has likely improved over the long term with the effects of fire suppression and changes to fire regime.

Alternative 3 would contribute additional direct or indirect effects to the cumulative effects of past, present or reasonably foreseeable future actions. The proposed commercial and non-commercial thinning activities would increase suitable northern goshawk habitat by 4% (130 acres). This would be counter to the cumulative effects of past timber harvest actions which have reduced the quality and distribution of northern goshawk habitat in the Project Area. The thinning proposed would counteract the effects of past fire suppression and changes to fire regimes by reducing stand densities in the treated stands. The higher stand densities that currently exist are a function of fire suppression effects. Cumulatively, in the short to mid term, northern goshawk habitat would be increased in the Project Area.

Over the long term, the cumulative effects of the proposed treatments (which will favor development of large tree structure) combined with the cumulative effects of current and likely future fire suppression actions would result in increases in suitable northern goshawk habitat. In years 20-40, 3,713 acres of suitable habitat would exist, with relatively high stand densities and the development of large tree structure on the treated acres. Cumulatively, habitat quality would improve over the long term.

Summary of Effects and Conclusions

Nesting Habitat

Tables 10 and 11 summarize the anticipated changes in three habitat components measured to describe the effects of the proposed alternatives on northern goshawk nesting habitat in three established territories and nest stands. Table 10 summarizes the anticipated changes for Alternatives 1 and 3, where no harvest action would occur in the nest stand; Table 11 summarizes the changes for Alternative 2, which would harvest commercial and non-commercial trees in the three nest stands.

Table 10. Summary of Changes in Nesting Habitat Components over Time for Alternatives 1 and 3

Habitat Component	Short Term (0-5 years)			Mid Term (5-30 years)			Long Term (30-100 years)		
	Spur Butte	Porcupine Creek	Bernard Mill	Spur Butte	Porcupine Creek	Bernard Mill	Spur Butte	Porcupine Creek	Bernard Mill
SDI	273	294	304	n/a ²	n/a ²	n/a ²	n/a ²	n/a ²	n/a ²
CC	35-51%	58%	55-60%	25-55%	30-60%	40-60%	40-60%	40-60%	50-65%
LTPA	<8	11	4	<4	<8	<4	4-8	8-10	4-8

SDI – Stand Density Index; CC – Canopy Closure; LTPA – Large Trees (>21”dbh) Per Acre

Table 11. Summary of Changes in Nesting Habitat Components over Time for Alternative 2

Habitat Component	Short Term (0-5 years)			Mid Term (5-30 years)			Long Term (30-100 years)		
	Spur Butte	Porcupine Creek	Bernard Mill	Spur Butte	Porcupine Creek	Bernard Mill	Spur Butte	Porcupine Creek	Bernard Mill
SDI	100-120	100-120	148	110-130	110-125	160-190	130-150	110-125	210-250
CC	35-40%	40-45%	45-50%	40-45%	45-50%	50-55%	45-55%	45-50%	50-55%
LTPA	8	11	4	10-12	12-15	8-10	12-30	15-30	12-40

SDI – Stand Density Index; CC – Canopy Closure; LTPA – Large Trees Per Acre

The two most notable differences between Alternatives 1 and 3, where no activity would occur in the nest stands, and Alternative 2, where commercial and non-commercial thinning would occur is in the changes to SDI, CC, and the number of large trees per acre over time. Alternatives 1 and 3 would result in the lowest number of large trees per acre, and slowest recovery over time when compared to Alternative 2. Likewise, Alternatives 1 and 3 would result in the greatest fluctuation in SDI and CC, and a longer delay in recovery of those habitat components when compared to Alternative 2. Alternative 2 would provide suitable nesting habitat over the greatest amount of

² The model used for predicting changes in stand density index (SDI), canopy closure, and large trees per acre (LTPA) did not account for continued insect mortality effect that would be predicted with alternative one, and the resulting changes to SDI, canopy closure, and development of large trees per acre. As such, quantitative data is not available. In the mid term, each of the three territories are expected to decline in SDI and canopy closures to levels represented by the upper management zone (UMZ). These are essentially densities and canopy closures that would be managed for in the short term by the actions proposed in Alternative 2. See the effects discussion for Alternative 1 in the above analysis.

time over the next 100 years, and that habitat condition, relative to large tree structure, canopy closure, and upper canopy structure would be most stable over that time period.

Post Fledging Area Habitat

Suitable northern goshawk PFA habitat would persist through the short, mid and long term for each of the three alternatives. The quality of habitat in each time period would vary between alternatives, as would the development or maintenance of certain habitat features. In the short term to early mid term (0-5 years), Alternative 1 would maintain the highest quality PFA habitat in each of the six (6) northern goshawk territories. Alternatives 2 and 3 would result in reduced habitat quality due to reductions in stand density, canopy closure, and upper canopy complexity. The magnitude of that change and effect varies by territory (Tables 8 and 9 demonstrate those differences for Alternatives 2 and 3). Alternatives 2 and 3 would maintain higher habitat quality in the mid to long term. The commercial and non-commercial thinnings proposed in the two action alternatives would stimulate the development of large tree structure more quickly than Alternative 1 (Alternative 1 – 50-70 years out after implementation; Alternatives 2 and 3 – 25 to 45 years out after implementation). Also, over the mid and long term, stand densities, canopy closure, and upper canopy level complexity would develop to desired conditions for northern goshawk PFA habitat. Alternative 1 would experience a further decline in habitat in the mid term due to insect and disease effects, and a lag in habitat improvement, with near desired habitat conditions developing well into the long term (50+ years). All three alternatives would maintain a mosaic of structure, canopy closure, and upper level canopy structure conditions.

Habitat Outside Existing Post Fledging Areas and Nest Stands

Alternative 1 would maintain the existing condition of suitable northern goshawk nests that exists outside existing PFA and nest stand habitats. Currently, 3,083 acres of suitable habitat exists. Over time, this habitat would improve with the slow development of large tree structure in the late long term (70-100 years). Large tree structure is relative scarce and absent in existing suitable habitat. Alternative 2 would result in short to mid term reductions in suitable northern goshawk habitat (2,497 acres). However, in the long term, suitable habitat would increase, and exceed current habitat acres (3,337 acres). Habitat quality would also improve with a greater presence of large tree structure, and in a shorter time frame than with Alternative 1. Large tree structure would be expected in years 30-40. Alternative 3 would result in a net increase in suitable northern goshawk habitat (3,213 acres) due to the conversion of unsuitable to suitable habitats. As with Alternative 2, suitable habitat would increase over the long term, with 3,713 acres of suitable habitat being present in years 2036 to 2046. Habitat quality would also be higher, as large tree structure would develop more rapidly than with Alternative 1, with large tree structure being abundant in 30-40 years out.

Issue #1

Issue 1 derived from Alternative 2, the Proposed Action through public scoping and the expressed concern and issue with implementing timber harvest actions in the three northern goshawk nest stands. A concern was raised that timber harvest in the form of proposed commercial and non-commercial thinning would affect the suitability of the nesting habitat and affect habitat use and reproductive success. Alternative 2 would also not meet Forest Plan standards for the deferral of harvest management in identified northern goshawk nesting habitat.

Alternatives 1 and 3 address this issue. Neither alternative proposes any harvest actions within the nest stands of the three potentially affected territories.

Land Resource Management Plan Standards

Nesting Habitat

Alternatives 1 and 3 would meet the Forest Plan standards as amended by the Forester's Eastside Forest Plan Amendment #2. Standard 5)a) directs that every known active and historical northern goshawk nest-site will be protected from disturbance. Standard 5)b) directs that 30 acres of the highest quality nesting habitat surrounding existing northern goshawk nests will be deferred from harvest.

Alternative 2 would not meet the Forest Plan standards as amended by the Forester's Eastside Forest Plan Amendment #2. Standard 5)a) would be met, as no disturbing activities would occur during the time of active nest use or when northern goshawks are present and nesting in the territory. However, Standard 5)b) would not be met, as the nest stand identified for each of the three territories (Spur Butte, Porcupine Creek, and Bernard Mill) would be entered with a timber harvest in the form of commercial and non-commercial thinning. A Site Specific Forest Plan Amendment would be required in order to implement this alternative.

Post Fledging Area Habitat

All three alternatives proposed with this project would meet Forest Plan standards as amended by the Forester's Eastside Forest Plan Amendment #2. Standard 5)c) prescribes that harvest may occur within the 400 acre Post Fledging Area (PFA), however existing late and old structure (LOS) stands will be retained and younger stands will be managed for LOS stand conditions. Alternative 1 would not enter PFA habitat, thereby meeting this standard. Alternatives 2 and 3 would enter portions of four (4) or five (5) territory PFA's. Prescriptions for the commercial and non-commercial thinnings proposed would maintain existing LOS stands, and would manage existing younger stands towards an LOS habitat condition suitable for northern goshawk fledging and foraging habitat. Alternatives 2 and 3 would meet this standard.

Purpose and Need

The Purpose and Need identified in Chapter 1 of the EA does not specifically mention northern goshawks or northern goshawk habitat. However, components of northern goshawk habitat, namely late and old structure habitat, are addressed as a need for enhancement and development. Such habitat condition for northern goshawk habitat in existing territories as well as across the Project Area is lacking. Northern goshawks would benefit from the development of late and old structure habitat that would result from Alternatives 2 and 3.

Desired Condition

Nesting Habitat

Alternatives 1 and 3 would not meet the desired condition for northern goshawk nest stands in the three territories analyzed with this project. The current condition, which is overstocked, stressed, and susceptible or succumbing to insect and disease effects is not stable and would not maintain suitable or desirable nesting habitat over the mid to long term. Large tree structure and canopy

closure features would be at risk and would likely drop well below thresholds that would provide suitable or even marginal habitat conditions for nesting northern goshawks.

Alternative 2 would meet the desired condition for northern goshawk nest stands in the mid to long term. In the short term, stand density and canopy closure would be reduced below published preferred canopy closures (>50% - Reynolds 1983; Reynolds et al. 1992; Daw and DeStefano 2001; Marshall 1992). However, large tree structure as it currently exists would be maintained and persist and be more resilient to further or future insect mortality. Over the mid term, stand densities and canopy closure would increase in response to the increased growing space. Canopy closures would approach desired closures within 20-40 years as remaining trees expand and develop their canopies and grow. In the mid to long term, additional large tree structure would develop and canopy closure and complexity would increase.

Post Fledging Area Habitat

Alternative 1 would meet the desired condition in the short to long term for providing a diversity of habitat conditions conducive to high quality PFA habitat. Existing PFA generally contain a diversity of different forest vegetation communities in a diversity of stand densities and structure conditions and canopy closures. Recent mortality due to insect and disease generally provides abundant prey species by attracting woodpeckers and other birds and by providing dead wood habitats that provide habitat for mammalian prey. The diversity of openings and dense habitats would continue to be provided for fledging northern goshawk juveniles into the long term. However, the development of large tree structure would be delayed when compared to Alternatives 2 and 3. Maintaining the relatively high overall stand densities and canopy closures would continue to put existing and future large trees (>21" dbh) at risk of insect and disease mortality; and this condition would slow the rate at which large tree structure would develop in the PFA. Such structure would likely develop in the later long term time period (50-100 years).

Alternatives 2 and 3 would meet the desired condition for the PFA habitat in the affected territories in the mid to long term. In the short term, desired conditions would not be met, as stand densities, canopy closure, and upper level canopy structure would be reduced and simplified. Some PFA's would be more affected than others, depending upon the acres treated as well as differences between the two alternatives, given differences in acres treated. Those differences, however, are relatively minor. In the mid to long term, stand densities, canopy closure, and upper level canopy structure would improve. Densities would increase, canopy closures would be higher, and upper level canopy structure would become more complex as remaining trees grew and developed. Large tree structure would also develop at a quicker rate and be available as a habitat component in a shorter time frame than found in Alternative 1. Such structure would develop in the late mid term to early long term (25-45 years). This would improve overall habitat quality for northern goshawks.

Land Resource Management Plan Amendment

Alternative 2 would require a site-specific Forest Plan amendment to allow for harvest within the core nest areas of three existing northern goshawk territories in the project area. Alternative 2 would not meet Standard 6.d.5)b) of the Regional Forester's Eastside Forest Plan Amendment #2 to the Forest Plan which precludes commercial and non-commercial thinning activities from identified core nest areas for known northern goshawk territories.

Monitoring

The following monitoring and survey actions would occur as prescribed for Alternatives 2 and 3. Monitoring would be done by either the district wildlife biologist or a trained biological technician.

With implementation of Alternative 2, nest stands in the Spur Butte, Porcupine Creek, and Bernard Mill would be monitored for occupancy annually for five (5) years following implementation of harvest activities in those stands. Monitoring would also occur the spring prior to implementation to determine presence/absence of the nesting pair. Monitoring would consist of a minimum of three (3) site visits to the nest stand and nest tree. The purpose of each visit is described below, and would be accomplished by visiting and observing the nest stand and nest tree. In the event that a new alternate nest is built and occupied, visits in May and June would be used to locate the new nest(s). The visits would occur in the following time frames:

1. Second week of May – Determine occupancy of the nest tree/nest stand. Determine if nest initiation and/or incubation has occurred.
2. Second Week of June – Determine nest success in hatching one or more nestlings.
3. Second Week of July – Determine fledgling success of one or more nestlings in the nest stand.
 - Additional days between the time periods identified above, or after the second week of July may be needed to determine occupancy and nesting success. However, every attempt would be made to minimize disturbance of nesting northern goshawk pairs at these nest stands.

With implementation of Alternatives 2 or 3, monitoring of territory occupancy would occur in the Bear Creek, Spur Butte, Porcupine Creek, Bernard Mill, and Jackass Creek territories prior to implementation of any activities within identified PFA habitat. With Alternative 2, the nest stand monitoring described above would accomplish this monitoring need. The territories would be monitored the spring prior to implementation of any actions in the PFA, if that action is to occur after March 1st or prior to August 31st of that year. Site visits to the nest stand and identified nest tree(s) would be used to determine occupancy and nesting activity in that territory. A minimum of three (3) site visits would be done to determine occupancy and nesting use. The first visit would not occur prior to the third week in April and the last visit would occur after the first week in June. Visits should be spaced by at least one week. If occupancy is confirmed for a territory, implement timing restrictions as described above in the Design Criteria. If a territory is **not** occupied, then timing restrictions described above would not be implemented.

With implementation of Alternatives 2 or 3, monitoring of the Cougar Creek drainage south of the 5870300 road would occur the spring prior to implementation of the Willow Pine Project. Purpose of monitoring is to determine presence and occupancy of a northern goshawk nest stand/territory in the vicinity of Cougar Creek. The Broadcast Acoustical Survey Protocol (pages 40-44, Woodbridge and Hargis 2005) would be implemented as directed in the Northern Goshawk Inventory and Monitoring Technical Guide.

- The protocol would be implemented in the Cougar Creek drainage south of the 5870300 road. The protocol defines tools, techniques, frequency, and other details of the monitoring effort. If occupancy is determined and is confirmed as northern goshawk, then the Design Criteria identified above for the Cougar Creek area would be implemented. This would include modifications to one or more units and implementation of timing restrictions per the Forest Plan standards for raptors.

Territories which have proposed activities (including timber harvest, non-commercial thinning, and prescribed fire/fuels treatments) within them would be monitored annually to determine occupancy and status of occupancy of that territory prior to and after those activities occur. Nest/territory visits would occur in May, June, and early July to determine presence/absence and reproductive success.

Identified northern goshawk territories, including nest stands and PFAs, which have proposed activities (including timber harvest, non-commercial thinning, prescribed fire/fuels treatments, timber haul and road construction/reconstruction activities) within or adjacent to would be monitored prior to implementation of those activities to determine goshawk presence/absence and territory activity. If the territory is active, standard timing restrictions of activities within ½ mile of the active nest or otherwise within the PFA would be put in place. No potential disturbance activities would occur within the active territory or immediately adjacent to the nest stand between March 1 and August 31.

Issue #2

Soil disturbance from roads used as haul routes (the activities of opening existing non-system roads, the resurfacing of open roads, new temporary road construction), and harvesting and fuel treatment activities have the potential to contribute sediment to streams, thereby affecting water quality and fish habitat.

Measures:

- Miles of new road construction and miles of non-system roads opened within 400 feet of streams.
- Acres of harvest and fuel treatment activities in units 400 feet from streams.
- Number of stream crossings by all new/existing roads used as haul routes.

Hydrology

Affected Environment

Drainages in the planning area normally have peak annual flows in March through April as a result of snowmelt. Peak annual flows as a result of rain on snow events in early winter have produced some of the highest flows in the planning area over the last 50 years. Peak annual floods 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 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 higher than historically due to loss of floodplain storage due to entrenched channels and soil loss, compaction, timber harvest, and road construction which cause flashier responses. This has been offset somewhat by increased understory canopy cover.

Base flows were probably higher prior to watershed alterations which have occurred over the last 150 years. Stream entrenchment has reduced storage potential in alluvial aquifers. Upland storage has been lost due to road construction, erosion and compaction. Prior to European settlement, frequent fires maintained lower evapo-transpiration and interception rates and water storage in wetlands and beaver ponds contributed to base flows. Increases in base flow due to removing trees tend to be short term (5 to 10 years) and return to pre-disturbance levels as other vegetation utilizes

the increase - grasses and shrubs in Juniper stands and primarily remaining trees in higher precipitation zones. There is very little likelihood of substantially under stocked stands in general forest management areas and 5 year fire return intervals in juniper and non-forest areas, major contributors to higher base flows in the past, under current management direction.

The Forest soil scientist indicated there were numerous headcuts and trampled banks on spatially intermittent tributaries in the planning area making the streams susceptible to increased flows.

Some of the Watershed and Subwatershed names and all the numbers have been changed by the USGS contractor and may not be consistent with the Upper South Fork Limited Watershed Analysis. In addition several of the watersheds have been consolidated to meet USGS protocols. The Middle Fork John Day, South Fork Beaver Creek, and Upper Beaver Creek Watersheds, and the Sunflower Creek, Lower South Fork Beaver Creek, and Beaverdam Creek Subwatersheds will be evaluated.

Equivalent Harvest Area (EHA) will be used to evaluate the risk to water quality and stream bank stability. The Equivalent Harvest Area (EHA) for the past harvest activities on the Upper Beaver Creek, South Fork Beaver Creek, and Middle South Fork John Day River Watersheds were calculated using standard Forest procedures and harvest information provided by the Paulina Ranger District. The Land Management Plan for The Ochoco National Forest (1989) assigned an EHA threshold of 25 percent to watersheds that flowed into the John Day River and the South Fork of Beaver Creek. A threshold of 35 percent was assigned to the Upper Beaver Watershed. The threshold value identifies the upper limit that is compatible with watershed sensitivity, without incurring damage in a major storm event. An assigned threshold of 35 percent indicates low sensitivity. However, the incidence of cutbank and headcuts in the streams in the Upper Beaver Creek Watershed indicates that the watershed is highly sensitive and a threshold of 25 percent is more appropriate. The EHA threshold should not be interpreted as a point above which detrimental impacts will occur but as a point above which detrimental impacts may occur, should a 10-year or greater storm or melt event take place (Anderson, 1989).

The EHA model was developed to evaluate third, fourth, and fifth order drainages. Stream order is a term used to characterize the branching of streams from the top of the drainage. A first order stream is an unbranched tributary. Second order streams are initiated by the confluence of two first order streams; third order streams start at the confluence of two second order streams, etc. While the model was developed to evaluate third through fifth order drainages and has been primarily 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 are especially sensitive to increases in flows due to faster delivery of water, less opportunity for channel storage, and greater chance of flow synchronization. Therefore, water yield affects resulting from proposed treatments analyzed by the EHA model should also reflect effects to the second and third order drainages of concern in the planning area.

Equivalent Harvest Area calculations assume all harvest activities, in Alternatives 2 and 3, would take place between 2007 and 2009. Non-commercial treatments (pre-commercial thinning), under all action alternatives, would be completed by 2014. Natural fuels treatment is assumed to not remove enough canopy to produce a measurable increase in water yield. Table 12 shows the EHA values from 2006 through 2014.

Table 12. Equivalent Harvest Area (FS Administered Land)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	EHA %
**										
Upper Beaver Cr. WS										
Alt 1 (No Action)	13.4	12.7	12.0	11.5	11.1	10.7	10.3	10.0	10.0	9.6
Alt 2	12.8	12.0	11.5	11.1	10.8	10.4	10.0	9.7		
Alt 3	12.7	12.0	11.5	11.1	10.7	10.4	10.0	9.7		
Beaverdam Cr. Sub WS										
Alt 1 (No Action)	12.2	11.7	11.0	10.4	10.0	9.6	9.2	8.9	8.9	8.6
Alt 2	11.7	11.0	10.5	10.0	9.7	9.3	9.0	8.6		
Alt 3	11.7	11.0	10.5	10.0	9.6	9.3	9.0	8.6		
South Fk Beaver Cr. WS/Lwr. SFk. Beaver Cr. Sub WS										
Alt 1 (No Action)	2.4	2.3	2.2	2.2	2.2	2.1	2.0	2.0	2.0	1.9
Alt 2	4.0	5.6	7.3	7.3	7.3	7.3	7.2	7.1		
Alt 3	3.5	4.7	5.8	5.9	5.9	5.9	5.9	5.9		
Mdl. SFk John Day River WS										
Alt 1 (No Action)	11.5	11.1	10.7	10.3	9.9	9.5	9.1	8.7	8.7	8.3
Alt 2	14.1	16.7	19.1	18.7	18.2	17.6	17.0	16.4		
Alt 3	13.5	15.5	17.4	16.9	16.4	15.9	15.4	14.8		
Pine Creek Sub WS										
Alt 1 (No Action)	2.4	2.4	2.3	2.3	2.1	2.0	2.0	1.9	1.9	1.9
Alt 2	4.4	4.3	4.3	4.2	4.1	4.0	3.8	3.6		
Alt 3	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.2		
Sunflower Cr. Sub WS										
Alt 1 (No Action)	12.3	11.8	11.4	11.0	10.6	10.2	9.7	9.3	9.3	8.9
Alt 2	15.0	17.8	20.5	20.0	19.4	18.8	18.2	17.6		
Alt 3	14.4	16.5	18.6	18.1	17.6	17.0	16.5	15.9		

Direct and Indirect Effects

Timber harvest and non-commercial thinning can reduce interception and evapotranspiration, increase snow accumulation, and change snow melt rate and timing. Fire can reduce interception by burning down-fuels and vegetation; reduce evapotranspiration by killing or burning back grasses, shrubs and small trees, and change the timing and rate of snowmelt. These increases would be partially offset by increased uptake by remaining trees and vegetation. The reduction in interception and evapotranspiration and rate of snow melt resulting from prescribed spring and fall burning should not result in any measurable increase in flows from areas being treated due to the low intensity of the burn.

The EHA model does not measure direct effects but is based on the principal that reduced canopy closure will reduce interception and evapotranspiration and will increase snow accumulation. Increases in water yield are nearly always higher on north slopes than on south slopes. Snowmelt rates are dependent on elevation and aspect. At the elevations found in the planning area, the snowmelt rate decreases with increases in canopy density, with the reduction being greatest in units with southerly aspects.

The majority of the project area is in Fire Regimes I and III, and fuel loadings have moved into Condition Class 2 and 3. Over time, without disturbance, fuel loading in stands would continue the progression toward Condition Class 3, which has 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, there would be an increase in EHA commensurate with the size and intensity of the fire. It is difficult to predict the time, or the scale and intensity at which such an event might occur, but it is highly probable that it would be larger and more intense than what happened historically due to increased ladder fuels and higher fuel loadings.

Alternative 1 (No Action): Fuel loading and ladder fuels would be allowed to increase at their current rate.

Alternative 2: Commercial treatments and pre-commercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Fuels treatment would reduce the amount of area susceptible to stand replacement wildfire, reducing the area in Mixed Intensity Fire Regimes by 8 percent and that in High Intensity Fire Regimes by 79 percent. This would reduce the risk of an EHA increases due to a high intensity wildfire.

Alternative 3: Commercial treatments and pre-commercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Fuels treatment would reduce the amount of area susceptible to stand replacement wildfire, reducing the area in Mixed Intensity Fire Regimes by 9 percent and that in High Intensity Fire Regimes by 69 percent. This would reduce the risk of an EHA increases due to a high intensity wildfire.

Cumulative Effects

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. Measurable increases in flow should start showing up when the EHA reaches about 20 percent (Hibbert, 1965) and should be roughly proportional to the percentage of the area above that value.

The EHA model evaluates water yield affects of past and proposed harvest treatments, fires, and proposed non-commercial thinning in the Willow Pine Planning Area. The model evaluated all timber harvest in the planning area over the last 28 years. Overstory removal and regeneration harvest prior to this is still affecting water yield, but should have substantially recovered. Roads can reduce canopy and leaf area index but the area is small. The Forest Plans maximum recommended open road density of 3 miles per square mile results in less than a 1 percent EHA. This is less than the accuracy of the model and if roads were included only sections that were in forested plant associations could be evaluated and roads in units would have to be backed out so the area was not double counted. The primary affects of roads are increased runoff efficiency resulting from extension of the drainage system and erosion from the road surface, cut and fill slopes. Natural fuels treatment normally only kills seedlings and saplings and without connected non-commercial thinning or harvest, does not remove enough of the canopy to affect the EHA. Insect, disease, and windthrow can reduce canopy but the concentration and area impacted are small and dispersed in the watersheds in the planning area and were not included in the model. Other management activities that remove trees that should not be affecting EHA are: removing safety trees adjacent to system roads.

Harvest treatments on private lands below the Forest Boundary have been similar but on a smaller scale than those on the Forest. The percentage of Forest Service and Forest Service forested Plant Association Groups (PAGs) within the affected subwatersheds is shown in Table 13. The percentage of the subwatershed under Forest Service administration and the percent forested give a perspective of the potential impacts of Forest Service and private management activities on the total subwatershed. PAGs in subwatersheds entirely outside the planning area within the three affected watersheds were not evaluated.

Table 13. Forested Area

	Area (ac)	FS (ac)	FS (%)	FS (ac) *	FS (%)
				Forested	Forested
Upper Beaver Cr. Watershed					
Beaver Cr. Subwatershed	16885	13128	78	4863	37
Sfk. Beaver Cr. Watershed					
Lwr. Sfk. Beaver Cr. Subwatershed	20014	2838	14	1476	52
Mdl. Sfk. John Day R. Watershed					
Pine Cr. Subwatershed	21108	1210	6	887	73
Sunflower Cr. Subwatershed	18547	15197	82	11325	75

* Area does not include juniper associations because of the small amount of water yield increase resulting from juniper thinning, the increase in infiltration, the decrease in overland flow, and the decrease in flow volume (Svejcar, 2004).

Based on species composition and past harvest activity, any future logging on private lands would probably be selective harvest. The only known harvest currently taking place on non Forest Service lands in effected sub-watersheds is on the in-holding on Cougar Creek. It is reasonably foreseeable that timber harvest on private land will occur in the future. Based on the projected EHAs on Forest Service administered lands, past and projected harvest on private lands, and the percentage of juniper at lower elevations on private lands, none of the sub-watersheds were

determined to be at high risk based on potential increased flows resulting from Equivalent Harvest Area (EHA).

Cattle would continue grazing in the allotments in the planning area. The Sunflower Allotment Management Plan (AMP), which includes the Willow Pine Planning Area was accomplished in 1995. Livestock have very little effect on Equivalent Harvest Area (EHA) with their primary influence being on stream bank condition which is one of the factors that determine what the channel response would be to changes in flow. District actions taken to improve stream bank conditions follow. The Sunflower Creek Enclosure has been in place for 18 years and there is a large enclosure on Murray Creek. A herder is used on the Sunflower Allotment to prevent livestock from over utilizing riparian areas. Troughs have been moved to reduce impacts on wetlands and funds have been requested to put additional troughs in the uplands to move livestock away from riparian areas. Upward trends in riparian condition are expected 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.

Alternative 1 (No Action): No increase in the cumulative water yield or peak flows would occur as a result of this alternative. No treatments affecting EHA are proposed under this alternative.

Alternative 2: Equivalent Harvest Area (EHA) from past harvest and the Murray Fire would continue to recover as canopy cover and leaf area index increase.

The Upper Beaver Creek, South Fork Beaver Creek, and Middle South Fork John Day River Watersheds are all under the Forest Plan EHA thresholds of 35, 25 and 25 percent respectively. The Lower South Fork Beaver Creek and Beaverdam Creek Subwatersheds in the Willow Pine Planning Area maintain EHAs under 20 percent indicating they would not have a measurable increase in flow. Sunflower Creek Subwatershed would be over 20 percent for only one year. All watersheds and subwatersheds in the planning area are at low to very low risk during the period being evaluated.

Alternative 3: Equivalent Harvest Area (EHA) from past harvest and the Murray Fire would continue to recover as canopy cover and leaf area index increase.

The Upper Beaver Creek, South Fork Beaver Creek, and Middle South Fork John Day River Watersheds are all under the Forest Plan EHA thresholds of 35, 25 and 25 percent respectively. All subwatersheds in the Willow Pine Planning Area are under 20 percent indicating they would not have a measurable increase in flow. All watersheds and subwatersheds in the planning area are at low to very low risk during the period being evaluated.

Monitoring: Implementation monitoring would be accomplished.

Sediment/Turbidity

Affected Environment

The Upper South Fork Limited Watershed Analysis, accomplished by the Malheur National Forest, has limited information on the planning area. Based on field surveys and monitoring it appears that more than half the sediment is coming from in channel erosion on Forest Service administered lands. Potential increases from in-channel sources resulting from harvest and natural disturbance induced increases in runoff are addressed by the Forest EHA model.

Figure 1. Representative Turbidity

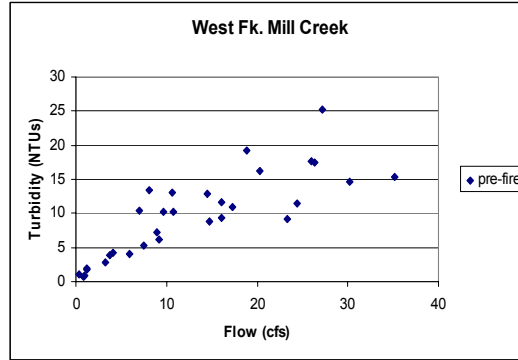
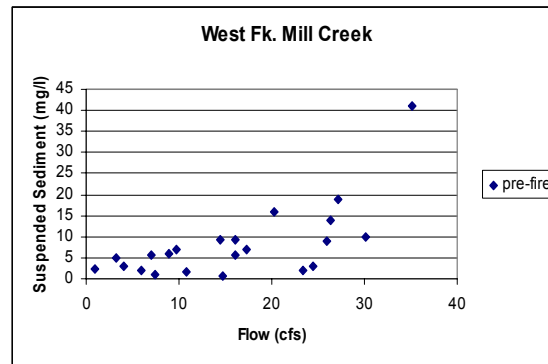


Figure 2. Representative Suspended Sediment



No records could be found of sediment or turbidity samples in the planning area. Those from West Fork Mill Creek prior to the Hash Rock Fire in August of 2000 should be representative of those expected on Sunflower Creek above the private in-holding. At turbidity levels below 5 NTU water at the station generally appears to be clear. The Representative Turbidity graph (Figure 1) and Suspended Sediment graph (Figure 2) are shown above.

Measurement: Turbidity is the degree to which suspended material in the water impedes light penetration. Turbidity is expressed in Nephrometric Turbidity Units (NTUs). There is normally a close correlation between turbidity and suspended sediment in a given stream, but this correlation can change as organic material increases over the summer or if the percent of sediment from different sources in the drainage changes. Turbidity does not measure the amount of sediment being transported as bedload. At turbidity levels above 25 NTU salmonids sight feeding may be reduced. Most measurable effects to aquatic life result from sediment instead of turbidity.

State water quality standards direct that turbidity levels should not exceed background levels by more than 10 percent. The Forest Plan indicates that this will be accomplished by maintaining stream bank stability and implementing Best Management Practices (BMPs). The EPA (referenced in R6, 1988) stated that BMPs are the primary mechanism to enable achievement of water quality standards. BMPs would be implemented to verify that management objectives are being accomplished.

Sediment from the uplands, direct and cumulative effects to water quality from accelerated sediment delivery related to timber harvest practices, fire, and road construction and use are to be 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 (RER) 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. Management activities more than 600 feet from stream channels deliver negligible sediment on the Ochoco National Forest and were not evaluated. The potential for soil erosion is based on the Forest Soil Resource Inventory (SRI); slopes are derived from the GIS Digital Elevation Model (DEM); delivery potential is calculated from a technique derived from PSWHA I (Levin, 1978); and potential sediment yield and recovery are calculated using the “Guide for Predicting Sediment Yield from Forested Watersheds” (Forest Service, R1/R4, 1981), and WATSED (Forest Service, R1, 1992). Since no tractor fire line is proposed, the amount of sediment delivered from hand fire line is very small, and the amount of hand line within an alternative would vary depending on conditions. Fire line was not included in this RER analysis. Based on the low average annual precipitation rate in the planning area, low volume per acre, and not operating in the rainy season, haul delivered sediment would be lower than projected by the model. The Forest procedure does not calculate the actual sediment load but calculates a Relative Erosion Rate (RER) that is used to compare alternatives.

The RER depicts potential sediment delivery based on the amount and type of ground disturbance, slope/erosion class (based on soil erosion potential and slope), and distance to stream channels. The RER model is an effective tool for comparing alternatives. The actual sediment delivery may be higher or lower than predicted depending on the amount of vegetative recovery before storm events and storm intensity. Elevated delivery may occur even if no additional activities are accomplished if a large runoff event occurs such as the high intensity rainstorm that caused the Newsome Creek flood in the Maurys in the spring of 1991. RER calculations assume all harvest activities, in Alternatives 2 and 3, would take place between 2007 and 2009. Reconstruction of closed system roads and temporary roads would be accomplished over the life of the sale as needed. It is assumed that reopened closed system roads would require light reconstruction. Natural and activity fuels treatments, in all action alternatives, would be completed by 2014.

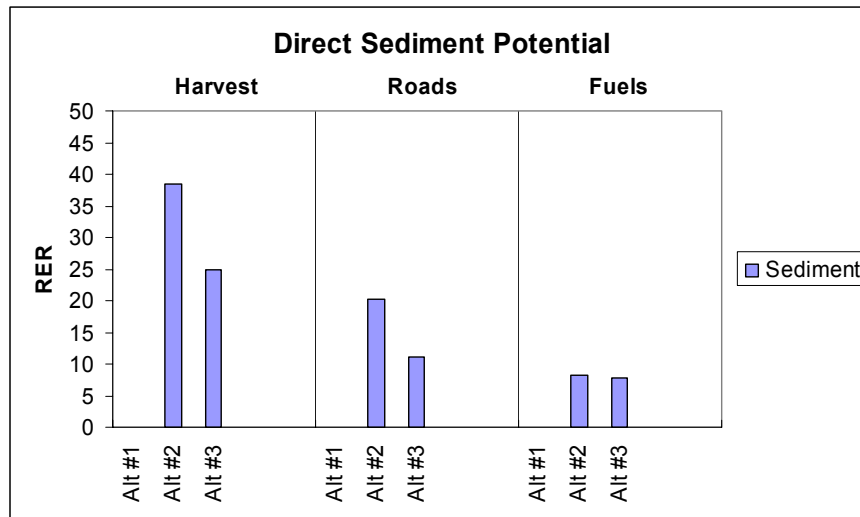
Direct Effects: The amount of sediment transported by streams is derived from surface erosion delivered to the channel, scour of the streambed, scour of the channel banks, and mass soil movement. Potential effects to channel scour and bank erosion, which account for most of the sediment transported in the planning area, are addressed under EHA.

The amount of sediment delivered from surface erosion and mass soil movement outside the stream channel is dependent on the potential for soil erosion, the amount and type of ground disturbance, slope, and distance to the stream. The slope erosion map for the planning area is on file at the Paulina Ranger District (Rager Ranger Station). Sediment from non-commercial thinning should result from the activity fuels treatment only and not from the thinning. About two-thirds 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. Management activities more than 600 feet from stream channels can be expected to deliver negligible sediment on this Forest.

High sediment levels adversely affect the aquatic habitats of fish, insects, and other aquatic animals, reduce the esthetic quality for recreation users, and may lead to channel type changes.

The increase in Relative Erosion Rate (RER) calculated for the alternatives should be roughly proportional to the area treated and the miles of road constructed and reconstructed. Haul delivered sediment should be proportional to the number of trips taken and miles traveled in the planning area, which should be roughly proportional to the volume harvested. The Relative Erosion Rate (RER) is an attempt to portray average sediment load changes attributable to forest management practices and natural disturbance factors. Sediment delivery on any given year will very depending on weather patterns, storm tracks, and snow melt. The following graph (Figure 3) compares the potential sediment delivery between the alternatives derived from the RER model.

Figure 3 - Willow Pine Direct Sediment Potential



Alternative 1: Sediment and turbidity levels would not change.

Alternative 2: Alternative 2 proposes to harvest 15 percent of the Willow Pine planning area with ground based equipment. It is estimated that 90 percent of the sediment delivered to streams from surface erosion comes from within 400 feet of the channel. This alternative proposes ground based selective harvest on approximately 11 percent (646 acres) of the lands within 400 feet of streams in the planning area. No harvest is proposed in RHCAs. Table 14 shows the area within 600 feet of streams where slopes are greater than 35% and cable would be pulled to reduce sediment delivery. This also reduces recovery time. Two units (48 and 107) have ground based yarding on highly erosive soils on slopes between 21 and 35 percent within 200 feet of streams. The total area encompasses only about an acre and the no harvest buffer would filter most of the potential sediment.

Megahan (1980) found that ground based selective harvest produced about 30 percent less sediment than clear cutting. The RER analysis indicates that about 57 percent of potential sediment in Alternative 2 originates from timber harvest. The no harvest RHCAs would substantially reduce the amount of sediment delivered to streams. Reshin et al. (2006) found a 10 meter (32.8 ft.) setback for felling and yarding activities prevented sediment delivery to streams from about 95 percent of harvest related erosion features and said a wider setback may be advisable on portions of units where steep inner gorges extended beyond 10 meters. Lynch et al. (1985) determined that a 30 meter (98.4 ft.) buffer from logging operations removed an average of about

75 to 80 percent of the suspended sediment in storm water. This is consistent with post harvest observations by the project hydrologist on the Ochoco National Forest.

Table 14. Harvest Unit Slopes > 35% which would Require Pulling Cable

Unit #	Distance from Stream (ft)			Acres
	000-200	201-400	401-600	
25	X	X	X	11.9
94			X	1.2
100	X	X		0.1
107	X	X	X	3.7
134	X			<0.1
144			X	0.8

No new system road is proposed in Alternative 2. This alternative constructs 0.42 miles of temporary road within 400 feet of streams. There are no stream crossings on proposed temporary roads. Reopening with limited reconstruction would be required on 7.8 miles of system road within 400 feet of streams. Reopened system roads would be inactivated (closed) and temporary roads would be decommissioned by the completion of the sale. Stream crossings can be a major source of sediment delivery. Roads can concentrate runoff and transport sediment down ditch lines, down the surface and can generate sediment on the approaches and at the crossing. Stream crossings on the following reopened roads that may need to be replaced or upgraded are shown in Table 15. Reopened system roads would be inactivated (closed) and temporary roads would be decommissioned by the completion of the sale. About 30 percent of new potential sediment is projected to come from roads.

Table 15. Stream Crossings on New and Reopened Roads

Route #	Category	Class II	Class III	Class IV
5800571	Reopen Closed			1
5800830	Reopen Closed			1
5870200	Reopen Closed			1
5870410	Reopen Closed		1*	
5870500	Reopen Closed			1
5870555	Reopen Closed			1
5870760	Reopen Closed			1
	Temporary	0	0	0

* GIS indicates Class III but high probability Class IV this far up the drainage

Alternative 2 proposes to treat 35% (7,071 acres) of the Willow Pine Planning Area with fire. About 1648 acres of this is within 400 feet of streams (29 percent). Implementation would not be accomplished all at one time but would take place over several years with burning after non-commercial thinning possibly not occurring for five to ten years depending on funding for non-commercial thinning and fuel breakdown time. No cat fire line is proposed. The amount of sediment from hand fire line is very small and the amount actually constructed would vary depending on fuels and weather conditions. It is estimated in underburn units between 10 and 25 percent of the area in the RHCA and 40 to 70 percent in the uplands would burn. Fire intensity would mostly be low but approximately five percent in fuel concentrations may burn at moderate

intensity. Ignition at least 50 feet from streams in combination with the width of many of the meadow systems should leave an adequate filter strip. Only about 10 percent of the area would be burned in hand pile units and grapple piled units will also have less area burned but intensity and severity would be higher. About 13 percent of the new potential sediment is projected to come from fuels treatments.

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. It is important that Class IV streams identified during sale layout receive adequate protection.

Field observations and Forest monitoring of the Trout Creek timber sale and the Hash Rock Fire have shown that intact RHCAs are effective at filtering sediment. Design elements prevent mechanical disturbance of stream channels and preclude placing landings and operating ground based equipment in RHCAs except on existing roads. No timber harvest is proposed in RHCAs in this alternative. Based on Forest monitoring, design elements to protect stream channels from mechanical disturbance and maintain filtering in fuels units, and the delay in burning in fuels units, it is my professional opinion that this alternative would meet state water quality turbidity standards.

Alternative 3: Alternative 3 proposes to harvest 12 percent of the Willow Pine planning area with ground based equipment. It is estimated that 90 percent of the sediment delivered to streams from surface erosion comes from within 400 feet of the channel. Approximately 422 acres of ground based selective harvest are proposed within 400 feet of streams in this alternative (7 percent). Table 16 shows the area within 600 feet of streams where slopes are greater than 35% and cable would be pulled to reduce sediment delivery. This also reduces recovery time. Two units (48 and 107) have ground based yarding on highly erosive soils on slopes between 21 and 35 percent within 200 feet of streams. The total area encompasses only about an acre and the no harvest buffer would filter most of the potential sediment. Megahan (1980) found that ground based selective harvest produced about 30 percent less sediment than clear cutting. About 35 percent less new potential sediment originates from harvest treatments in this alternative than in Alternative 2. The no harvest RHCAs would substantially reduce the amount of sediment delivered to streams. Reshin et al. (2006) found a 10 meter (32.8 ft.) setback for felling and yarding activities prevented sediment delivery to streams from about 95 percent of harvest related erosion features and said a wider setback may be advisable on portions of units where steep inner gorges extended beyond 10 meters. Lynch et al. (1985) determined that a 30 meter (98.4 ft.) buffer from logging operations removed an average of about 75 to 80 percent of the suspended sediment in storm water. This is consistent with post harvest observations by the project hydrologist on the Ochoco National Forest.

Table 16. Harvest Unit Slopes > 35% Which Would Require Pulling Cable

Unit #	Distance from Stream (ft)			Acres
	000-200	201-400	401-600	
107	X	X	X	3.7
134	X			<0.1

No new system road is proposed in Alternative 3. This alternative constructs 0.33 miles of temporary road within 400 feet of streams. There are no stream crossings on proposed temporary roads. Reopening with limited reconstruction would be required on 2.7 miles of system road within 400 feet of streams. Reopened system roads would be inactivated (closed) and temporary roads would be decommissioned by the completion of the sale. Stream crossings are a major

sediment delivery site. Roads can concentrate runoff and transport sediment down ditch lines, down the surface and can generate sediment on the approaches and at the crossing. Stream crossings on the following reopened roads that may need to be replaced or upgraded are shown in Table 17. About 46 percent less new potential sediment originates from roads in this alternative than in Alternative 2.

Table 17. Stream Crossings on New and Reopened Roads

Route #	Category	Class II	Class III	Class IV
5870200	Reopen Closed			1
5870410	Reopen Closed		1*	
5870500	Reopen Closed			1
5870760	Reopen Closed			1
	Temporary	0	0	0

* GIS indicates Class III but high probability Class IV this far up the drainage

This alternative proposes to treat about 6 percent less fuels in the Willow Pine Planning Area than Alternative 2. About 1503 acres of this is within 400 feet of streams (27 percent). Implementation would not be accomplished all at one time but would take place over several years with burning after non-commercial thinning possibly not occurring for five to ten years depending on funding for non commercial thinning and fuel breakdown time. No cat fire line is proposed. The amount of sediment from hand fire line is very small and the amount actually constructed would very depending on fuels and weather conditions. It is estimated in underburn units between 10 and 25 percent of the area in the RHCA and 40 to 70 percent in the uplands would burn. Fire intensity would mostly be low but approximately five percent in fuel concentrations may burn at moderate intensity. Ignition at least 50 feet from streams in combined with the width of many of the meadow systems should leave an adequate filter strip. Only about 10 percent of the area would be burned in hand pile units and grapple piled units would also have less area burned but intensity and severity would be higher. About 6 percent less new potential sediment originates from fuels treatments in this alternative than in Alternative 2.

The RER analysis indicates that Alternative 3 generates about 35 percent less potential sediment than Alternative 2. Most sediment delivered by this alternative would come from stream crossings, road drainage close to streams and harvest and fuels treatments adjacent to Class IV streams. It is important that Class IV streams identified during sale layout receive adequate protection.

Field observations and Forest monitoring of the Trout Creek timber sale and the Hash Rock Fire have shown that intact RHCAs are effective at filtering sediment. Design elements prevent mechanical disturbance of stream channels and preclude placing landings and operating ground based equipment in RHCAs except on existing roads. No timber harvest is proposed in RHCAs in this alternative. Based on Forest monitoring, design elements to protect stream channels from mechanical disturbance and maintain filtering in fuels units, and the delay in burning in fuels units, it is my professional opinion that this alternative would meet state water quality turbidity standards.

Indirect Effects: The majority of the project area is in Fire Regimes I and III, and fuel loading levels have moved into Condition Class 2 and 3. Over time, without disturbance, fuel loading in stands would continue to progress toward Condition Class 3, which has a higher risk of high intensity fire. In the long term, there is a potential for indirect effects associated with fuel loading

that would carry high intensity wildfire. If a large scale, high intensity fire was to occur, there is a high probability of increased sediment delivery resulting in adverse effects to aquatic habitats. It is difficult to predict the time or the scale and intensity at which such an event might occur, but it is highly probable that it would be larger and more intense than what happened historically due to increased ladder fuels and higher fuel loadings.

Livestock distribution and utilization in the planning area are dependent on forage availability and palatability. Use patterns may change due to weather, the season and/or as a result of management activities.

Figure 4. Wildfire/PNF Delivered Sediment

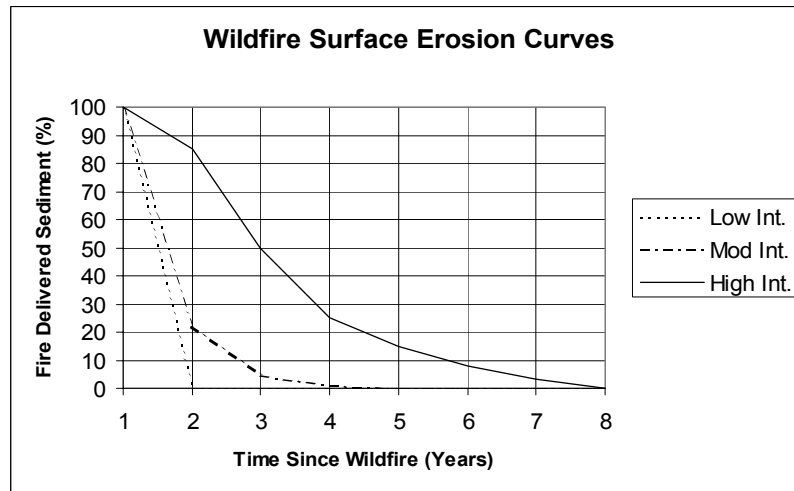
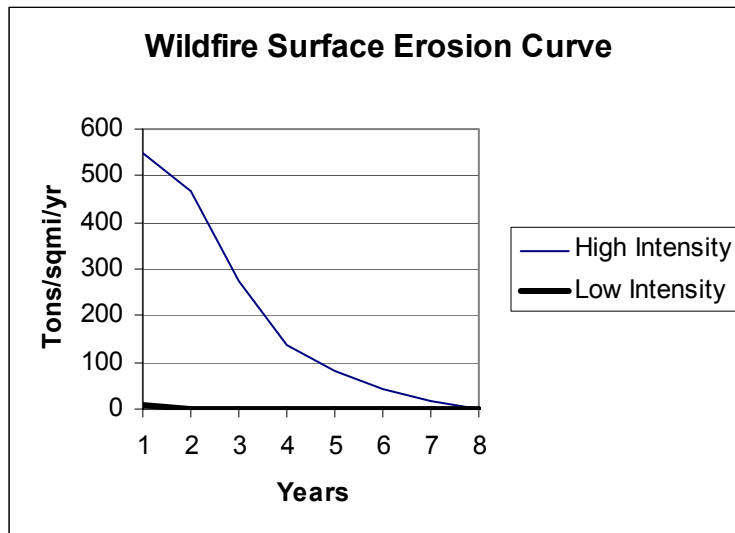


Figure 5. Wildfire Surface Erosion Curve



* Base value @ 25% slope on granitic soils
(sediment routing not evaluated)

Alternative 1: Fuel loadings and ladder fuels outside the Sunflower Fuels CE planning area would continue to increase and fire intensities would be higher than under historic conditions should a wildfire get started. Intensity is a major consideration in the potential sediment produced by prescribed and wild fire. Figure 4 from WATSED (Forest Service, 1992) shows that a low intensity fire can produce over an order of magnitude less sediment than a high intensity wildfire. Intensity also affects the number of years it takes for a burned area to return to a pre-fire erosion rate. As can be seen in Figure 5, erosion rates should return to pre-fire levels within a year after a low intensity fire but may take up to 8 years with a high intensity wildfire. Low intensity fall burns in plant associations with non rhizominus grasses may take two years to recover instead of one. Livestock distribution and use in riparian areas and uplands would remain the same.

Alternative 2: Commercial treatments and pre-commercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Fuels treatment would reduce the amount of area susceptible to stand replacement wildfire, reducing the area in Mixed Intensity Fire Regimes by 8 percent and that in High Intensity Fire Regimes by 79 percent. This would reduce the risk of sediment delivery increases due to a high intensity wildfire.

There is a potential of increased livestock use in treated riparian areas and in the burn area due to the removal of brush and down wood, increased grass and forbs, increased palatable 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.

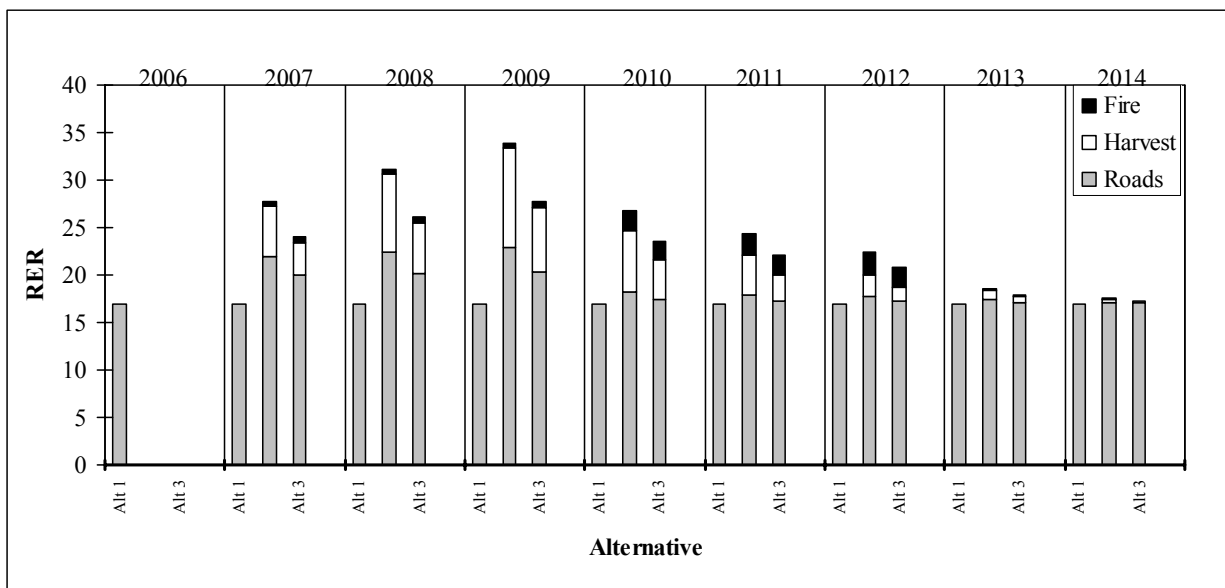
Alternative 3: Commercial treatments and pre-commercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Fuels treatment would reduce the amount of area susceptible to stand replacement wildfire, reducing the area in Mixed Intensity Fire Regimes by 9 percent and that in High Intensity Fire Regimes by 69 percent. This would reduce the risk of sediment delivery increases due to a high intensity wildfire.

There is a potential of increased livestock use in treated riparian areas and in the burn area due to the removal of brush and down wood, increased grass and forbs, increased palatable 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.

Cumulative Effects

It is estimated that most of the sediment in the streams in the Willow Pine Planning Area is coming from in channel erosion such as bank erosion, head cuts, and channel scour. In channel effects are addressed by the EHA model.

Figure 6. Willow Pine Planning Area RER



The Murray Fire occurred in August of 2002. Low and moderate burn areas in the fire should be recovered. Fire delivered sediment should be coming primarily from sites within the 125 acres (approximately 39 percent of the fire) that burned at high intensity and should be on the tail of the recovery curve (see Figure 4). Very little of the Murray fire burned at high severity. Surface erosion from high intensity burn areas should recover to normal levels by 2009. Due to the mitigating effects of the east side climate and the soils and slope in the high intensity burn area, there is not much risk of shallow landslides.

Roads and livestock are the two primary management activities currently resulting in surface sediment levels above background. Based on the Ochoco GIS Transportation Layer as of 8/22/06, the open road density in the Willow Pine Planning Area (including private in-holdings) is 2.34mi/sqmi. This is below the 3 mi/sq.mi guideline in the Forest Plan and meets Forest Standards and Guidelines. Open road density within 400 feet of streams is 3.34 mi/sq.mi. While livestock can affect upland sediment delivery by trampling and trailing, in the Willow Pine Planning Area, their primary impact appears to be on channel condition. Channel conditions 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 affects specifically to livestock, and the inability to separate long term affects from past management or events from current management. Because of this livestock affects were not included in Figure 6.

The Sunflower Allotment Management Plan (AMP), which includes the Willow Pine Planning Area was accomplished in 1995. Livestock can influence stream bank condition. The Sunflower Creek Exclosure has been in place for 18 years and there is a large exclosure on Murray Creek. A herder is used on the Sunflower Allotment to prevent livestock from over-utilizing riparian areas. Troughs have been moved to reduce impacts on wetlands and funds have been requested to put additional troughs in the uplands to move livestock away from riparian areas. In addition to maintaining bank condition and reducing trampling, exclosures, moving cattle, and relocating

troughs out of riparian areas increase sediment filtering capacity. Changing livestock management is outside the scope of this document; however, it is reasonably foreseeable that there would be an improvement in riparian condition due to changes in the range utilization standards in the Grazing Implementation Monitoring Module (IIT, 2000). Studies in the intermountain region (Clary, 1999) indicate that the height of grasses and forbs that are to be left in key riparian areas indicate a level of grazing that allows a corresponding recovery of palatable woody vegetation. Bank stability and channel geometry interact with vegetation but may respond differently, depending on the extent of continued mechanical disturbance in the channel and the current channel condition.

Even if no additional ground disturbing activities took place in the watershed, elevated sediment delivery could happen if a large runoff event occurred.

Alternative 1: Sediment delivery from the 125 acres of high intensity burn in the Murray Fire would continue to recover (see Figure 4). The Sunflower Fuels CE would continue as planned. Projected sediment from the Sunflower CE was too small to show up on the graph. No increase in the cumulative sediment yield in the planning area would occur as a result of this alternative. The primary source of non channel delivered sediment above background results from the road system. Road densities within 400 feet of streams would remain the same.

Alternative 2: Sediment delivery from the 125 acres of high intensity burn in the Murray Fire would continue to recover (see Figure 4). The Sunflower Fuels CE would continue as planned. Projected sediment from the Sunflower CE was too small to show up on the graph. Roads are the largest non-background contributor to sediment delivery in the planning area. All new roads and reopened closed roads under this alternative would be closed and temporary roads would be decommissioned. Open road densities within 400 feet of streams would remain the same.

Harvest, road construction and reconstruction, and fuels treatment in this alternative would increase the cumulative annual sediment for the next 8 to 10 years (see Figure 6). Design elements prevent mechanical disturbance of the stream channel and preclude placing landings and using ground based yarding in RHCAs. Based on analysis of proposed treatments, design elements to protect stream channels and filtering potential of RHCAs, and the maintenance of existing flows, Alternative 2 would maintain channel equilibrium in the Willow Pine planning area and would not result in changes in channel form and/or sediment bedload. The increase in sediment yield would be within the normal sediment flux.

Alternative 3: Cumulative effects in this alternative would be similar to Alternative 2. Harvest, road construction and reconstruction, and fuels treatment in this alternative would increase the cumulative annual sediment for the next 8 to 10 years (see Figure 6). Design elements prevent mechanical disturbance of the stream channel and preclude placing landings and using ground based yarding in RHCAs. Based on analysis of proposed treatments, design elements to protect stream channels and filtering potential of RHCAs, and the maintenance of existing flows, Alternative 2 would maintain channel equilibrium in the Willow Pine planning area and would not result in changes in channel form and/or sediment bedload. The increase in sediment yield would be within the normal sediment flux.

Monitoring: Implementation monitoring would be accomplished. Pre and Post treatment pebble counts would be accomplished to verify the sediment load doesn't change.

Chemical Effects

Affected Environment

None of the streams in the Willow Pine Project Area are on the state 303(d) List of impaired waters for nutrients or chemical pollutants. No water chemistry sample data was found for Sunflower Creek or other streams in the project area. Regional Environmental Monitoring and Assessment Program (REMAP) data for the John Day was only available through 2003, but it does not appear they are collecting data in the project area. It is reasonable to assume the conclusion of the “Upper Deschutes River Basin R-Map: 1997-1998 Water Chemistry Summary” Technical Report BIO99-04 that, “sites in the Ochoco Mountains tend to be of higher water quality than lower elevation sites in the Crooked sub-basin” also applies to the project area.

Prescribed fire in Alternative 2 and 3 would only have a minimal impact on the watershed because the surface vegetation, litter, and forest floor should only partially burn and the increase in available nutrients would be short term. Most of the increased available nutrients would be taken up by plants or bound to the soil, roots, or debris. Van Wyk (1982) found that nutrient release as a result of prescribed burning did not persist beyond the first winter after burning with the nutrient output returning to pre-burn levels within 3 to 10 months. Most of the increase occurred in the first 2 storms after the burn.

Temperature

Affected Environment

The District Fisheries Biologist indicated that redband trout are the only native salmonid species currently present in the planning area. The temperatures in the INFISH Interim Riparian Management Objectives (Table 18) are based on Bull trout presence or potential. The Ochoco National Forest has incorporated project design criteria to not measurably increase the 7-day moving average daily maximum water temperature on any adult holding habitat or spawning or rearing habitats in the planning area based on the INFISH interim (Riparian Management Objectives) RMOs. The state water quality standards more accurately reflect attainable conditions and target species (redband trout) found in the project area. The new state standards (340-041-0028, approved by EPA Mar 2004) say the seven-day-average maximum temperature of a stream identified as having salmon and trout rearing and migration use may not exceed 18.0°C (64.4°F). The state of Oregon assumes that waters meeting this standard will provide water temperatures suitable for redband trout spawning. Water temperatures over the 18.0°C threshold are not to be increased further except in accordance with Water Quality Standards direction. 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)).

The 2004/2006 Oregon 303(d) list was approved by EPA on May 1, 2007. Begg Creek, Murray Creek, Porcupine Creek, and Sunflower Creek are on the 2004/2006 state 303(d) list of Water Quality Limited Water Bodies for summer water temperature. Table 18 shows the 7 day average max water temperatures for stations in the planning area measured through 2005. Figures 7 and 8 depict the daily 7 day average maximum water temperature for Sunflower Creek and Wildcat Creek, representative of streams in the planning area, for 1995 through 2005.

**Table 18. Willow Pine Planning Area 7 Day Average Max Water Temperatures 1995-2005
(Temperatures over threshold are highlighted)**

Station		199 5	199 6	199 7	199 8	199 9	200 0	2001	2002	200 3	200 4	200 5
Lwr SFk Beaver Sub Watershed												
Begg Cr	7 Day								69.5	DW		
	d>64. 4								23			
Sunflower Sub Watershed												
Sunflower Cr	7 Day					63.8	DW	76.4	DW	DW		
	d>64. 4					0		83				
Porcupine Cr	7 Day								73.7			
	d>64. 4								37			
Wildcat Cr	7 Day				68.6	DW		70.4				
	d>64. 4				40			56				
Murray Cr	7 Day							84.1	79.7			
	d>64. 4							106	55			

* Temperatures appear to be the result of placing logger in direct sun or from isolated pool effects.

** DW= dewatered

Measurement: No measurable increase in water temperature, except in accordance with Water Quality Standards direction, may result from management practices in Beg Creek, Murray Creek, Porcupine Creek, and Sunflower Creek because they are on the State 303d list of Water Quality Limited Water Bodies for summer water temperature. While not on the 2002 303(d) list, Table 18 shows that all of the perennial streams that have been monitored in the planning area are over the state threshold of 64.4°F at least some years and should be managed under the same constraints as Sunflower Creek.

Figure 7. Sunflower Creek

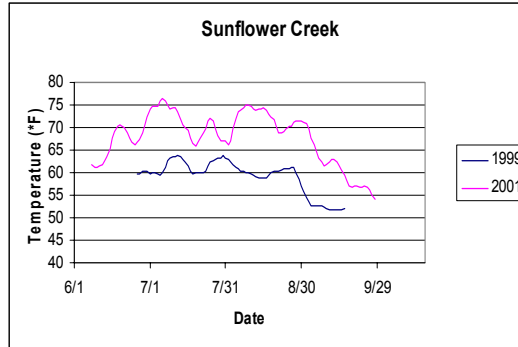
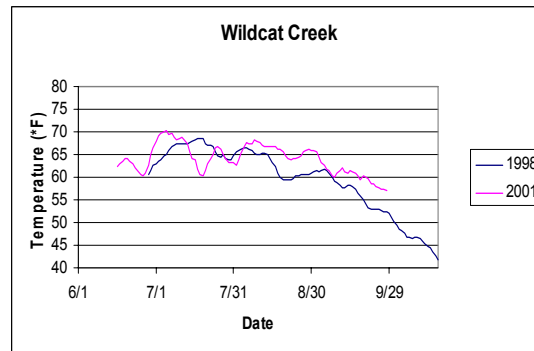


Figure 8. Wildcat Creek



Direct Effects: Reductions in solar input resulting from shading are a primary factor effecting stream temperature. Shade functions (Beschta, et al., 1987) generally occur within 100-200 feet of the channel. Non-commercial thinning is proposed in RHCAs under Alternatives 2 or 3. Non-commercial thinning would not be accomplished closer than 50 feet from fish-bearing or perennial non-fish bearing streams and there would be no harvest in RHCAs. Shade was not a consideration along intermittent streams since they should not affect peak water temperatures; however project design and implementation of design elements would result in maintaining some shade along treated intermittent streams also.

Based on monitoring on Auger Creek on the Lookout Mountain Ranger District, non-commercial thinning in RHCAs, incorporating design elements, should not reduce shading on perennial streams. 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)). Burning would be accomplished when moisture conditions favor a low intensity burn. To further reduce this risk, fire ignition would generally occur at least 50 feet from the stream to maintain a filter strip. Fire needs to be reintroduced into RHCAs. To accomplish this while still meeting other RMOs including not causing a measurable increase in water temperatures, the burn in the RHCA should be about one-third to one-half that in the uplands. Burning within meadow systems adjacent to creeks, to retard conifer encroachment, would be coordinated with the District Botanist, Fisheries Biologist, and/or Hydrologist.

Alternative 1: No reduction in shading would result from this alternative. There would be no increase in water temperatures.

Alternative 2: About 68 acres (11.5 percent) of RHCAs on fish bearing streams would have some level of non-commercial thinning in this alternative. Non-commercial thinning incorporating proposed design criteria should not reduce shading of fish bearing or non-fish bearing perennial streams. There is a risk of prescribed fire reducing shade for a short term however water temperatures should still meet state standards. Approximately 1.5 miles of fish bearing streams are in or adjacent to units with prescribed fire. It is estimated that between 10 and 25 percent of the area in the RHCA would actually have fire in it (at low intensity). Ignition at least 50 feet from streams and letting fire back in combined with the width of many of the meadow systems should leave an adequate filter strip. There should not be any measurable increase in water temperatures on fish bearing or non fish bearing perennial streams. There is a potential to increase water temperature in intermittent non-fish bearing streams (Class IV) when they are flowing, but this should not result in a violation of state water quality standards because these streams go dry before peak water temperatures occur in the watershed.

Alternative 3: About 51.3 acres (8.6 percent) of RHCAs on fish bearing streams would have some level of non-commercial thinning in this alternative. Non-commercial thinning incorporating proposed design criteria should not reduce shading of fish bearing or non-fish bearing perennial streams. There is a risk of prescribed fire reducing shade for a short term however water temperatures should still meet state standards. Approximately 1.5 miles of fish bearing streams are in or adjacent to units with prescribed fire. It is estimated that between 10 and 25 percent of the area in the RHCA would actually have fire in it (at low intensity). Ignition at least 50 feet from streams and letting fire back in combined with the width of many of the meadow systems should leave an adequate filter strip. There should not be any measurable increase in water temperatures on fish bearing or non fish bearing perennial streams. There is a potential to increase water temperature in intermittent non-fish bearing streams (Class IV) when they are flowing, but this should not result in a violation of state water quality standards because these streams go dry before peak water temperatures occur in the watershed.

No measurable direct temperature change would occur in any of the Class I-III streams in the project area under any of the alternatives.

Indirect Effects: The majority of the project area is in Fire Regimes I and III, and fuel loadings have moved into Condition Class 2 and 3. Over time, without disturbance, fuel loading in stands would continue the progression toward Condition Class 3, which has 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 which would be offset to some degree by increased stream flows. Monitoring on the upper West Fork of Mill Creek after the Hash Rock Fire in 2000 showed a 7-8°F increase in water temperatures during the first three years after the fire. Temperatures at this station are falling but are still above threshold. Increases in temperature would be proportional to the amount of canopy lost, the distance to the stream and the aspect. The affect would be most pronounced in confined valleys with dense understory. While producing other adverse affects, loosing shade on other than perennial streams would not have much effect on summer maximum stream temperatures. It is difficult to predict the time, or the scale and intensity at which such an event might occur, but it is highly probable that it would be larger and more intense than what happened historically due to increased ladder fuels and higher fuel loadings

Alternative 1: Fuel loadings and ladder fuels would be allowed to increase at their current rate.

Alternative 2: Commercial treatments and pre-commercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Fuels treatment would reduce the amount of area susceptible to stand replacement wildfire, reducing the area in Mixed Intensity Fire Regimes by 8 percent and that in High Intensity Fire Regimes by 79 percent. This would reduce the risk of water temperature increases due to a high intensity wildfire.

Alternative 3: Commercial treatments and pre-commercial thinning would reduce ladder fuels and reduce the number of stands at high risk from insects and disease. Fuels treatment would reduce the amount of area susceptible to stand replacement wildfire, reducing the area in Mixed Intensity Fire Regimes by 9 percent and that in High Intensity Fire Regimes by 69 percent. This would reduce the risk of water temperature increases due to a high intensity wildfire.

Cumulative Effects: Begg Creek, Murray Creek, Porcupine Creek, and Sunflower Creek are on the state 303(d) list of Water Quality Limited Water Bodies for summer water temperature. Monitoring indicates that the floating 7-day maximum average water temperatures in most of the other project area streams are also over threshold.

Past logging, roading, and grazing have reduced shading in the planning area. This has been offset in some drainages by increased shading from dense overstocked stands of conifers. No reduction of shading should result from non-commercial thinning based on design criteria. Possible short term reductions in shade resulting from prescribed fire should not produce any measurable increases in temperature.

It is reasonably foreseeable that cattle would continue grazing in the allotments in the planning area. The Sunflower Allotment Management Plan (AMP), which includes the Willow Pine Planning Area was accomplished in 1995. The Sunflower Creek Exclosure has been in place for 18 years and there is a large exclosure on Murray Creek. A herder is used on the Sunflower Allotment to prevent livestock from over utilizing riparian areas. Troughs have been moved to reduce impacts on wetlands and funds have been requested to put additional troughs in the uplands to move livestock away from riparian areas. Upward trends in riparian condition are expected due to changes in the range utilization standards in the Grazing Implementation Monitoring Module (IIT, 2000). Studies in the Intermountain Region (Clay, 1999) 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 mechanical disturbance in the channel and the current channel condition. State Water Quality Rules say, recurring activities, including grazing pastures are not to be considered new or increasing discharges which would trigger an anti-degradation review as long as they do not increase in frequency, intensity, duration, or geographic extent (OAR 340-041-0004(4)(a)).

Alternative 1: Pre Forest Plan timber sales that are still limiting shade would continue to recover. Livestock management would continue in the Sunflower Allotment. Road densities adjacent to perennial streams would not change. Water temperatures would not change.

Alternative 2: Pre Forest Plan timber sales that are still limiting shade would continue to recover. Livestock management would continue in the Sunflower Allotment. Road densities adjacent to perennial streams would not change. The cumulative water temperatures on perennial streams would not change. There is a potential for water temperature increases on intermittent streams

(Class IV) when they are flowing, but this would not violate state water quality standards because these streams go dry before peak water temperatures occur in the watershed.

Alternative 3: Cumulative affects in this alternative would be similar to those in Alternative 2.

All alternatives would not be producing further measurable increases in the maximum water temperature and would meet state and INFISH water quality temperature standards. State Water Quality Rules also state, recurring activities, including rotating grazing pastures, are not to be considered new or increased discharges which would trigger an anti degradation review as long as they do not increase in frequency, intensity, duration, or geographic extent (OAR 340-041-0004(4)(a)).

Monitoring: Implementation monitoring would be accomplished.

Soils

Affected Environment

The Sunflower Watershed area is comprised of classic scab stringer terrain characterized by an average of 30 percent scabland plateaus dissected by timbered stringer drainage ways. Plateau uplands are comprised of old basalt flow surfaces that have been deeply incised. The scab/stringer landtype has been identified as one of the major landtypes at the level V Eco-region scale (approx. 1/116,000), covering approximately 25 percent of the Ochoco NF. Much of the area within the analysis area is non-commercial scabland, sage, juniper, rock outcrop, low site ponderosa or meadow. The very southern portion of the analysis area is underlain by sedimentary and meta-sedimentary rock from the Upper Triassic and Upper Jurassic age.

Volcanic ash from Mt. Mazama blanketed the area about 7,600 years ago and has been subsequently reworked by water and air. A thin layer of ash from Newberry Crater has also been deposited over much of the area. The drainage areas have collected wind and water eroded ash from the adjacent scablands, creating lithic scabland soils derived from basalt on the scab surfaces and deeper ash soils mixed with colluviums in the drainage side slopes and bottomlands. Soils on steep to very steep plateau drainage side slopes and lava flow scarps are generally moderately deep to deep on the northerly aspects and shallow to moderately deep on the southerly aspects. Ash soils generally have sandy loam and loam surface textures underlain by finer textured, mixed colluviums. Infiltration in the deep ash soils is rapid to very rapid but very slow on the scablands, which are largely residual soils with clay-loam or clay textures.

Management Direction

The Ochoco National Forest Land Resource Management Plan (LRMP) directs land managers to consider three primary aspects of the Soil Resource when planning and implementing a project. These include: 1) Soil Compaction and Displacement; 2) Surface Soil Erosion and 3) Soil Mass Wasting (LRMP, p.4-196). The LRMP also includes cautionary narrative for recognizing the sensitivity and potential of scablands to be adversely affected by management activities (LRMP, 4-197).

- 1) **Soil Compaction and Displacement:** Maintain at least 80% of an activity area in a non-compacted/non-displaced condition.
- 2) **Surface Soil Erosion:** Achieve effective ground cover to minimize the erosion of soil following planned management activities. Refer to the LRMP for minimum effective

ground cover requirements for specific Soil Resource Inventory (SRI) Erosion hazard Classes (LRMP, p. 4-196).

- 3) **Soil Mass Wasting:** Evaluate alternative project proposals to be documented in the project’s environmental analysis when a project could result in an increased potential for mass wasting that could cause significant soil loss or sedimentation, hazard to property loss of fish habitat or damage to other resource values.

Soil Types and Hazard Ratings

Soil types mapped within proposed commercial thinning units include M13, P2, P3, P35, P5, P54, P8, P85, V1, V2, V8, V83, X9, Y2, Y3, Y34, and Y4 (Ochoco SRI, 1977). The SRI landtypes are mapped at a scale of one inch to the mile. Hazard ratings for compaction, displacement and erosion on each of these landtypes are included in Table 19.

Table 19. Soil Resource Inventory Landtype Hazard Ratings

Soil_type	M13	P2	P3	P35	P5	P54	P8	P85
Erosion Hazard	SI	SI_M	SI	SI_M	SI_M	M	M	M
Compaction hazard	H	H	H	H	M_H	M_H	H	H
Mixing and Displacement hazard	L	M_H	M_H	M_H	L	L_M	L	L
Soil_type	V1	V2	V8	V83	X9			
Erosion Hazard	M	S	M	M_S	SI			
Compaction hazard	H	H	H	H	H			
Mixing and Displacement hazard	M_H	M	L_M	L_M	L			
Soil_type	Y2	Y3	Y34	Y4				
Erosion Hazard	S	S	S	S				
Compaction hazard	M_H	H	H	M_H				
Mixing and Displacement hazard	M_H	M	M					

Sensitive Soils

There are no officially designated sensitive soils identified within the Ochoco National Forest Land Resource Management Plan (LRMP). The following management limitations and descriptions are derived from landtype interpretation Tables contained in the Ochoco NF Soil Resource Inventory (SRI).

Erosion

Surface erosion hazard ratings are included in the SRI for all landtypes mapped on the Ochoco NF. Landtypes Y2, Y3, Y34 and Y4 have severe erosion hazard ratings as a result of steep slopes and surface soil textures. The Y2 landtype, when located along stringer escarpments, is susceptible to overland flow erosion when disturbed due to their coarse textured soils comprised of ash. Units 12, 94, 97, 98, 100, 103 and 107 contain areas of landtype Y2 within their GIS designated boundaries. Landtypes Y3 and Y4 are comprised of finer textured loess located on steep slopes. Units 12, 42, 96 and 99 have a component of Y3; Units 1, 12, 94, 100, 101 and 102 have a component of Y34; and Unit 37 has a component of Y4 within proposed activity area boundaries designated in GIS.

Slumping

The Y2, Y3 and Y4 soils and others along steep escarpments and drainage ways are susceptible to small slumps. Units 28, 96, 101 and 102 have some overlap of dormant landslide terrain mapped in GIS. Fuels Treatment unit # 317 also overlies dormant landslide terrain as mapped in GIS. Units identified with these landtypes within their GIS boundaries would have these areas excluded from ground based harvest during layout or implementation for slope concerns. All surface water sites would require no traffic buffers of 150 feet.

Compaction

A high or moderately high compaction hazard exists for all soil types within the analysis area. Soils along the bottoms of the stringers are especially sensitive to compaction by logging equipment, large ungulates and recreational vehicle activity, especially when soil moistures are near or above field capacity.

Roads

Road construction and the lack of maintenance accounts for much of the cumulative erosion impacts within the analysis area, especially where roads are located along or within drainage ways. The analysis area (the Sunflower and portions of the Pine Creek and Rock Creek/South Fork Beaver Creek sub-watersheds) has a relatively low road density when compared to much of the surrounding area on the district.

Wet and Dry Meadows

Meadow areas within the project area are generally associated with stringer bottoms and headwater areas of intermittent streams. Landtype M13 is a complex of wet and dry meadow types with seasonal water tables at or near the surface. Proposed activity unit #'s 8, 10, 13, 27, 28, 45, 50, 51, 54, 55, 73, 75, 76, 77 and 95 have landtype M13 within some portion of their boundaries.

Scablands

Scablands are represented by landtype P5 and also complexes that include P5 (P54, P35 and P85) within the analysis area. Units 1, 5, 9, 13, 16, 31, 101, 102, 105, 106 and 107 include the P5 landtype; Units 17, 83, 84 and 92 include landtype P35; Units 37, 38, 41, 45, 46, 48, 51, 56, 57, 62, 63, 65, 66, 67, 68, 71, 73, 75 and 117 include landtype P54; and Units 24, 50, 52, 53, 54, 55 and 62 includes landtype.

Stringer terrain below scablands is sensitive to erosion when drainage becomes concentrated as a result of disturbance on the scab areas. Edge areas along the interface between scablands and forested stringer drainages are very sensitive and provide critical buffers to slow down and dissipate the rapid runoff from the scabs. Concentrated flows from the shallow soil and rocky apron areas are capable of down cutting through the deeper ash soils located on the side slopes of drainage ways. Infiltration buffers (minimum of 66 feet) are recommended along scab stringer interfaces in the uplands, generally accounted for by PACFISH buffers. Scab soils are also highly susceptible to erosion when rutted and channeled.

Regeneration

Landtypes with low to very low regeneration potential are P3, P8, Y3, and Y4. Units having some portion of their area in these landtypes include #'s 4, 5, 6, 7, 8, 9, 10, 12, 13, 21, 26, 27, 28, 30, 31, 32, 33, 34, 35, 36, 37, 38, 42, 48, 58, 62, 73, 93, 94, 95, 96, 105, 106, 107, 117, 118, 136 and 144. Steep and rocky south slopes are a primary concern for regeneration, while the droughty conditions found in landtypes P3 and P8 create a shortened planting season on south slopes. Units 37 and 94 contain 1 and 4 acres, respectively of landtype Y4, although neither are located on steep, south facing escarpments where seed trees should be maintained in excess of other areas on similar soil types.

Tillage Potential

Most soils over the area are too steep, too rocky and too shallow for tillage operations. Soils with moderately deep profiles comprised of ash can be tillable depending on subsurface rock contents. These include the P2, P3, P35, P8, V1, V2, V8, X9 and Y2 landtypes. Conditions even within these landtypes are extremely variable and require unit specific assessments to determine the suitability for this operation.

Existing Conditions

Soil disturbance levels within the analysis area were assessed on an individual activity area unit basis and included in Appendix B. Disturbance levels were determined from traverse surveys of visible soil disturbance conditions, past activity databases and/or photo interpretation. Current disturbance conditions are a result of impacts from past management activities such as timber harvest and grazing, and vary according to the extent and intensity with which these activities have occurred.

Traverse surveys were conducted by a trained soil scientist and range conservationist within a subset of stand exam units within the analysis area during the summer and fall of 2002. Measured lengths of visual soil disturbance categories (Categories 1-6: Soil Disturbance Assessment Form) directly overlap 24 activity areas proposed under the Willow Pine EA. Raw data from these traverse surveys is summarized as existing detrimental disturbance for these activity areas (see Appendix B, Ex. % Detr., units in boldfaced type). Raw data traverses in stand exam units that are not proposed for management under this proposed EA were extrapolated to other proposed activity areas where soil types and past harvest activities were similar. Aerial photo interpretation and the GIS past activities database were used to help estimate existing detrimental soil conditions in these and the rest of the activity area units proposed under the Willow Pine EA.

Existing conditions for proposed activity area units have been placed in disturbance brackets ranging in ten percent increments (Table 20). Approximately half of the proposed units have

disturbance levels below 10% and half have disturbance levels between 10 and 19%. Units in the 20-29% and greater disturbance classes currently exceed Regional and Forest Plan Standards and are directed to be left without an increase in detrimental conditions following proposed activities.

Table 20. Existing Detrimental Disturbance Classes by Proposed Activity Units

	Detrimental Disturbance Categories					
	0	1 to 9%	10 to 19%	20 to 29%	30 to 39%	40 to 49%
# Units	1	54	54	9	3	0
% of units	1%	45%	45%	7%	2%	-

Harvest Activities

Past harvest activities are the primary source of detrimental soil disturbance within the Willow Pine analysis area. The use of caterpillar type tractors and rubber-tired skidders has occurred on much of the forested acreage in the analysis area with slopes less than 30-40%. Approximately half of the proposed commercial harvest units have disturbance levels indicating this type of activity.

Although many areas tractor logged on the Ochoco National Forest in the past have cumulative detrimental levels ranging from 30-40% from multiple harvest and mechanized fuels treatments (David, 2002), many of the areas proposed for commercial harvest have lower disturbance levels reflective of less intensive management and small mill selection cutting (Martin, 2006).

Documented harvest activities from the past activities database (FACTS) within the watershed include overstory removal, single tree selection, commercial thinning and shelterwood cuts. Additional activities within the watershed are summarized in a spreadsheet compiled by district personnel but are not spatially entered into GIS. Past activities have created roads, skid trails, landings and off trail impacts where machines have traversed to pile or crush slash.

System Roads

System roads constructed and maintained for the implementation of past management activities also contribute to the extent to which the soil resource has been impacted. Proposed activity units have varying amounts of Level 1, 2 and 3 roads within their unit boundaries. Acreage committed to Level 1, 2 and 3 roads within units, as calculated from GIS, are included in Appendix B. The majority of units have less than 3% of their area dedicated to system roads, with none exceeding 5%. Units 21, 27, 36, 43, 52, 66, 93, 128 and 145 have between 4 and 5% of their area dedicated to system roads.

Landings and Skid Trails

The majority of proposed commercial harvest units have existing landings from past activities. Approximately 331 landings with an average size of 1/8 acre are currently present within or adjacent to activity areas proposed for commercial harvest under this project. The majority of units have 2% or less of their acreage currently in landings. Nine units have between 4 and 6% of their acreage in landings (Appendix B). These areas are considered to be detrimentally compacted, totaling approximately 41 acres.

Skid trails from previous entries are present within the majority of proposed activity units and are available for re-use under this entry whenever possible. These trails lead to existing landings and vary in spacing and extent from unit to unit. Traverse surveys within areas of documented past harvest activities indicate that these trails are variable in extent and cover approximately 10 to 15% of a given area.

Grazing

Grazing has also contributed to the existing condition of the soil resource, primarily along the stringer bottomlands where concentrated use tends to occur. Evidence of compaction, loss of effective cover, head cutting, post holing and puddling from concentrated herds of cattle, horses, sheep and elk are present within the analysis area (Sunflower Environmental Assessment, 1995). The majority of these impacts are within Riparian Habitat Conservation Area (RHCA) buffers and outside the boundaries of proposed activity areas.

Environmental Consequences

Scale of Analysis and Types of Effects

The analysis area for determining the effects of the Willow Pine Environmental Assessment on the soil resource is specific to the individual proposed activity area unit boundaries when addressing direct, indirect and cumulative effects to the physical, chemical and biological components of the soil resource.

Direct Effects

Direct effects to the soil resource are primarily related to alterations of the physical component of the soil through compaction or displacement by machines utilized for harvest and yarding operations. Direct effects can also include burn damage as a result of pile burning.

Indirect Effects

Indirect effects include changes in the biotic and chemical components integral to soil productivity as a result of physical alterations to the soil resource, changes to the chemical component of the soil resource from the physical removal or treatment of vegetative material during harvest and fuels treatment activities, and/or potential erosion resulting from the physical compaction or displacement of mineral soil and organic cover.

Cumulative Effects

Cumulative effects are primarily the incremental increase in detrimental soil conditions as a result of proposed activities occurring in areas where soil disturbance and detrimental impacts currently exists from previous activities.

Measurements of Effects Analysis

The environmental consequences of the alternatives are described as effects to the components of the soil resource that influence site productivity. Direct effects to the physical component of the soil primarily occur as compaction and displacement of mineral soil by machinery traffic used to harvest, yard or haul material. Compaction and displacement incurred under this proposed EA are estimated spatially within an activity area based on the amount and types of activities proposed and the amount of these disturbances that already exist. Levels documented from past harvest activities

partially determine the increase in disturbance during this entry, primarily in terms of skid trails and landings that can be re-used. Estimated changes in disturbance levels are tallied in order to determine compliance with Regional and LRMP Standards. The manipulation, removal or burning of organic matter on site also has direct and indirect effects on the productivity of the soil resource and can be tracked by changes to the Fire Regime Condition Class (FRCC) estimates of woody debris on site.

Alternative 1 - No Action

Direct and Indirect Effects

The No Action alternative would have no direct or indirect impacts to the soil resource. No new soil disturbance would occur within the analysis area as a result of this alternative. Existing detrimental disturbance levels would remain at current levels as estimated by traverse surveys and aerial photo interpretation.

Cumulative Effects

There would be no incremental cumulative change in effects to the soil resource as a result of this alternative.

Alternative 2 - Proposed Action

Proposed activities have the potential to affect soil productivity if the sum total of detrimental disturbance exceeds 20% of the spatial extent of an activity area. The Ochoco LRMP directs management activities to leave a minimum of 80% of an activity area in a condition of acceptable productivity (OLRMP, p.4-196, 1989). LRMP standards would be met under this proposed EA on a unit basis through the use of Best Management Practices (BMPs), the administration of timber sale contract language intended to minimize detrimental impacts from proposed activities and design criteria such as tillage.

Direct and Indirect Effects

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

Compaction

Compaction in moderate textured, volcanic ash soils occurs primarily as a result of vibration and compressional forces from machinery used for harvest and yarding operations. The level of compaction incurred by machine traffic varies according to the soil moisture levels at the time of operation (Chitwood, personal communication). Finer textured soils comprised of residuum or older ashes are compacted primarily by compressional forces. These soil types are also prone to puddle and rutting as a result of machine traffic during periods of elevated soil moistures.

Compaction of both textural soil types generally requires multiple passes before soil strengths are increased sufficiently to meet the definition of detrimental. Detrimental compaction requires bulk

density increases of 20% or greater over natural, undisturbed levels in ash soils, and 15% or greater in finer textured residual soils (FSM 2500, R6 Supplement). Levels exceeding a 20% increase in bulk density have been measured on ash soils after four or more passes by ground-based tracked and rubber tired machinery used for similar harvest operations (McNabb and Froehlich, 1983).

Displacement

Displacement of soil can occur when ground-based machinery pivots quickly on a slope with exposed or loose mineral soil. Mineral soil exposed by past activities or with limited vegetative cover on the soil surface is susceptible to displacement from machine traffic off of established skid trails and landings. Detrimental displacement requires the removal of greater than 50% of the mineral A horizon over an area of 100 square feet or greater (FSM 2500, R6 Supplement).

Burn Damage

Burn damage of soil can occur when the burning of coarse woody debris creates elevated soil temperatures for an extended period of time. Detrimental burn damage would be expected to occur where machine piles of logging slash and other fuels on landings or grapple piles elsewhere in the units were burned and residence times were extended. The burning of slash piles has the potential to volatilize nutrients and soil organisms contained in the soil beneath them. Oxidized soils resulting from extended durations of elevated temperatures underneath burn piles meet definitions of detrimental burn damage.

Unit Impacts

Compaction within proposed activity units is predicted to occur in areas where temporary roads, landings and skid trails are created, as well as areas where multiple passes of harvest or fuels piling machinery occurred off of skid trails. Predictions for the amount of compaction are discussed as follows.

Temporary Roads

Alternative 2 would require the implementation of new temporary road construction to reach 22 proposed activity areas and/or landings within them. New temporary roads would be created in Units 1, 5, 6, 12, 14, 23, 25, 32, 33, 35, 48, 49, 54, 55, 58, 62, 96, 99, 101, 102, 111 and 122. These temporary roads would be created on a variety of soil types and cover a total of 3.7 miles or 6.8 acres within proposed unit boundaries for Alternative 2. Acreages within each activity area unit are included in Table 21. An additional 0.4 miles or 0.8 acres would be impacted outside of activity area unit boundaries under Alternative 2.

Table 21. New Temporary Roads within Proposed Units for Alternative 2.

Unit_No	Unit_Ac	mi_new temp rd	ac_new temp rd	% unit
1	12	0.12	0.22	1.75
5	63	0.55	1.00	2.70
6	60	0.45	0.82	2.47
12*	74	0.10	0.18	0.25
14	14	0.07	0.13	0.67
23	40	0.23	0.42	1.30
25	104	0.32	0.58	0.56
32	105	0.22	0.40	0.38
35	14	0.09	0.16	1.18
48	130	0.51	0.93	0.71
49	29	0.18	0.33	1.15
54*	32	0.02	0.04	0.11
55*	34	0.19	0.35	1.00
58	27	0.19	0.35	1.26
62	200	0.10	0.18	0.09
96	14	0.10	0.18	1.28
99	5	0.04	0.07	1.43
101	20	0.04	0.07	0.36
102	35	0.07	0.13	0.36
111*	18	0.15	0.27	1.50
122	21	0.02	0.04	0.17

* units dropped for Alternative 3.

Landings and Skid Trails

Landings and skid trails would be detrimentally compacted following machine harvest and yarding activities. Although there is some natural mitigation of compaction on skeletal surface phases of soils with enough rock to provide increased bearing strength, the variability of this condition is difficult to map at general mapping scales. The entire width and length of skid trails and landings is estimated to be detrimentally compacted for the purpose of this analysis.

Existing landings would be re-used under this alternative in all but 12 units and are assumed to increase in size from their current average of 1/8 acre to an average of 1/4 acre in order to accommodate whole tree yarding prescriptions requiring the processing of tops and crowns at the landings. An estimated 44 new landings totaling 11 acres would be created within 20 proposed units at an average size of 1/4 acre. The average acreage estimates were used for calculating the percentages of each unit dedicated to new landings and the increase in size of existing landings within proposed activity units (Appendix B). Landings within units less than 15 acres in size and proposed for the removal of 2,000 bf or less per acre are likely to be closer to 1/8 acre in size. The majority of proposed activity unit are estimated to have approximately 5% or less of the total acreage committed to landings for this proposed entry (Appendix B, % unit landings post harvest). Units 1, 42, 56, 67, 84, 105 and 138 would have between 8 and 12% of their unit boundaries committed to landings.

Existing skid trails would be utilized wherever possible during this entry. New skid trails would be created in portions of units not entered in the past or leading to newly created landings within 20 units under this proposal. Increases in detrimental soil conditions as a result of skid trails would vary between proposed activity units, primarily depending on the extent of existing trails that are re-usable and the location of material proposed for harvest. The amount of additional acreage committed to skid trails under this proposal would be inversely proportional to the number of existing skid trails available for use. Skid trails are likely to average between 10 and 15% of the unit area, depending on the average distance between them. Average acreage committed to skid trails in two units of the Black Bear timber sale was observed to be 15% for somewhat similar silvicultural prescriptions and volume removals (David, 2000).

Soil Tillage

Tillage mitigation would be utilized in ground-based units to rectify detrimental impacts incurred by the proposed activities where they exceeded 20% after harvest, yarding and fuels treatments were completed or where existing conditions above 20% were increased from proposed activities. Units in which tillage is predicted to be necessary have estimated percent detrimental conditions following harvest and fuels activities that exceed 20% (Appendix B). This includes unit #'s 3, 4, 5, 6, 9, 11, 12, 16, 17, 19, 21, 22, 25, 27, 28, 30, 31, 32, 33, 38, 42, 47, 48, 50, 51, 52, 55, 62, 66, 73, 84, 91, 95, 110, 111, 117, 118, 124, 128, 133, 138, 140 and 141. Some of these units are predicted to be within a few percent of the 20% and standard and may meet standards after implementation of harvest and fuels treatments. Unit #'s 3, 9, 19, 21, 22, 25, 42, 47, 55, 62, 84, 91, 124, 128, 138, 140 and 141 are slated for grapple piling and are recommended to have machinery limited to operation on skid trails and landings utilized for the harvest activities in order to reduce impacts and possibly avoid the need for tillage.

Tillage methodologies and guidelines are included in Appendix C. Deep tillage with a winged subsoiler or forest cultivator would be utilized on landings and skid trails located on ash soils where depths of the surface ash are greater than 14" and content of rocks greater than 3" is less than 35%. Soil types P2, P3 and Y2 are the primary landtypes with ash cap soils classified as moderately deep to deep and capable of being tilled effectively to de-compact detrimental levels of soil strength. Detrimental disturbance levels within affected units would be expected to be reduced to 20% or brought back to those existing prior to this entry where they currently exceed 20%.

Off Trail Tracks: Harvest Operations and Grapple Piling

Feller/Buncher machinery would travel off of designated skid trails in order to cut and accumulate material proposed for removal that is greater than 25 feet from a designated skid trail. Travel of these machines off of skid trails would incur an increase in bulk density/soil strength on the soil over which it passed directly related to the number of passes that occur. Changes in bulk density/soil strength are not considered to be detrimental on up to five passes of machinery over currently un-impacted ground. Tracks from these machines were not observed to be detrimental in two units of the Black Bear TS (David, 2000). However, monitoring of prescription units in which feller/bunchers were utilized for thinning prescriptions on ash soils elsewhere on the Ochoco and Deschutes National Forest has shown an increase in detrimental conditions as a result of these operations. There is some natural mitigation on skeletal surface phases of soils in activity areas that contain enough rock to provide increased bearing strength and reduce compaction of the fines between the rocks. An estimated increase in detrimental soil disturbance of <5% across a unit as a result of off trail tracks is incorporated into unit estimates of soil disturbance in the following narrative and Appendix B.

Total Compaction

Changes to detrimental disturbance levels as a result of harvest and fuels prescriptions implemented under the Willow Pine project are predicted based upon a number of factors. Percent changes are indirectly proportional to the amount of existing detrimental disturbance that can be utilized during this entry (i.e. skid trails and landings). Factors affecting the changes to detrimental disturbance levels are primarily the trees per acre cut (tpa), which translates into the number of harvest and yarding machine trips; and the inclusion of additional machine traffic from fuels treatments (i.e. grapple piling off of skid trails). Proposed activity units identified with greater than 60 trees per acre proposed for removal are assumed to incur an approximate 10% increase in detrimental conditions from these activities. Activity units proposed for grapple piling would have additional off trail traffic from grapple piling machines and would incur impacts on approximately 5% additional area within them.

Units were stratified according to existing detrimental disturbance levels, 0 to 9%, 10 to 19% and >20% for the prediction of increases in detrimental disturbance. Units with existing detrimental conditions of 20% or greater are predicted to have an increase of 5% in detrimental conditions as a result of this entry if there is no additional grapple piling and 10% if this is necessary. These predictions account for the amount of existing disturbance that can be re-utilized during this entry when disturbance levels are this high.

Units with existing detrimental conditions of 10 to 19% are predicted to have an increase in detrimental disturbance of 5% if tpa is <60, or a 10% increase if tpa is >60. Grapple piling is predicted to incur an additional 5% increase. Although some overlap of this entry would occur with past disturbance, additional skid trails and landings are necessary and off trail tracks are more likely to incur detrimental disturbance.

Units with existing detrimental conditions of <10% are predicted to have a 15% increase in units with >60 tpa cut, 10% increase with <60 tpa cut and an additional 5% increase if grapple piling occurs (Appendix B). Approximately 308 acres within activity area units would be detrimentally compacted as a result of implementing this alternative.

Other Disturbance

Displacement

Although displacement of mineral soil may occur from the maneuvering of harvest and fuels piling machinery, off-trail traffic of feller bunchers was observed to incur minimal amounts of detrimental displacement on ash soils within units of the Black Bear Timber Sale located on the northern portion of the district. Areas where displacement was identified were infrequently large enough where they did occur to meet detrimental conditions (David, 2000). Less than 1% of the unit area off of skid trails is predicted to be detrimentally displaced during these activities. Areas of detrimental displacement are likely to occur along the edges of skid trails on which whole tree yarding occurs and on landing areas where there would be direct overlap with detrimental compaction.

Pile Burning

Piles on landings are estimated to cover approximately 2500 ft², totaling < 1% of the unit area. The burning of landing piles is likely to incur detrimental damage on these areas. Temperatures

exceeding 200 degrees C have been measured 2-5 cm below the soil surface for greater than 4 hours during active pile burns, while soil pH levels were shown to increase dramatically for the 0-2.5 cm and 2.5-10 cm soil horizons following these burns (Sheay 1993). Although few studies have monitored the long-term recovery of soil underneath pile burns, these operations likely inhibit the productivity of these areas for a number of years.

Grapple piles located within the unit would approximate 250 ft² and would be more loosely piled than piles located on landings. These areas would have slightly lower impacts due to shorter residence times and a smaller extent of influence. Areas under grapple piles may or may not be detrimentally burned as a result. The overlap of many of these piles on compacted skid trails would reduce the increase of detrimental conditions within a proposed activity area. Units identified for grapple piling are included in Appendix B.

Prescribed Burning and Precommercial Thinning

Commercial harvest units proposed for prescribed burning fuels treatments are identified in the Fuels section of the Willow Pine EA. Burn Plan prescriptions would minimize impacts to the soil resource. Activity units with higher fuel loads following harvest activities would be grapple piled prior to burning in order to reduce the extent of larger woody material capable of maintaining longer residence times of elevated temperature at the soil surface. As a result, no detrimental burn impacts are expected to occur as a result of prescribed burning activities.

Units proposed for Pre-commercial Thinning would have no entries with machinery and incur no additional detrimental compaction. Jackpot piles and burns would incur a minor amount of burn damage across the unit areas.

Effective Ground Cover

The Ochoco LRMP directs land management activities to be planned to achieve effective ground cover within the first and second year in order to minimize surface erosion as a result of soil disturbance. Landtypes with severe erosion hazard ratings (P3, Y2, Y3, Y34, and Y4) have higher minimums for percent effective ground cover one and two years following the implementation of planned activities (OLRMP, p. 4-196). Unit areas with these landtypes are listed under sensitive soils earlier in this document. The landtypes of concern are generally a small percentage of the units in which they occur and are recommended for exclusion during layout or reduced fuels treatments in order to maintain higher levels of effective ground cover.

Current levels of effective ground cover within proposed activity area units are relatively high due to their inherent production of herbaceous vegetation and elevated levels of woody debris in the absence of fire. Proposed activity area units are located within the Dry Grand Fir (CWG111), Douglas Fir (CDSD), Mesic Pine (CPG222) and Dry Pine (CPS221) Plant Associations, which are described to have 50%, 60%, 80% and 80% mean herbaceous cover, respectively, in representative plots (Johnson, 1991). Herbage production of these sites is 339 lb/ac, undocumented, 393 lb/ac, and 421 lb/ac. Fire Regime Condition Class (FRCC) estimates for activity area units currently place the majority of units in condition class 2 or 3, with 15 and 40 tons/acre, respectively, of woody debris currently on site. These figures combine to indicate levels of effective cover provided by herbaceous vegetation and woody debris at or above those recommended for the Erosion Hazard ratings of the soil types located on these sites.

Alternative 2 would directly affect effective ground cover by crushing and uprooting herbaceous vegetation and piling and burning woody debris. Reductions of effective ground cover provided by herbaceous vegetation would occur primarily on skid trails and landings that are created or re-used during the implementation of this project. These reductions would occur for the short-term until live vegetative cover of herbaceous forb and grass species returns. The rate of return of live vegetative cover has been observed on untilled skid trails on the district to reach up to 40% within 3 years (Mafera, personal communication). Approximately 308 total acres within the project area, estimated as the sum of the change in detrimental disturbance within individual activity area units (Appendix B), would be affected in this way.

The piling and burning of woody debris is proposed to occur within a subset of commercial harvest units as a precursor to prescribed burning prescriptions. Reductions of fuel loads on acres classified as FRCC 3 and FRCC 2 would occur as a result of these operations to or toward FRCC 2 and FRCC1, respectively. These reductions would occur on approximately 60% of a given unit area. Despite these reductions, effective ground cover levels provided by live vegetation and woody debris are expected to meet effective ground cover standards listed in the LRMP for all soil types within unit boundaries.

Surface Soil Erosion

Areas of detrimental soil disturbance would be susceptible to elevated surface erosion in the short-term where compaction and/or displacement reduced live vegetation and woody debris currently providing effective ground cover. Actual rates of erosion would vary according to the extent of disturbance, surface soil textures and the slope of disturbed areas. Changes to rates of erosion are expected to be localized to the skid trail and landing areas where live vegetative cover was substantially reduced by harvest and fuels treatment activities. Changes to surface erosion rates would be expected to be reversed by tillage operations and/or the re-establishment of live vegetative cover over subsequent years.

Approximately 309 total acres within the analysis area would have an elevated risk of erosion in the short-term as a result of implementing Alternative 2. These acres include soil types with primarily slight, slight-moderate and moderate surface erosion hazard ratings that are estimated to produce between 100 and 200 ft³ of soil/acre/year under conditions of complete loss of vegetative and woody debris cover (SRI, 1977). Soil types with severe ratings are estimated to lose up to 300 ft³ of soil/acre/year under the same absence of effective cover. Acres of soil types with this rating are not likely to be disturbed by skid trails or landings due to their excessive slopes.

Erosion loss estimates for this project use an inverse relationship between effective ground cover and erosion rates for unit acres not in skid trails or landings. A direct ratio of reduction from the figures cited in the SRI for the complete loss of effective ground cover is used to generate a rate of loss for these acres. Cover values of 70% were used as an average effective ground cover for all acres not detrimentally disturbed in any of the four primary PAGs identified in the analysis area (DF, DA, MP and DP). This figure is then multiplied by the range of soil loss cited in the SRI for each erosion hazard rating and subtracted from the upper end of the range. Erosion loss estimates are summarized for the slight, slight-moderate and moderate erosion risk ratings as a result of this calculation in Table 22.

Erosion loss rates on a per acre basis are further reduced using a weighted average between loss rates of acres in skid trails and landings and acres with effective ground cover remaining. Units would have little or no effective ground cover on up to 20% of their acreage and an average

effective ground cover of 70% on approximately 80% of their acreage based on FRCC estimates and PAG herbaceous cover values. The weighted average of loss rates of these two effective cover values are also included in Table 22 for the different erosion hazard ratings.

Table 22. Estimated Soil Loss/Acre/Year for SRI Erosion Hazard Ratings

SRI Erosion Hazard Rating	SRI soil loss/ac/year with all effective ground cover removed	Recalculated loss/ac/year with effective ground cover of 70%	Weighted average loss/ac/year following implementation
Slight (SI)	100 ft ³	30 ft ³	44 ft ³
Slight-Moderate (S-M)	150 ft ³	80 ft ³	94 ft ³
Moderate (M)	200 ft ³	130 ft ³	144 ft ³
Severe (S)	300 ft ³	230 ft ³	244 ft ³

Sediment Delivery

Activity area unit acres immediately adjacent to RHCAs have the potential to deliver sediment to valley bottoms and stream channels. Table 23 summarizes the total and estimated detrimental acres of proposed commercial harvest activity units that are immediately adjacent to RHCA buffers for Category 1, 2 and 4 streams. Approximately 2.7 miles of proposed harvest unit boundaries are adjacent to Category 1 stream buffers, 3.8 miles are adjacent to Category 2 stream buffers and 7.2 miles are adjacent to Category 4 stream buffers under this alternative. Alternative 2 Unit #'s 2, 3, 8, 10, 11, 13, 14, 16, 17, 18, 21, 22, 23, 25, 28, 30, 31, 32, 35, 38, 39, 40, 41, 43, 47, 48, 49, 51, 54, 55, 61, 62, 63, 66, 71, 73, 76 77, 79, 80, 92, 95, 100, 101, 102, 103, 107, 111, 114, 115, 120, 121, 122, 124, 133, 136 and 141 are included in this list.

Table 23. Acres of Commercial Harvest Units Immediately Adjacent to RHCAs

PACFISH/INFISH Stream-category	Alt_2 Unit acres adjacent to RHCA buffer	Alt_2 Detrimental acres adjacent to RHCA buffer
Category 1	71 ac	14 ac
Category 2	100 ac	20 ac
Category 4	190 ac	38 ac

Acreage within activity areas that is not committed to skid trails or landings is not likely to contribute to concentrated overland flows during storm events since the level of detrimental disturbance is predicted to be relatively low and effective ground cover provided by herbaceous vegetation would not be altered substantially. Traffic from feller bunchers or grapple piling machinery off of skid trails is expected to minimally reduce effective ground cover provided by herbaceous vegetation. Grapple piling would reduce the woody debris component within units in which it occurred, reducing effective ground cover levels on these acres to varying degrees. However, the majority of acreage would be at or only slightly below current levels following implementation of all proposed activities.

The rate and extent of surface erosion would also be minimized within the activity area units in which disturbance occurred as a result of water control clauses in the timber sale contract and tillage in some areas. The construction of waterbars on skid trails would limit the energy and accumulation of overland flows during storm events on these surfaces. Tillage of skid trails and

landings where feasible would increase the infiltration capacity of the temporarily disturbed areas and reduce the accumulation of storm water as overland flows.

The estimated amount of eroded soil actually leaving proposed commercial harvest units under this alternative is as follows. The average erosion rate for the Slight-Moderate erosion hazard rating from Table 22 (94 ft³ soil/ac/year = 3.5 yd³ soil/ac/year = 4.9 Tons soil/ac/year) is applied for all soil types and multiplied by the acres of commercial harvest units immediately adjacent to RHCAs (in 1 acre widths) from Table 23. The totals are included in Table 24 and converted to cubic yards and Tons per acre per year and to Tons/year/ mile of RHCA buffer. These figures are estimates for the purpose of comparison between Alternatives and Stream Category types only.

Table 24. Alternative 2 Potential Soil Loss Reaching RHCA Buffer Boundaries

RHCA Stream Category	Alt_2 soil loss reaching RHCA buffer (yd³/year)	Alt_2 soil loss reaching RHCA buffer (Tons/year)	Alt_2 soil loss per mile of RHCA buffer Tons/year
Category 1	247 yd ³ /year	350 T/year	130 T/year
Category 2	348 yd ³ /year	490 T/year	129 T/year
Category 4	661 yd ³ /year	661 T/year	92 T/year

The movement of eroded soil by overland flows is a concern to aquatic and biotic components of the watershed. PACFISH/INFISH RHCA buffers provide a physical distance of undisturbed ground and vegetative cover to reduce the energy of overland flows before they reach stream channels. Although 200 ft stream buffers have been shown to be physically large enough to reduce the delivery of sediment to streams in watersheds of western Washington (FEMAT, 1993), the effectiveness of 300 and 150 foot buffers in reducing sediment delivery to perennial and intermittent eastside streams, respectively, is not well studied or documented.

For the purpose of this analysis, the concepts adopted by erosion and sediment delivery models such as the Water Erosion Prediction Project (WEPP) that a large portion of sediment contained in overland flows is filtered out by effective ground cover and physical distances is applied. The presence of vegetative cover within stream buffers that is undisturbed by proposed management activities is likely to contribute to dissipating overland flow energies and filtering sediment contained in them. Slopes between proposed harvest units and stream channels are generally less than 20% and vegetative cover is relatively high. The physical distance of these buffers would act to dissipate these flows during low to moderate return interval storm events and allow the majority of sediment to be deposited on the uplands and terraces above floodplains before they reached stream channels. As a result, the overall risk of delivery of sediment directly from acreage within units to stream channels is low and a lesser percentage of the sediment eroded from proposed commercial harvest units is estimated to reach the stream channels via overland flows during storm events.

Roads and Sediment

The greater risk of sourcing and delivering sediment to stream channels is from the presence of roads and associated drainage culverts within RHCAs or directly between activity area units and RHCA boundaries. Approximately 11 miles of road proposed for haul under this project for Alternatives 2 are currently located within RHCAs that could contribute sediment to streams.

Approximately 1.94 miles of currently closed Level 1 roads would be opened for haul under Alternative 2 that could be a source of sediment during the period of haul and before closure and rehabilitation. No new temporary roads proposed under this alternative are located within RHCAs. Unit #'s 2, 66, 80, 103, 111, 120 and 124 have roads at or near the interface of their unit boundaries and the RHCA buffers that have the potential to concentrate overland flows in their drainage ditches and focus them toward stream channels via inappropriately located relief culverts.

Cumulative Effects – Alternative 2

Cumulative effects to the soil resource would occur within activity area unit boundaries where detrimental disturbance of past, present and reasonably foreseeable projects overlap with acres implemented under Alternative 2. Cumulative effects to the soil resource would occur where impacts from proposed activities incrementally increased detrimental disturbance in units with existing disturbance from past activities. Existing and estimated detrimental disturbance levels after implementation for proposed activity areas under this alternative are summarized in Appendix B. These levels include impacts from recent past projects and older past activities.

Prescriptions implemented in the past twenty years are primarily commercial thins or overstory removals that incurred moderate levels of disturbance to the soil resource. Recent past projects within the analysis area include the Cougar, Sunny and Willow John projects (FACTS activity database). Few of these project acres overlap activity areas proposed under the Willow Pine EA. Older prescriptions that do overlap some of the proposed activity area acres include the Roadrunner, Telephone and Willow projects. Prescriptions of these projects are overstory removal or single-tree selection tree cuts that incurred varying amounts of detrimental disturbance. These levels are accounted for in the individual unit estimates of existing detrimental disturbance.

The amount of incremental change to detrimental disturbance levels is likely to be inversely proportional to the amount of existing disturbance on site. Cumulative impacts could create detrimental disturbance in areas where off trail travel of feller bunchers used in this entry overlapped machine trafficked areas from past entries. Units with less than 10% existing disturbance are estimated to have an increase in detrimental disturbance of 10 to 15%, depending on trees per acre cut and fuels treatments. Additional entries into a subset of commercial harvest units proposed under the Willow Pine project could occur to grapple pile logging slash and existing woody fuel loads. Incremental increases in detrimental disturbance are likely to be less than 5% under this restriction and should maintain disturbance levels within acceptable LRMP levels.

Proposed activity units with impacts from previous activities exceeding 10% are likely to have temporary, cumulative detrimental soil disturbance levels greater than 20% following the implementation of harvest and fuels treatment activities. Units with existing disturbance levels of >20% are likely to have a 5% increase in these levels. Units in both of these categories would require tillage operations to reduce detrimental disturbance levels to meet Regional Standards. Tillage mitigation to rectify compaction incurred by proposed activities in excess of the LRMP standard would leave all activity areas in which it was used in a condition of acceptable soil productivity in terms of the spatial extent of detrimental disturbance. The cumulative effects of proposed harvest activities in areas with existing levels of impact from past projects is not expected to negatively affect long-term site productivity. Summary alternative Tables include estimated acres that would require tillage mitigations to meet LRMP standards in units where cumulative effects exceeded 20% or increases from levels already exceeding 20% occurred (Appendix B). An estimated 65 acres of tillage could be necessary to meet LRMP standards.

Cumulative effects of implementing the Willow Pine project and managed foreseeable future projects within the project area on the soil resource would be relatively minimal. Approximately 4,492 acres are proposed for prescribed burning within the analysis area under the Sunflower Natural Fuels Categorical Exclusion. Approximately 840 of these acres overlap the commercial harvest units proposed under the Willow Pine EA, some of which would be prescribed burned prior to this entry and some afterward. Burn Plans for these prescriptions limit the amount of consumption of vegetative cover and would incur negligible detrimental disturbance to the soil resource.

The majority of impacts from grazing are within Riparian Habitat Conservation Area (RHCA) buffers and outside the boundaries of proposed activity areas. Grazing has also contributed to the cumulative impacts on the soil resource, primarily along the stringer bottomlands where concentrated use tends to occur. Evidence of compaction, loss of effective cover, head cutting, post holing and puddling from concentrated herds of cattle, horses, sheep and elk were present within the analysis area (Sunflower Environmental Assessment, 1995).

Direct and Indirect Effects – Alternative 3

Direct effects to the soil resource would occur under the Alternative 3 as detrimental disturbance in the form of compaction, displacement, or burn damage from ground-based machine traffic and pile burning. Definitions of detrimental for these disturbances are found in the Regional supplement to the Forest Manual (FSM 2500, R-6 supplement 2500-98-1). The proposed activities would incur detrimental impacts in the form of compaction, displacement and pile burn damage in the same manner as described for Alternative 2, including compaction, displacement and burn damage.

Unit Impacts

Compaction within proposed activity units is predicted to occur in areas where temporary roads, landings and skid trails are created, as well as areas where multiple passes of harvest or fuels piling machinery occurred off of skid trails. Predictions for the amount of compaction are discussed as follows.

Temporary Roads

Alternative 3 would require the implementation of new temporary road construction to reach 18 proposed activity areas and/or landings within them. New temporary roads would be created in Units 1, 5, 6, 14, 23, 25, 32, 33, 35, 48, 49, 58, 62, 96, 99, 101, 102 and 122. These temporary roads would be created on a variety of soil types and cover a total of 3.3 miles or 6.0 acres for Alternative 3. Acreages within each activity area unit are included in Table 25. An additional 0.2 miles and 0.5 acres would be impacted as a temporary road for Alternative 3.

Landings and Skid Trails

Landings and skid trails would be detrimentally compacted following machine harvest and yarding activities. Although there is some natural mitigation of compaction on skeletal surface phases of soils with enough rock to provide increased bearing strength, the variability of this condition is difficult to map at general mapping scales. The entire width and length of skid trails and landings is estimated to be detrimentally compacted for the purpose of this analysis.

Alternative 3 would create an estimated 34 new landings within 15 proposed units (Appendix B). New landings would total approximately 8.5 acres, calculated as an average size of ¼ acre. Landings within units less than 15 acres in size proposed for the removal of 2,000 mbf/acre or less are likely to be closer to 1/8 acre in size.

Existing landings would be re-used under this alternative in all but 12 units and are assumed to increase in size from their current average of 1/8 acre to an average of ¼ acre in order to accommodate whole tree yarding prescriptions requiring the processing of tops and crowns at the landings. Approximately 260 existing landings total 32.5 acres within proposed activity area units and would increase to 65 acres during implementation of whole tree harvest prescriptions. The majority of proposed activity units are estimated to have approximately 5% or less of the total acreage committed to landings for this proposed entry (Appendix B, % unit landings post harvest). Existing skid trails would be utilized and created as described under Alternative 2.

Table 25. New Temporary Roads within Proposed Units for Alternative 3.

Unit-No	Unit-Ac	mi-new temp rd	Ac-new temp rd	% unit
1	12	0.12	0.22	1.75
5	63	0.55	1.00	2.70
6	60	0.45	0.82	2.47
14	14	0.07	0.13	0.67
23	40	0.23	0.42	1.30
25	104	0.32	0.58	0.56
32	105	0.22	0.40	0.38
35	14	0.09	0.16	1.18
48	130	0.51	0.93	0.71
49	29	0.18	0.33	1.15
58	27	0.19	0.35	1.26
62	200	0.10	0.18	0.09
96	14	0.10	0.18	1.28
99	5	0.04	0.07	1.43
101	20	0.04	0.07	0.36
102	35	0.07	0.13	0.36
122	21	0.02	0.04	0.17

Soil Tillage

Tillage mitigation would be utilized in ground-based units to rectify detrimental impacts incurred by the proposed activities as described under Alternative 2. Units in which tillage is predicted to be necessary have estimated percent detrimental conditions following harvest and fuels activities that exceed 20% (Appendix B). This includes unit #'s 4, 5, 6, 11, 17, 19, 27, 28, 30, 31, 32, 33, 42, 48, 50, 51, 52, 55, 62, 66, 73, 84, 91, 95, 117, 118, 124, 133, and 138 for a total of 49 acres. Some of these units are predicted to be within a few percent of the 20% and standard and may meet standards after implementation of harvest and fuels treatments without tillage. Unit #'s 19, 42, 55, 62, 84, 91, 124 and 138 are slated for grapple piling and are recommended to have machinery limited to operation on skid trails and landings utilized for the harvest activities in order to reduce impacts and possibly avoid the need for tillage.

Tillage methodologies and guidelines are included in Appendix C and would be as described as for Alternative 2, except over fewer acres. The depth and rock content of all soil types within proposed activity areas is variable throughout their extent. Detrimental disturbance levels within affected units would be expected to be reduced to 20% or brought back to those existing prior to this entry where they currently exceed 20%.

Off Trail Tracks: Harvest Operations and Grapple Piling

Feller/Buncher machinery would travel off of designated skid trails in order to cut and accumulate material proposed for removal that is greater than 25 feet from a designated skid trail. Travel of these machines off of skid trails would incur an increase in bulk density/soil strength on the soil over which it passed directly related to the number of passes that occur. Changes in bulk density/soil strength are not considered to be detrimental on up to five passes of machinery over currently un-impacted ground. Tracks from these machines were not observed to be detrimental in two units of the Black Bear TS (David, 2000). However, monitoring of prescription units in which feller-bunchers were utilized for thinning prescriptions on ash soils elsewhere on the Ochoco and Deschutes National Forest has shown an increase in detrimental conditions as a result of these operations. A conservative estimated increase in detrimental soil disturbance of 5% across a unit as a result of off trail tracks is incorporated into unit estimates of soil disturbance in the following narrative and Appendix B.

Total Compaction

Changes to detrimental disturbance levels as a result of harvest and fuels prescriptions implemented under this alternative are predicted based upon the same factors as described for Alternative 3. A total of 229 acres within activity area units is estimated to be detrimentally compacted as a result of implementing this alternative.

Other Detrimental Disturbance

Displacement

As described under Alternative 2, less than 1% of the unit area off of skid trails is predicted to be detrimentally displaced during these activities. Areas of detrimental displacement are likely to occur along the edges of skid trails on which whole tree yarding occurs and on landing areas where there would be direct overlap with detrimental compaction. This would occur over fewer total acres than under Alternative 2.

Pile Burning

Piles on landings are estimated to cover approximately 2500 ft², totaling < 1% of the unit area. The burning of landing piles is likely to incur detrimental damage on these areas. The effects described under Alternative 2 are applicable to pile burned under this alternative. The effects of burning grapple piles located within the unit would be the same as those described under Alternative 2. Units identified for grapple piling are included in Appendix B.

Effective Ground Cover

The Ochoco LRMP directs land management activities to be planned to achieve effective ground cover in order to minimize surface erosion as a result of soil disturbance. Alternative 3 would affect

effective ground cover in much the same manner as described under Alternative 2. An estimated 229 acres would be affected under this alternative.

Surface Soil Erosion

Areas of detrimental soil disturbance would be susceptible to elevated surface erosion in the short-term where compaction and/or displacement reduced live vegetation and woody debris currently providing effective ground cover. Actual rates of erosion would vary according to the extent of disturbance, surface soil textures and the slope of disturbed areas. Changes to rates of erosion are expected to be localized to the skid trail and landing areas where live vegetative cover was substantially reduced by harvest and fuels treatment activities. Changes to surface erosion rates would be expected to be reversed by tillage operations and/or the re-establishment of live vegetative cover over subsequent years. Approximately 229 total acres within the analysis area would have an elevated risk of erosion in the short-term as a result of implementing Alternative 2.

Sediment Delivery

Activity area units immediately adjacent to RHCAs have the potential to deliver sediment to valley bottoms and stream channels. Table 26 summarizes the acres of proposed commercial harvest activity units that are immediately adjacent to RHCA buffers for Category 1, 2 and 4 streams. Unit #'s 8, 10, 11, 14, 17, 18, 23, 28, 30, 31, 32, 35, 39, 41, 43, 48, 49, 51, 54, 55, 61, 62, 63, 66, 73, 79, 80, 92, 95, 100, 101, 102, 103, 107, 111, 114, 115, 124, and 133 are included in this list.

Approximately 2 miles of proposed harvest unit boundaries are adjacent to Category 1 stream buffers, 1.4 miles are adjacent to Category 2 stream buffers and 4.6 miles are adjacent to Category 4 stream buffers under this alternative.

Table 26. Acres of Commercial Harvest Units Immediately Adjacent to RHCAs

PACFISH/INFISH Stream category	Alt_3 acres adjacent to RHCA buffer	Alt_3 Detrimental acres adjacent to RHCA buffer
Category 1	53	10.5
Category 2	37	7.4
Category 4	121	24.2

The rate and extent of soil erosion within activity area units would be limited as described under Alternative 2. Alternative 3 would directly affect effective ground cover on an estimated 229 acres, primarily on skid trails and landings created and/or used during the implementation of this project.

The estimated amount of eroded soil actually leaving proposed commercial harvest units under this alternative is as follows. The average erosion rate for the Slight-Moderate erosion hazard rating from Table 22 (94 ft³ soil/ac/year = 3.5 yd³ soil/ac/year = 4.9 Tons soil/ac/year) is applied for all soil types and multiplied by the acres of commercial harvest units immediately adjacent to RHCAs (in 1 acre widths) from Table 26. The totals are included in Table 27 and converted to cubic yards and Tons per acre per year and to Tons/year/ mile of RHCA buffer. These figures are estimates for the purpose of comparison between Alternatives and Stream Categories only.

Table 27. Alternative 2 Potential Soil Loss Reaching RHCA Buffer Boundaries

RHCA Stream Category	Alt_3 soil loss reaching RHCA buffer (yd3/year)	Alt_3 soil loss reaching RHCA buffer (Tons/year)	Alt_2 soil loss per mile of RHCA buffer Tons/year
Category 1	185 yd3/year	260 T/year	130 T/year
Category 2	129 yd3/year	174 T/year	125 T/year
Category 4	448 yd3/year	569 T/year	124 T/year

As described under Alternative 2, the overall risk of delivery of sediment directly from acreage within units to stream channels is low. A maximum of 20% of the unit acres immediately adjacent to RHCA boundaries is likely to be detrimentally disturbed to levels capable of generating eroded sediment and a lesser percentage of that sediment is capable of reaching the stream channels via overland flows during storm events. Slopes between proposed harvest units and stream channels are generally less than 20% and vegetative cover is relatively high. The reduction in detrimental disturbance levels within the subwatersheds when compared to Alternative 2 would decrease the amount of soil eroded and potentially delivered to all PACFISH/INFISH stream classes within the analysis area.

Roads and Sediment

The greater risk of sourcing and delivering sediment to stream channels is from the presence of roads and associated drainage culverts within RHCAs or directly between activity area units and RHCA boundaries. Approximately 9.5 miles of road proposed for haul under this project for Alternatives 3 are currently located within RHCAs that could contribute sediment to streams. Approximately 0.74 miles of currently closed Level 1 roads would be opened for haul under Alternative 3 that could be a source of sediment during the period of haul and before closure and rehabilitation. These are both fewer miles than would be utilized/re-opened under Alternative 2, equating to a reduction of sediment movement when compared to Alternative 2. No new temporary roads proposed under this alternative are located within RHCAs. Unit #'s 66, 80, 103 and 124 have roads at or near the interface of their unit boundaries and the RHCA buffers that have the potential to concentrate overland flows in their drainage ditches and focus them toward stream channels via inappropriately located relief culverts.

Prescribed Burning and Precommercial Thinning

Commercial harvest units proposed for prescribed burning fuels treatments are identified in the Fuels section of the Willow Pine EA. Burn Plan prescriptions would minimize impacts to the soil resource. Activity units with higher fuel loads following harvest activities would be grapple piled prior to burning in order to reduce the extent of larger woody material capable of maintaining longer residence times of elevated temperature at the soil surface. As a result, no detrimental burn impacts are expected to occur as a result of prescribed burning activities.

Units proposed for Pre-commercial Thinning would have no entries with machinery and incur no additional detrimental compaction. Jackpot piles and burns would incur minor amounts of burn damage across the unit areas.

Cumulative Effects – Alternative 3

Cumulative effects to the soil resource are the same as those described for Alternative 2 for detrimental disturbance within activity area units with pre-existing levels of disturbance. All activity areas proposed for this alternative are described and summarized under Alternative 2 (Appendix B) and include impacts from recent past projects and even older past activities. The implementation of Alternative 3 would incrementally increase detrimental disturbance in units where existing disturbance from past activities is present in the same manner as described under Alternative 2. The cumulative effects of proposed harvest activities in areas with existing levels of impact from past projects is not expected to negatively affect long-term site productivity.

Tillage mitigation to rectify compaction incurred by proposed activities in excess of the LRMP standard would leave all activity areas in which it was used in a condition of acceptable soil productivity in terms of the spatial extent of detrimental disturbance. Summary alternative Tables include estimated acres that would require tillage mitigations to meet LRMP standards in units where cumulative effects exceeded 20% or increases from levels already exceeding 20% occurred (Appendix B). An estimated 49 acres could be in need of tillage under this alternative to meet LRMP standards.

Cumulative effects of implementing the Willow Pine project and managed foreseeable future projects within the project area on the soil resource would be relatively minimal. Approximately 4,492 acres are proposed for prescribed burning within the analysis area under the Sunflower Natural Fuels Categorical Exclusion. Approximately 572 of these acres overlap the commercial harvest units proposed under the Willow Pine EA, some of which would be prescribed burned prior to this entry and some afterward. Burn Plans for these prescriptions limit the amount of consumption of vegetative cover and would incur negligible detrimental disturbance to the soil resource.

Fisheries and Aquatic Resources

Affected Environment

The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (P.L. 104-267), established procedures to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. The Act requires Federal agencies to consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (MSA §305(b)[2]). No streams within Project 6th field sub-watersheds are identified as EFH, however, these habitats occur within three miles downstream of the Project area.

The Willow Pine Fuel and Vegetation Management Project conforms to the 2003-2006 Joint Aquatic and Terrestrial Programmatic Biological Assessment for federal lands within the Deschutes Basin administered by Bureau of Land Management Prineville Office and all lands within the Deschutes and Ochoco National Forest (NMFS # 2004/00371) letter of concurrence dated June 7, 2005.

The Clean Water Act (1972) established the basic structure for regulating discharges of pollutants into the waters of the United States and is administered by the Oregon Department of Environmental Quality (DEQ). Section 303(d) of the Act requires that each state identify rivers,

lakes and streams (i.e. waters) that do not meet applicable water quality standards. These waters are designated as "Water Quality Limited," and placed on the 303(d) list.

The state of Oregon is drafting TMDL prescriptions for Water Quality Limited stream segments are those impacted by point or non-point pollution sources to the extent that the water quality is sufficiently impaired to restrict its use (Don Butcher, personal communication 3 March 2006). Non-point pollution sources are those that enter water bodies throughout their surrounding areas, rather than through identifiable pipe or culvert. Non-point pollution sources may be natural or man-made; however, the most typical are those related to runoff of rainfall and melting snow. Soil erosion is a good example, but here refers to temperature impairment because degraded riparian cover has produced changes to stream water temperatures, affecting the ability of trout to grow and swim, among other life-supporting activities (Spence et al., 1996). Within the project area Sunflower Creek, Porcupine, and Murray Creek are 303(d) listed for temperature during the summer months (ODEQ).

Aquatic species of the Middle South Fork John Day and Upper Beaver Creek watersheds:
Federally listed species

This review and subsequent findings are included for possible effects to species: (1) that are listed or proposed for listing by the U. S. Fish and Wildlife Service (USFWS) and by the National Marine Fisheries Service (NMFS) as endangered or threatened; or (2) that are designated by the Pacific Northwest Regional Forester as sensitive. This report was prepared in compliance with the requirements of FSM 2670.44 and the Endangered Species Act (ESA) of 1973.

Middle Columbia River Evolutionarily Significant Unit (ESU) Steelhead trout (*Oncorhynchus mykiss*) within the South Fork John Day River were federally listed as a Threatened species under the Endangered Species Act on March 25, 1999. Critical Habitat was designated September 2, 2005. An ESU is a Pacific salmon population or group of populations that is substantially reproductively isolated from other conspecific population that represents an important component of the evolutionary legacy of the species.

The Project area lies within two 5th field watersheds: Upper Beaver Creek (HUC 1707030308) contains less than 20% of the area, and Middle South Fork John Day River (HUC 1707020103). Each 5th field watershed within the Project area contains two smaller 6th field sub-watersheds. Beaverdam and Lower South Fork Beaver Creek flow into Upper Beaver Creek, eventually joining the South Fork Crooked River. Sunflower and Pine Creek 6th field sub-watersheds flow into the South Fork John Day River.

Steelhead have been excluded from the Upper Beaver Creek watershed following completion of the Bowman Dam (river mile 70) on the Crooked River in 1961 (USDA Forest Service (a), 2005). Steelhead trout are naturally excluded from the Sunflower and Pine creek, a 6th field sub-watersheds of the Middle South Fork John Day by the South Fork Falls on the South Fork John Day River near river mile 29.

Steelhead have Designated Critical Habitat in the adjacent Lower South Fork John Day River watershed and Wind Creek sub-watershed approximately three miles downstream of the project area. The Project is in the Middle South Fork John Day River watershed, and while steelhead trout and its Critical Habitat do exist, Middle Columbia ESU steelhead trout do not occur within the project area because they are prevented from accessing the Project area by the South Fork Falls.

The project would have little potential for effects to the species or its Critical Habitat based on proximity and will not be discussed further.

Bull trout populations (*Salvelinus confluentus*) were listed as threatened under the ESA on June 10, 1998. Bull trout do not occur within the project area. Critical habitat has been formally designated and does not include any aquatic habitat within the project area. Because there are no populations of bull trout in the project area and no critical habitat occurs in the project area, this project will have “no effect” and this species will not be discussed further in this report.

Columbia spotted frog (*Rana luteiventris*) has been a Candidate species for federal listing under the ESA since 1993. Populations of Columbia spotted frogs exist within the project area. Columbia spotted frog are a USDA Forest Service Regional Sensitive Species and will be addressed below.

R6 Sensitive Aquatic Species

The primary objective of the U.S. Forest Service Sensitive Species program is to ensure that our actions do not lead to a loss of species viability or result in a trend toward listing under the ESA (Forest Service Manual, section 2670).

Red-band trout

Red-band trout was considered for Candidate species under the Endangered Species Act until March 20, 2000, at which time the US Fish and Wildlife Service determined listing was not warranted (USFWS, 2000). Red-band trout is a sub-species of rainbow trout (*Oncorhynchus mykiss*) and is known to utilize Columbus, Cougar, Wildcat, and Sunflower creeks within the Sunflower Creek watershed. Currens and Stone (1988) suggest that Red-band/rainbow were genetically isolated from South Fork John Day River populations of mixed-stock (hatchery influenced) populations above the South Fork (Izee) Falls.

Red-band trout habitat requirements are similar to other trout species; optimal water temperatures are 54–64° F. Fish may survive temporary exposure to 85° F. where cooler flows from seeps, springs and tributaries provide thermal refugia. Spawning gravel size ranges from 0.25 to 2.0 inches in diameter.

Project area streams provide primary spawning and rearing habitat for Red-band trout. Red-band spawn from May through June in the North Fork Malheur River (Schwabe, et al., 2000) and it can be generalized that timing is consistent with that on the Ochoco National Forest. Muhlfeld and Bennett (2001) reported that maintaining pools with adequate cover, cobble substrate and depth is critical for conserving Red-band trout stocks. These habitat elements and others are limited or degraded within the Project area (Table 28).

Red-band trout are widely distributed across the Ochoco National Forest’s perennial flowing tributaries. Habitat for Red-band trout is characterized by clear, cool water with relatively stable flows. Streams with healthy Red-band trout populations show an abundance of instream cover, well-vegetated stable stream banks, relatively stable temperature regimes, and abundant macro-invertebrates. Streams with the highest Red-band trout densities within the Project area include Sunflower, Wildcat and Cougar Creek.

Table 28. Determination for Threatened, Endangered, Sensitive, and Proposed and Management Indicator Species or designated Critical Habitat common to Alternatives 2 and 3.

Species	Listing	Within Project Area (Y/N)	Determination
Red-band trout <i>Oncorhynchus mykiss gairdneri</i>	Sensitive	Y	MIIH
Rainbow trout <i>Oncorhynchus mykiss spp.</i>	MIS	Y	MIIH
Malheur mottled sculpin <i>Cottus bairdi</i>	Sensitive	Y	NI
Columbia spotted frog <i>Rana luteiventris</i>	Candidate Sensitive	N	NLAA MIIH
West Slope cutthroat trout <i>Oncorhynchus clarki lewisi</i>	Sensitive	N	NI
Mid-Columbia River spring Chinook <i>Oncorhynchus tshawytscha</i>	Sensitive	N	NE
Mid-Columbia River spring Chinook Essential Fish Habitat (EFH) <i>Oncorhynchus tshawytscha</i>	EFH	N	NAA
Bull trout <i>Salvelinus confluentus</i>	Threatened	N	NE
Mid-Columbia River steelhead trout <i>Oncorhynchus mykiss ssp.</i>	Threatened; Critical Habitat	N	NE, NAA ¹

Determinations for Federally Listed Species

- NE No Effect
- LAA May Effect - likely to adversely affect
- NLAA May Effect - not likely to adversely affect

Determinations for Federally Listed Species Habitat

- NAA No Adverse Affect
- LAA Likely to Adversely Affect

Determinations for Sensitive and Management Indicator 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
- WIFV* Will Impact individuals or habitat with a consequence that the action may contribute to a trend
towards Federal listing or cause a loss of viability to the population or species
- *Trigger for a Significant Action As Defined In NEPA*
- BI Beneficial Impact

¹Designated Critical Habitat includes all river reaches accessible to Middle Columbia River steelhead trout of the South Fork John Day River. A natural barrier to anadromy occurs at South Fork Falls, at (RM) 28.4, approximately three miles downstream of the project area.

Columbia spotted frog

Columbia spotted frog is a Candidate species for listing under the ESA. Bull (2005) found that areas with permanent water were used as breeding sites or as post-breeding site during the summer. These sites included ice-covered ponds, warm springs, rivers, reservoirs and slow-water stream reaches. Seeps in forested areas were used for over-wintering. Breeding occurred from March through June with hatching occurring up to twenty one days later. Most individuals studied returned to the same breeding area (site fidelity), although some used adjacent sites when they were available. Individuals studied moved approximately three-tenths of a mile between breeding and over-wintering sites. Fish, garter snakes and birds are known to prey on adult frogs and their larvae.

Habitat alteration that increases slow-water habitat benefits Columbia Spotted frog while those practices that decrease access to permanent water sources decreases survival. Bull reported that timber harvesting on public lands was unlikely to have a large impact on the species because of riparian area buffer zones in use by both departments of Agriculture and Interior.

Prescriptive burning can create inhospitable conditions for Columbia spotted frog where the duff layer is removed or its water content decreased during the species migrations from breeding to over-wintering locations, which has been reported to be up to three-quarters of a mile. Bull described direct mortality from wildland or prescriptive fire as minimal, but others (Pilliod, et al. 2003) reported that fire-induced vegetation changes, which affect changes in the water-holding capacity of soils, surface run-off, and loss of moisture in the duff layers, could create inhospitable habitat for amphibians in general.

Formal surveys for Columbia spotted frog have not been conducted within the project area, however, resource specialists have observed individuals in Project riparian areas as recently as 2005 (Jim David, personal conversation March 23, 2006). Suitable habitat for Columbia spotted frog exists in streams and wetlands less than one acre in the project area.

Baseline Conditions

There are four 6th field watersheds in the Project area: 1) Sunflower Creek, 2) Pine Creek, 3) Upper Beaver Creek and 4) Beaverdam Creek. Sunflower and Pine are tributary to the South Fork John Day River while Upper Beaver Creek and Beaverdam are tributaries to the South Fork Crooked River.

Table 29. Baseline conditions on named representative streams within the Project area.

Stream	Tributary to:	Access on FS road	303d listed for temperature	LWD*	Cut-banks*	# Pools/100 feet*	Shade	Fish-bearing
Begg	SF Beaver	5870-700; 700-730	No	1	1	2	2	N
Bull	SF Beaver	745	No	N/D	N/D	N/D	N/D	N/D
Columbus	Sunflower	5870-550; 58-560	No	2	2	2	2	Y
Cougar	Sunflower	58-800, 5870-300, 830	No	2	2	2	2	Y
Jackass	Sage Hen	58-800	No	1	1	2	1	N
Little Bear	SF Beaver	5870-800	No	1	1	2	2	N
Murray	Sunflower	58-500, 5870	303(d)	2	2	2	2	Y
Poker	Sage Hen	760	N/D	N/D	N/D	N/D	N/D	N/D
Porcupine	Sunflower	58, 820, 828	303(d)	1	1	2	2	N
Sunflower	SF John Day	58	303(d)	2	2	2	2	Y
Wildcat	Sunflower	58-820, 58-800	No	2	1	2	2	Y

*1 Meets Forest standard

Y/N: Yes/No

*2 Does not meet INFISH RMO or Forest Plan standards.

N/D: No data available for this creek

INFISH Riparian Management Objectives (RMOs), Endangered Species Act consultation guidelines and the Ochoco National Forest LRMP include several key habitat elements that will be considered in the analysis of this project. These key habitat elements will include chemical contaminants/nutrients, sediment/substrate, temperature, and riparian conditions. The analysis of this project for fisheries will tier to both the soils and hydrology reports. Data for this analysis was derived from Pacific Northwest Region 6 USDA Forest Service inventories and Oregon Department of Fish and Wildlife reports. Where specific stream data is lacking, inference based on adjacent streams is considered in the overall assessment.

Environmental Consequences

The short-term, long-term and cumulative effects of each alternative on stream health and watershed condition and function were evaluated by examining the environmental baselines of potentially affected watershed and the comparing how each alternative would affect these

baselines. Short-term effects to rainbow trout are defined as less than two to three years based on their life history and breeding patterns (Spence, et al., 1996) and from 9-21 months for Columbia spotted frog based on their age at sexual maturity (Bull, 2005). Pilliod et al., (2003) partitions the biotic responses to fire as immediate (during and days after a fire), short-term (<1 year), mid-term (1–10 years), and long-term (>10 years).

A population is most affected when successful breeding is curtailed. Long term effects are defined here as those occurring through two or more cycles where breeding and growth were affected. Comparison of affects of each alternative was made by determining how each alternative would affect key habitat factors and indicators of stream health and current literature on the species.

Alternative 1: No Action

Under Alternative 1, RHCAs would continue to exist in their current condition. The direct effect of “no action” is a decision to maintain current forest conditions within the Project area.

Direct and Indirect Affects

Roads and landings

The Ochoco National Forest manages Forest roads through a maintenance level classification. Level 1 roads are closed, and Level 2 and 3 roads are open to vehicle traffic. Within the Project area are an estimated 96 miles of open road, resulting in an open road density of 2.34 miles per square mile. There are another approximate 22 miles of Level 1 (closed) road (Magill, 2003). Under Alternative 1, there would be no need to temporarily neither re-open from 11.4 to 20 miles Level 1 road nor construct from 3.9 to 4.5 miles of new temporary road. This would maintain current road densities; reduce the potential for sediment inputs from ground disturbance and dust. This would produce neutral affects to the RHCA and its species because no change would occur.

Commercial and non-commercial thinning

Under Alternative 1, commercial thinning would not occur. Vegetation outside of RHCAs will remain at current stocking levels and within a high probability for stand replacing fires based on those levels (Hann, et al., 2002). There would be no ground disturbance from tractor logging.

The occurrence of conifers would increase, potentially becoming as well established within the RHCA as in targeted the stands (units). The result would be dead or dwarfed conifers in numbers greater than tall, healthy conifers. Under Alternative 1, non-commercial thinning would not take place within the RHCA. Where conifers are suppressed and fail to attain diameters greater than twelve inches, future large woody debris (LWD) potential would be limited; as time passed, naturally falling trees would rarely attain the diameter classes needed to attain INFISH LWD objectives. As the vigor of conifers decreased over time, the amount of effective shade and multi-layered canopy would decline, leading to potential increases in RHCA air and water temperatures. Conifer species would remain in their present densities, which is expected to reduce the growth potential of individual trees where dense clumps of conifers less than seven inches occur. These trees would have a greater likelihood of remaining suppressed over their lifetimes and would not attain growth characteristics associated with riparian shade and LWD recruitment potential.

The potential for short-duration, minute contributions of sediment carried by wind and precipitation where ground disturbance has occurred would not exist although these processes will continue to

occur naturally and through other activities that occur within the Project area: motorized recreation, grazing, travel, and a variety of Forest maintenance activities. This would produce neutral affects to the RHCA and its species because no change would occur.

Fuels treatments

Condition classes describe the degree of departure from historic fire regimes resulting in alterations of ecosystem components such as species composition and structural age. One or more of the following activities has contributed to this departure: fire exclusion, timber harvest grazing or other management activities.

There are an estimated 68.17 tons per acre of fuels across the three Condition classes ranging in size from greater than 0.0 (duff) to fuels greater than 20.1 inches. Under Alternative 1, these fuels would remain and increase over time. Conditions outside of the RHCA would continue to influence habitat conditions within the RHCA. The historic fire regime for the area would remain suspended. Forest tree species would continue growing with natural thinning being the result of disease, water stress and other types of occurrences that may kill individuals. The risk of wildfire to RHCA values would increase appreciably.

Should a stand replacing fire within the Project area become established, significant shade could be lost for approximately 40 to 50 years based on site specific soils characteristics and an estimated rate of four feet of growth per ten years. During this time, precipitation could carry exposed soil into the stream channels, increasing sediments that can interfere with spawning and over-wintering of resident fish. Stream banks would have greater potential to become weakened, collapse and decrease the number and depth of existing pool habitats. These introductions of sediment have the potential to affect substrate size, again influencing the ability of aquatic species to carry out their life processes of spawning, hatching, rearing and feeding. Heavy inflows of sediment could fill pools, which could become more easily heated where shade was lost. The magnitude and persistence of fire-caused changes in water chemistry would increase with increasing fire severity and decrease with stream or pool size and flow conditions. As vegetation redeveloped, fewer nutrients would be available for leaching, diminishing erosion potential, and nutrient concentrations in affected waters would return to pre-fire levels (Gresswell, 1999).

Should severe fire enter the RHCA, stream channel stability could be affected as vegetation holding soils was lost and in-channel LWD was removed; these changes could impact pool frequencies and quality as infilling or scouring occurred. Large woody debris, an important provider of stream channel stability, pool formation, and cover may be lost. Vegetation is a key component of the RHCAs, containing conifer and hardwood species. While species are adapted to survive fire, severe fire generally kills individual trees and root stocks, as well as seed stock present in the soils (FEIS, 2006). With heavy precipitation post-fire, some rilling could occur, potentially increasing drainage densities and peak flows. Stream bed permeability could be reduced as a result of the influx of fine sediments, reducing the ability of fish and macro-invertebrates to breed, feed and grow. Fire activities would result, with potential affects from suppression activities. Post-fire, Burned Area Emergency Rehabilitation (BAER) success would be dependant on incident type and field conditions. Wildfire is an occurrence that cannot be completely mitigated.

Individual red-band trout and Columbia spotted frog may suffer mortality, however, depending on the size, severity and duration of the fire, affects to the species could range from minor losses to population losses within the affected watersheds. Over time, re-colonization could occur, however,

depending on a fire's characteristics, red-band trout and Columbia spotted frog populations could be affected, especially within the Sunflower sub-watershed.

Cumulative Effects

The Willow Pine area has experienced extensive management; past and on-going sheep and cattle grazing and associated rangeland improvements (fencing, reservoir construction, trough placement, pasture rotation scheduling); timber harvesting, silvicultural treatments, road construction, fire suppression and fuels work designed to set the stage for a return to natural fire cycles. These activities have contributed to changes in stream morphology and ecological conditions resulting in what we see today (Cilimburg and Short, 2005; Hubbard et al., 2004; Roundy, 1999; and Spence et al., 1996).

There are several data gaps associated with timber management prior to 1970. Sale prescriptions have included regeneration harvest (4,189 acres), intermediate harvest (6,350 acres) and have included activities for aspen release and wildlife improvements. Regeneration harvest began in 1973 and has not occurred since 1991. Intermediate harvest is recorded from 1953 to the present time. Timber harvest has occurred on approximately 52 percent of the Project area.

Commercial harvest under a variety of prescriptions (overstory thinning, regeneration, improvement cutting, shelterwood thinning) has occurred in the Project area since the late 1950's, reaching peak levels between 1970 and 1989 at 2,564 and 2,082 acres respectively. These activities fell to 647 acres during the 1990's. Commercial thinning activities would increase the amount of these activities to 3,211 acres under Alternative 2 to 2,552 acres under Alternative 3. Harvest results in the removal and disturbance of soils and vegetation and can affect the routing of water during precipitation events. These activities can increase sediment deliveries which can affect spawning and over wintering gravels, abrade fish gill tissue during respiration and reduce both species natural prey base (Spence et al., 1996; Bull, 2005).

Data indicates that approximately 68% of riparian area's within the Project area is in unsatisfactory condition based on inadequate shade, cutbank area, low LWD occurrence and recruitment potential, and temperature (see Table 29). Temperature is the greatest limiting factor in significantly improving fisheries habitat in the Project area.

Grazing can affect erosional processes particularly where riparian zone grazing occurs. Livestock, attracted by shade, water and high quality forage increases sediments and decreases shade above those levels that would otherwise occur by trampling banks and browsing palatable willow species (Spence, et al., 1996). Among the ongoing federally permitted multiple use beneficial uses of the Project area, forage for livestock grazing occurs on an annual basis under Allotment Management Plans. There are currently 738 cow/calf pairs under a six-pasture rest-rotation schedule within the Project area from June 1 through September 15. Under Alternative 1, forage conditions are not likely to improve because densely spaced deeper-rooted conifers less than seven inches would out compete grasses for rooting space and moisture. The most abundant forage is within the RHCA under typical conditions. Alternative 1 would maintain existing foraging conditions and season of use.

For this allotment, a temporary pasture rotation schedule was implemented and will remain in effect until 2008. The temporary pasture rotation schedule was created to ensure that pastures underburned receive two full growing seasons of forage recovery after treatment through rest and deferred grazing.

The affects of over use of riparian plant species, streambank erosion and water resources by livestock is well documented (Kauffman, et al., 1983; Roundy, 1999). These affects have direct bearing on water quality (Hubbard et al., 2004) and fish habitat conditions. In maintaining current vegetation and dead fuels levels upslope, livestock are encouraged to spend long hours in the RHCA until encouraged to utilize range improvements further upslope.

Fire is a natural event for which many species, including aquatic species, have some adaptation. However, conditions within the Project area reflect static land use and the resulting chronic condition: heavy fuels loads, stands that have had no periodic fire to limit the number of conifers, resulting in more, smaller diameter trees competing for available rooting space.

Data gaps in fuels management activities have also occurred; however, best available information suggests that 3,739 acre of the current project area has experienced underburning, machine and grapple piling and burning. The Sunflower Natural Fuels Project is authorized to underburn 4,500 acres within the current project area and has treated approximately 1,500 acres as of fall 2005. This project, initiated in 2004, will treat remaining acres through 2008, at which time a review of fuels conditions and affects will occur (Tom Mountz, personal communication, April 18, 2006). Individual sets of units, or “burn blocks” will allow treatment to occur concurrently with grazing within the Sunflower Allotment and during the first two years of Willow Pine implementation.

Little research has been conducted on the effect of prescribed fire within riparian areas and less provides information on long term use of fire within a given watershed. Bêche (University of California, Berkeley, 2004[b]), conducted a small, short-term experiment to address affects to pre- and post-fire water chemistry and other variables during a two-year period. Changes were short-term and recovery occurred within one-year post fire, however, there were some changes in chemistry that, taken cumulatively, may create a period of altered water chemistry that may affect aquatic species at critical life history changes. Dissolved oxygen, a most critical aspect of over all water quality, was unaffected; however, ammonia, nitrogen, and phosphorus levels did rise from pre-prescriptive fire conditions to post-prescriptive fire. Post-project, ammonia levels were greater for one year, nitrogen for 19 days; phosphorus increases were measurable for two months (Bêche, 2004[a]).

Nitrate is considered non-toxic to aquatic vertebrates and invertebrates, however, as a naturally occurring nutrient; it can lead to increases in algae, resulting in lower dissolved oxygen levels. Dissolved oxygen in 303d listed streams is likely to be below desired levels in the Project area during summer weather months because of its temperature impairment. High water temperatures decrease dissolved oxygen levels. Over the nine year estimated implementation time, approximately 6 months of cumulative nitrogen increases could be seen in Project area waters. This is not likely to create additional oxygen stress to trout because of its dispersed occurrence.

Phosphorus is considered non-toxic to aquatic vertebrates and invertebrates, however, in combination with heightened nitrogen levels, can contribute to nutrient enrichment of surface water, leading to increases in algae, resulting in lower dissolved oxygen levels. Phosphorus spikes lasting for two months per year would occur for approximately nine years. This is not likely to create additional oxygen stress to trout, especially where fall burning occurs.

There have been reports of the temporary reduction in use of burned areas by fish for up to four years in areas of wildfire (Cilimburg and Short, 2003). This may occur in the unlikely event that spawning usage and egg development is interrupted as a result of water quality changes following

understory burning. This review focuses on large wildfires but serves as an informative primer on a wide range of fire effects.

Gresswell (1999) reported that water chemistry did not affect macroinvertebrate distribution, however, it is likely that functional feeding group (FFG) assemblages may change with changes in type and abundance of allochthonous materials and periphyton biomass. Other workers (Spencer, Gabel and Hauer, 2003) have found that macroinvertebrate communities dominated by generalists were well-adapted to shifts in food sources.

Historically, approximately 40 percent of forestland experienced frequent (0-35-year) fire return intervals. Wildfire suppression since the 1900s increased the amount of surface and ladder fuels. Surface fuel complexes, such as slash left behind post harvest and shrubs and saplings, are critical to fire behavior – intensity and rate of spread. The accumulation of these natural and human-caused fuels has increased the conditions necessary to support overstory canopy fires (Graham, et al., 2004). The affects from wildfire to fish depends on a wide variety of factors including fire severity and extent, health of the population and habitat connectivity to other fish and frog stocks.

The “no action” alternative would not affect red-band trout and Columbia spotted frog directly, although affects could be realized in the event of a large wildfire.

Direct and Indirect Affects under Alternatives 2 and 3

Sediment, Temperature, and Riparian Conditions

Roads and landings

Within the Willow Pine Fuels Reduction and Vegetation Management Project area there are approximately 2.34 miles per square mile, or about 74 miles, of Level 2 and 3 open system roads within the 20,170 acre area.

Under Alternative 2, an approximate 81 miles of existing maintenance Level 1 through 3 roads would receive necessary pre-project maintenance for the anticipated three years of active timber haul. This would include approximately 20.2 miles of administratively closed road (Level 1) that would be re-opened temporarily for the duration of the commercial thinning, estimated to take about three years. Alternative 3 would use an approximate 62 miles of maintenance Level 1 through 3, with about 11.4 miles of this being administratively closed road (Level 1) that would be re-opened. New temporary road construction would be limited to 4.5 and 3.9 miles under Alternatives 2 and 3 respectively. This amount of new temporary road would not significantly change overall road density under either alternative. No new temporary roads will be built within the RHCA. Post harvest, Level 1 and new temporary roads would be rehabilitated and closed (ripped, revegetated and culverts pulled where needed). Road density would return to its current level.

There is a limited amount of RHCA that would be directly affected by existing Level 1 through 3 roads under Alternatives 2 or 3 (Table 30). There are approximately 6.5 miles of existing road that would be in use less than 300 feet from fish-bearing waters and another 2.8 miles of road that would be within 150 feet of perennial streams (Table 30) in Alternative 2 and in Alternative 3, there are approximately 6.16 miles of roadway within the RHCA, of which 0.6 miles are within the 300 foot buffer of a perennial, fish-bearing stream channel. Both alternatives would increase the amount of use-related dust and would necessitate some ground disturbance to carry expected truck traffic. Because Level 1 roads are closed and may require greater vegetative clearance, there are

potentially 3.8 acres of clearance that may be required for the total 1.94 miles of Level 1 road to be used within the RHCA under Alternative 2 assuming a right-of-way clearance of sixteen feet. Under Alternative 3, there may be 1.44 acres of Level 1 roadway within the RHCA that may require vegetation removal as a consequence of using 0.74 miles of Level 1 roadway. Pre- and post-project road work would ensure proper drainage is completed to meet Forest Service standards on all roads.

The creation of new road would construct approximately 40 new temporary landings. Generally, there are landings every 600 feet adjacent to the right-of-way that are approximately one-quarter of an acre. New landings would be approximately one-quarter acre (10,890 square feet or approximately 104 feet by 104 feet) or under although landing size varies depending on the size of each individual thinning unit and its proximity to other units or existing landings. Landings are cleared of vegetation during commercial harvest to provide clear area to stack logs and load onto trucks. There are 331 existing landings and a proposed 44 new landings that will be used under Alternative 2. New landing construction would result in 11 acres of new ground disturbance and reconditioning approximately 83 acres of existing landing.

Under Alternative 3, 260 existing landings and 34 new landings would be created reducing the amount of ground disturbance and compaction that would occur to 8.5 acres of new ground disturbance and 65 acres of reconditioning. There will be no landings built within the RHCA although use of existing landings would occur to access adjacent units. This would further reduce the need to create new temporary roads and landings. Following commercial thinning, these landings would be made hydrologically benign by ripping and seeding.

Construction of new temporary roads and landings may have the affect of increasing the potential for run off for a period of three years from harvest. The Project would require that all roads be closed immediately following harvest of individual units that use new temporary or Level 1 roads. It is reasonable to believe that during the following year, grass seedlings used to rehabilitate closed areas would become established, further reducing potential runoff.

Under Alternatives 2 and 3, the maximum difference between existing conditions would be a temporary increase of up to 4.5 miles. Under both action alternatives, road densities within the Project area would, post project, remain the current 2.34 miles per square mile.

Alternative 3 proposes fewer ground disturbing activities associated with transportation, which could translate into less potential for overland flow and road related sediment inputs. Affects to aquatic species and their habitats would be minimal and very localized.

Under all alternatives, there is an extensive network of existing roads, most of which receive regular use for administrative purposes and by the general public for transportation and recreation. Currently, open road densities are at 2.34 miles per square mile, below the Forest Plan standard of 3.0 miles per square miles. However, permanent increase in road density would not occur under any alternative, including the “no action” alternative. Prior to harvest contract completion, all roads will be checked to ensure a hydrologically benign condition. Water would be applied to all roads used to mitigate for the potential increase in dust that would occur from hauling along all existing and temporary roads in the Project area. Because very little new road is being built, none of which is within the RHCA, and dust abatement practices, it is unlikely that minute quantities of dust that may settle in streams or wetland areas would have more than a negligible affect on red-band trout or Columbia spotted frog or their habitat and would have no effect on steelhead trout downstream within the South Fork of the John Day River.

The hydrology report of this document states that field observations and monitoring on the Ochoco National Forest have shown that intact RHCA's are effective at filtering sediment from roads and landings. Design elements on this project prevent mechanical disturbance of stream channels and preclude placing landings and operating ground based equipment in RHCA's except on existing roads. Based on the monitoring and design elements that are designed to protect stream channels and maintain filtering capacities of RHCA's that these alternatives would meet state water quality turbidity standards. Therefore there will be no increase in sediment or change of habitat from the implementation of these alternatives for redband, steelhead trout or Columbia spotted frogs.

Because there are no new roads or landings being built in the RHCA, riparian habitat/vegetative conditions and stream temperature will not be affected by these activities in either alternative 2 or 3.

Table 30. Miles of road within RHCA under Alternatives 2 and 3.

Stream Categories	Alternative 2		Alternative 3	
	Maintenance Level	Miles	Maintenance Level	Miles
Category 1 Fish-bearing, perennial	LEVEL 1	0.98	LEVEL 1	0.60
	LEVEL 2	2.41	LEVEL 2	2.45
	LEVEL 3	3.10	LEVEL 3	3.11
Total miles of existing road used		6.49		6.16
Category 2 Perennial non-fish bearing	LEVEL 1	0.71	LEVEL 1	0.08
	LEVEL 2	1.57	LEVEL 2	1.41
	LEVEL 3	0.48	LEVEL 3	0.48
Total miles of existing road used		2.76		1.97
Category 3 Ponds, lakes wetlands, reservoirs greater than 1 acre	LEVEL 1	0.0	LEVEL 1	0.0
	LEVEL 2	0.0	LEVEL 2	0.0
	LEVEL 3	0.0	LEVEL 3	0.0
Total miles of existing road used		0.0		0.0
Category 4 Intermittent; wetlands less than 1 acre; landslide prone, landslides	LEVEL 1	0.25	LEVEL 1	0.06
	LEVEL 2	0.85	LEVEL 2	0.70
	LEVEL 3	0.65	LEVEL 3	0.64
Total miles of existing road used		1.75		1.40

The data in this Table was derived from Project GIS layers.

Categories are derived from PACFISH/INFISH standards. Maintenance level is as follows: Level 1 (administratively closed), Level 2 (high clearance vehicles), Level 3 (maintained for low clearance vehicles like family cars).

Commercial Thinning

The Project is designed to improve stands by reducing understory trees less than 21 DBH within the uplands, and surface fuels throughout the Project area. Thinning can affect understory microclimates through opening overstory canopies to solar insolation (Graham, 2004). However, thinning is an appropriate method of fuel treatment (Graham et al., 2004; Agee and Skinner, 2005). Thinning may improve resistance to severe wildland fire. In principle, decreasing crown density reduces crown fire potential by making tree-to-tree crown fire less probable; removing surface and ladder fuels may reduce the amount of “torching” in the canopy because flame lengths must be longer to get into the canopy. Larger trees are generally more fire resistant, therefore, retaining the larger trees of fire resistant species would allow for the stewarding of healthier, fire resistant forests closer to historic stand structure conditions. However, Agee and Skinner report there is some risk with creating drier conditions in remaining fuels through opening the understory to surface wind.

Commercial thinning is excluded from the RHCA. Where these activities occur full RHCA widths would be identified prior to thinning activity initiation. These widths may be increased where the Fisheries biologist determines that on-the-ground features, such as sudden changes in slope, might lead to sediment deliveries from thinning or later fuels activities. Under all alternatives, RHCA buffer widths adjacent to units would be flagged and reviewed prior to initiation of Project activities.

Project design criteria and the filtering capabilities of RHCA widths ranging from 50 to 300 feet on each bank throughout the project are expected to retard any sediment leaving these units, which occur on slopes less than 12 percent. The distance between project activities and the stream channel would allow dissipation of sediment generated during precipitation events except where concentrated into culverts and relief ditches which may have substantially less vegetative cover. This would result in minimal impacts to fisheries habitat because sediment levels would not be likely to rise about background levels. Also, temperature conditions (as a result of shade) and riparian habitat conditions will not be affected since no commercial harvest will occur within the RHCA's.

As stated above, the hydrology report of this document states that field observations and monitoring on the Ochoco National Forest have shown that intact RHCA's are effective at filtering sediment from roads and landings, but also from commercial thinning operations. Design elements on this project that prevent commercial thinning activities within RHCA's. Based on the monitoring and design elements that are designed to protect stream channels and maintain filtering capacities of RHCA's that these alternatives would meet state water quality turbidity standards. Therefore there will be no increase in sediment or change of habitat from the implementation of commercial thinning within these alternatives for redband, steelhead trout or Columbia spotted frogs.

Non-Commercial Thinning

With full RHCA buffers in place and project design criteria prohibiting non-commercial thinning from occurring within 50 feet of true (obligate) riparian vegetation, stream-side shading is not likely to be affected from thinning nor would LWD recruitment. These uplands do provide a degree of interception of precipitation, which is associated with slowing potential velocities and decreasing water delivery to the channel during a storm event. Relative to the over all size of all sixth field watersheds, the project area is small, reducing the probability of any change in accelerated run-off.

Alternative 3 would drop Units 3, 87, 88 and 22 from the Cougar Creek headwaters, removing the need to conduct grapple piling at that location. Unit 25, within that same headwater region, would be reduced from 104 to 41 acres, resulting in a net reduction of 121 acres of non-commercial thinning in those headwaters.

Non-commercial thinning within the RHCA is designed to support increased growth and vigor of conifer species within these Project riparian areas where shade potential is currently suppressed. Treatment also provides a mechanism to reduce ladder fuels that could carry fire into over story canopy. Non-commercial thinning would occur within RHCAs; trees less than seven inches DBH would be thinned where in competition with larger trees. Riparian species (alder, willow) would not be thinned. No treatment would occur within 50 feet of true riparian vegetation to avoid even temporary loss of direct shade to waters.

Non-commercial thinning within the RHCAs is unlikely to cause direct effects to red-band trout or Columbia spotted frog because all activities would be at least 50 feet from open water, would use hand equipment only and would not skid trees within the RHCA non-commercial thinning units. There would be no loss of tree species greater than seven inches DBH to non-commercial thinning, nor would grapple piling occur, activities which cause a higher degree of ground disturbance than the foot traffic anticipated from non-commercial thinning crews. Indirectly, a beneficial affect, that of healthier conifers capable of producing significant shade and providing for LWD recruitment, may be realized. Large woody debris is defined under INFISH RMOs as more than 20 pieces of wood per mile that are greater than 12 inches in diameter, longer than 35 feet.

Fuels

Fuels treatments under both alternatives focuses on understory burning following commercial harvest and non-commercial thinning. Alternative 3 decreases the amount of treatment from 3,208 acres under Alternative 2 to 2,552 acres under Alternative 3. This treatment is spread over several years time, by season, with breaks in activities in 2008 and 2012. Under Alternative 2, understory burning in the vicinity of units 300 and 303 would not occur within 150 feet of riparian vegetation within any Category 3 wetland (pond, lake or wetland greater than one acre) or within 50 feet of riparian vegetation for Category 4 wetlands (pond, lake or wetland less than one acre). Geographic Information Data indicates the presence of these features near Begg and Bull Creek and along southern tributaries to Sunflower Creek. There are a total of 1,583 acres of RHCA's within the project area. Fuels treatments will occur on 134 acres (8%) of RHCA in Alternative 2 and 162 acres (10%) of RHCA in Alternative 3.

Throughout the project area the amount of grapple piling to support fuels reduction activities falls from 640 acres under Alternative 2 to 361 acres under Alternative 3, however none of that would be occurring within the RHCA. Grapple piling of residual slash resulting from harvest and noncommercial thinning activities is done to lessen fuel loadings and break up fuel continuity. Piling in the RHCA would be by hand. Affects from underburning to the RHCA would be minimal based on project design criteria. Pile burning would not cover more than 5% of an RHCA within the Project area. Where piles were created, fire would not be allowed to creep more than ten feet away.

Burning within the Project area may produce small amounts of ash and fine sediment; flushes which may occur during spring or early fall flows are unlikely to cause long-term shifts in chemistry which could impact red-band trout within the occupied project reaches because spring run-off would likely prevent accumulations high enough to cause effects to spawning and juvenile

trout (INCHEM, 1986). There is little difference between timing and acreage burned between alternatives. Because individual units are spread throughout the project area, and because of design criteria adopted, there may be some level of changes to water chemistry at the sub-lethal level, but ash particulate – that is, fine ash sediments, may remain suspended for some time until joining larger water bodies downstream.

Pilliod, et al. (2003) does report that amphibian mortality can occur during wildlife and prescriptive fire due to the inability of individuals to burrow out of the thermal zone of a fire. The Project would implement full RHCA buffer widths around ponds, wetlands, seeps and springs of from 50 to 150 feet depending on the size of the habitat feature as required under INFISH. These buffers would greatly reduced the possibility of individual cases of mortality.

Much of the existing literature on fire effects in aquatic systems, especially as they apply to fish, is based on wildfire data. These types of fires are much more severe than prescriptive fires and have included riparian habitats. Gresswell (1999) synthesized existing literature to address the effects of fire on aquatic systems. These effects may be classified as direct and immediate, or indirect and sustained. The magnitude of effects is dependent on many factors, including fire severity, geology and post-fire precipitation as well as species and life history stage.

Fire can cause immediate changes in the water chemistry of forest streams, both as a by-product of heating and from smoke and ash inputs during the burning process (Minshall et al. 2001) and reduce dissolved oxygen levels. Adsorption of smoke and aerial or direct deposition of ash into surface waters can affect pH and nutrient levels in aquatic systems (Cilimburg and Short, 2003). Pulses of inorganic nitrogen and phosphorus into nearby watercourses and water bodies are most commonly noted after forest fires (Gresswell 1999). Spencer and Hauer (1991) attributed nitrogen pulses to the diffusion of smoke into stream water, and phosphorus spikes were attributed to ash deposition. These post-wildfire data are indicative of the negative impacts of severe fire behavior; the Fuels prescriptions would not produce flame lengths nor fire behavior associated with wildfire effects.

Extrapolation on the affects of these changes for a period of time stretching from 2004 to 2012, when prescriptive fire treatments will occur from both the Sunflower Natural Fuels and Willow Pine Fuels Reduction and Vegetation Management Projects, would indicate higher than baseline levels of ammonia for approximately nine years. In concentrations as low as 80 parts per billion, ammonia is toxic to trout (Spence, et al., 1996). While project activities are not expected to elevate ammonia to toxic levels (Bêche, 2005), detectable ammonia could occur present, which would most likely be at levels trout would excrete through the normal metabolic processes (INCHEM, 1986).

Concerns about the affects of prescriptive fire on managed riparian areas have limited its use. However, a study conducted by Bêche et al. (2005[b]) killed less than five percent of riparian area trees where ground fuels were 57 % of available fuels. The prescriptive fire did not change the amount or location of LWD; trees killed were generally too small to be considered LWD. There was no evidence of post-fire changes in water chemistry parameters, which suggests that smoke related changes in water chemistry are dependant on the size and severity of a fire. Effects to macroinvertebrates were consistent with Minshall (see below). Bêche et al. suggest that leaving a buffer between the active channel and treatment area is effective in reducing potential inputs of sediment (and ash) or associated nutrients. Project design criteria are slated for just that occurrence where fire would not be started closer than 50 feet from riparian vegetation and would not be

allowed to back down into any true riparian vegetation. This will effectively leave a buffer between burned areas and the stream system.

Minshall (2003) examined the effects of fire on macroinvertebrates. Macroinvertebrates are key food items for red-band trout and Columbia spotted frog. Red-band trout are confined to flowing water (lotic) habitats while Columbia spotted frog occur in non-flowing (lentic) ponds and wetlands as well as habitats associated with red-band trout. While the studies Minshall cites were conducted in lotic stream ecosystems, many macroinvertebrate groups are common to both types of ecosystems. Minshall's paper serves to illustrate the potential affects to the food sources of these Forest Service Sensitive and Endangered Species Act Candidate species.

Direct effects to macroinvertebrates from fire were minor to indiscernible. Both pre- and post-fire communities were identical, however, intense heating in areas of shallow water volume, such as slow-water or very small streams may have negative effects, such as overloading the macroinvertebrates food sources with ash, leading to weight loss, and death of individuals. It is reasonable to believe that intense heating on habitats such as ponds and wetlands would also show changes.

Indirectly, the impact of fire on macroinvertebrate communities will vary with the extent and intensity of the fire, the size of the stream, remaining vegetative cover and other variables. It may take 1-2 years for macroinvertebrate communities to return to pre-fire conditions, although variations in the community may continue from 5-10 years. He goes on to suggest that recovery of this important food source for red-band trout and Columbia spotted frog is likely to be slowed where natural processes are already impaired.

Burning of the grapple piles would occur in the fall, with pile locations focused on up-slope locations outside of "washes" or depressions that might facilitate concentration of up-slope water run-off of sediment and ash during precipitation events.

Over time, fuels treatments within the Project area are expected to reduce the potential for high intensity wildfire, which can cause significant disruptions to aquatic species and their habitats.

Due to the design criteria of all grapple piling outside of RHCA's, hand piling within RHCA's and not closer than 50 feet from stream channels, fire will not be allowed to creep outside of the piles more than 10 feet, fire for fuels reduction would not be started within 50 feet of true riparian vegetation and would not be allowed to back into riparian vegetation providing for buffering of any fine sediments or ash deposits, there will be no effect on sediment, stream temperature or riparian conditions as a result of implementation of these alternatives. The hydrology report indicates that buffers are adequate to maintain stream systems that meet state water quality standards for turbidity and temperature. Chemical contaminants, as stated above will occur as part of project activities but are not expected to elevate ammonia to toxic levels (Bêche, 2005), detectable ammonia could occur present, which would most likely be at levels trout would excrete through the normal metabolic processes (INCHEM, 1986). Bêche et al. also suggested that leaving a buffer between the active channel and treatment area is effective in reducing potential inputs of sediment (and ash) or associated nutrients and that is being done with this project.

Table 31. Comparison Between Alternatives 2 and 3 for Selected Project Elements.

Selected Project activities	Alternative 2	Alternative 3
Thinning		
Commercial	3,211	2,551
Non-commercial (outside commercial units)	1,340	1,259
Non-commercial (overlapping units)	2,603	2,054
Roads (miles)		
Level 1	20.2	11.4
Level 2	50.0	39.8
Level 3	10.7	10.6
New temporary	4.5	3.9
Total Roads	85.4	65.6
Landings		
New	44 (11 acres)	34 (8.5 acres)
Existing	331 (82.7 acres)	260 (65 acres)
New Landings within the RHCA	0	0
Roads within the RHCA (refer to Table 30)	11	9.5
Fuels (acres)		
Grapple or hand-piling (acres)	640	361
Understory burning outside of commercial and non-commercial thinning units (acres).	2519	2765

Cumulative Effects

The Murray Fire occurred in August of 2002. Low and moderate burn areas in the fire should be recovered. Fire delivered sediment should be coming primarily from sites within the 125 acres (approximately 39 percent of the fire) that burned at high intensity and should be on the tail of the recovery curve (see Figure 4). Very little of the Murray fire burned at high severity. Surface erosion from high intensity burn areas should recover to normal levels by 2009. Due to the mitigating effects of the east side climate and the soils and slope in the high intensity burn area, there is not much risk of shallow landslides.

Roads and livestock are the two primary management activities currently resulting in surface sediment levels above background. Based on the Ochoco GIS Transportation Layer as of 8/22/06, the open road density in the Willow Pine Planning Area (including private in-holdings) is 2.34mi/sqmi. This is below the 3 mi/sqmi guideline in the Forest Plan and meets Forest Standards and Guidelines. Open road density within 400 feet of streams is 3.34 mi/sqmi. While livestock can affect upland sediment delivery by trampling and trailing, in the Willow Pine Planning Area, their primary impact appears to be on channel condition. Channel conditions 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 affects specifically to livestock, and the inability to separate long term affects from past management or events from current management. Because of this livestock affects were not included in Figure 6.

The Sunflower Allotment Management Plan (AMP), which includes the Willow Pine Planning Area was accomplished in 1995. Livestock can have a major influence on stream bank condition.

The Sunflower Creek Exclosure has been in place for 18 years and there is a large exclosure on Murray Creek. A herder is used on the Sunflower Allotment to prevent livestock from over-utilizing riparian areas. Troughs have been moved to reduce impacts on wetlands and funds have been requested to put additional troughs in the uplands to move livestock away from riparian areas. In addition to maintaining bank condition and reducing trampling, exclosures, moving cattle, and relocating troughs out of riparian areas increase sediment filtering capacity. Changing livestock management is outside the scope of this document; however, it is reasonably foreseeable that there would be an improvement in riparian condition due to changes in the range utilization standards in the Grazing Implementation Monitoring Module (IIT, 2000). Studies in the intermountain region (Clary, 1999) indicate that the height of grasses and forbs that are to be left in key riparian areas indicate a level of grazing that allows a corresponding recovery of palatable woody vegetation. Bank stability and channel geometry interact with vegetation but may respond differently, depending on the extent of continued mechanical disturbance in the channel and the current channel condition.

Even if no additional ground disturbing activities took place in the watershed, elevated sediment delivery could happen if a large runoff event occurred.

Grazing of livestock within the Project area would continue during the Project. Beneficial effects to woody riparian species such as willows may occur where fire has affected root stock. Stimulation of willow production during prescriptive fire would increase their potential as forage for livestock. Understory burning could also stimulate new grasses, increasing overall forage production within the RHCA which may result in increase livestock use within the RHCA. Without proper management, this could result in a higher probability of exceeding forage and browse utilization standards. However, livestock numbers and season of use are expected to remain the same and improvement in forage production in the adjacent Project uplands following thinning and underburning may serve to increase forage amounts within the overall Project area, reducing the probability that the RHCA would be the primary site of palatable forage species.

Summary

Although there is a small potential for red-band trout and their habitat to be affected by minute amounts of sediment that reach the stream, which may be generated from road use and its maintenance and limited construction, landing maintenance and its limited construction, commercial thinning, understory burning and grapple piling activities, any overland flow capable of carrying sediments would be very small to undetectable compared with background levels.

There may be a temporary increase in non-permeable surfaces resulting from soil compaction associated with roads, landings, and skidding, however, these affects would be minimal. It is unlikely that adverse affects to red-band trout, Columbia spotted frog or their habitats would occur from the project.

There would be no loss of shade-producing canopy and limited activity within the RHCA - non-commercial thinning which may improve shade and LWD potential, and underburning where fire creeps into the RHCA. The Project would not contribute to stream warming. Because fueling and lubricating would not occur within the RHCA under any circumstances, there is no potential for introduction of chemical contaminants into the stream channel or within the RHCA. Project design criteria for water drafting would prevent stream de-watering and fish entrainment where drafting was necessary for dust abatement practices.

There would be no changes to existing stream channel structure or functionality because activities would not occur within the RHCA or, where run-off potential exists, project activities have little causal mechanisms to raise sediment levels to those occurring from existing road use and existing conditions.

Drainage densities would be increased slightly for the three year harvest period, but would return to pre-project levels. There may be some instances of direct impact to Columbia spotted frog during activities around wetland, spring and seep areas where individuals may be migrating outside of the established RHCA buffer, however, movement was reported to occur in August-September, before the time frame that underburning would occur. Bull (2005) reported that timber harvest was likely not a large factor in the species decline.

There are potential beneficial affects to red-band habitat resulting from non-commercial thinning and fuels treatments within the Project area and within the RHCA where this prescription may release existing conifers, providing a greater degree of shade, providing cover and thermal regulation to water temperature. Larger, healthier trees are likely to provide for future LWD, an important channel forming component currently lacking within Project area streams.

In summary, the implementation of Alternatives 2 or 3 may have no effect on Threatened and Endangered (T&E) species. Implementation of either alternative would produce long-term beneficial effects to Sensitive species discussed in this report. There may be short-term, effects to individuals or habitat from all project activities, however, the Project would not produce effects leading to listing under the Endangered Species Act. Again, limited by research availability on long-term prescriptive fire effects, there may be short-term effects to individuals or habitat from long-term prescriptive fire use, however, because fire was a natural part of the landscape pre-European settlement and native species evolved under these historic conditions, the Project is unlikely to produce effects leading to listing under the Endangered Species Act.

Wildlife Other Concerns – Big Game Habitat

Measures

HEI; Change in marginal and security cover; change in road density

Introduction

The Forest Plan identifies big game habitat standards that are to be met to insure adequate habitat for species such as the Rocky Mountain elk and mule deer persists over time. Both Rocky Mountain elk and mule deer occur in the project area in relative abundance. The Project area is within the Ochoco Wildlife Management Unit (WMU), as designated by the Oregon Department of Fish and Wildlife. As of 2006, the Ochoco WMU was near or exceeded the Management Objective for elk (4,600; MO = 4500) and was below the Management Objective for mule deer (16,500; MO = 20,500). Table 32 provides additional population data for the Ochoco WMU for Rocky Mountain Elk and mule deer.

Table 32. Population Statistics from 2001 to 2006 for the Ochoco Wildlife Management Unit.

Year	Rocky Mountain Elk			Mule Deer		
	Population (MO)	Bull:Cow Ratio (MO)	Calf:Cow Ratio (MO)	Population (MO)	Buck:Doe Ratio (MO)	Fawn:Doe Ratio (MO)
2001	5,200 (2,600)	18:100 (20:100)	44:100 (40:100)	18,300 (20,500)	16:100 (12:100)	36:100 (35:100)
2002	4,800	20:100	43:100	18,300	12:100	37:100
2003	4,600	18:100	48:100	17,800	12:100	44:100
2004	4,000	8:100	38:100	17,000	15:100	30:100
2005	4,500 (4,500)*	11:100	45:100	17,000	14:100	46:100
2006	4,600	24:100	53:100	16,500	16:100	N/A

* - Management Objective for Rocky Mountain Elk in the Ochoco WMU changed to 4,500 animals.

Both summer and winter range habitat is present in the project area, although winter range habitat, as designated by the Forest Plan (MA-F20 – Winter Range) makes up only a small portion of the project area. A total of 212 acres exists as MA-F20 Winter Range habitat, roughly 1% of the project area. Effective or usable winter range habitat in the Project Area, however, may include all of the Project Area. This is dependent upon annual snow fall and snow conditions. As an example, winter of 2003/2004 found near record levels of snow pack and snow depths in the project area, as well as a long persistence. Wintering elk and mule deer stayed to the lowest elevations of the project area, with most wintering on neighboring private and BLM lands. However, the winter of 2004/2005 was one of the milder winters on records, with very little relative snow pack. Winter track surveys found elk and mule deer at all elevations across the project area through out the months of December through March.

The Forest Plan identifies standards for overall habitat effectiveness of big game habitat (measured by the Habitat Effectiveness Index [HEI]), and open road densities for each Management Area on the Ochoco National Forest. Table 33 identifies the Standards for each measure for General Forest (MA-F22) and Winter Range (MA-F20).

Table 33. Management Standards for HEI and Open Road Density, and Corresponding Values for Percent Area Cover and Cover Quality for General Forest (MA-F22) and Winter Range (MA-F20) in the Project Area, Decade Two.

Management Area	HEI	Percent Area in Cover (%)	Cover Quality (%)	Open Road Density (mi/mi ²)
	PIPO-Mixed Con Average	PIPO-Mixed Con Average	PIPO-Mixed Con Average	
MA-F20	4	7	3	3(1)*
MA-F22	7	15	53	3

* - for winter range, road density is managed for 1 mi/mi² during December 1 through May 1
PIPO – Ponderosa Pine forest type; Mixed Con – Mixed Conifer forest type (Douglas fir and grand fir dominated forest)

Hiding and security cover is also an important component of big game habitat. It is particularly critical during calving and fawning season, when newly dropped calves and fawns are vulnerable from predation; and during the fall hunting season when elk and deer are vulnerable to hunting mortality. The Forest Plan does not specifically identify a standard for retention or management of hiding or security cover. Hiding cover is generally described as screening cover, usually in the form of vegetation that screens a standing elk or deer from sight. Thomas describes hiding cover in

his publication *Wildlife Habitats in Managed Forests: the Blue Mountains of Oregon and Washington* as vegetation capable of covering 90% of a standing adult deer or elk from human view of a distance not less than 200' (1979). Hiding and security cover may also mitigate some of the effects of open roads, road densities and vehicle traffic associated with those roads. Much of the vegetation that makes up hiding and security cover is in the form of sapling, poles, reproduction and brush understories that provide a dense horizontal cover. As Thomas noted, topography itself does not function as hiding or security cover, but in its effect on screening capabilities of vegetation, may enhance a forest vegetation's ability to provide hiding and security cover (1979).

A standard exists for road densities, as described in Table 33. Road density assesses the affect of open roads and the access by motor vehicles they enable on elk and deer habitat and the use of habitat by elk and deer. Numerous studies have rigorously looked at the effect of open roads, road densities, and the access and use by motor vehicles afforded by those roads (Roland et al. 2005; Wisdom et al. 2005; Johnson et al. 2005; Wisdom et al. 2005 [2]). Increases in road densities (miles of roads/square mile area), locations of roads, and the intensity of traffic greatly influence distribution, movement patterns, and access to habitat, as well as risk to hunter related mortality. Generally these effects are negative as road density increases, as studies are now showing not only hunter related mortality increasing (Johnson et al. 2005), but also secondary effects to elk and deer nutrition and energetics (Cook et al. 2004; Johnson et al. 2005).

Affected Environment

Thermal Cover

Thermal cover is described by Thomas (1979) as forested vegetation that allows deer and elk to achieve homiothermy (thermoneutrality in maintaining body temperature). Such habitat condition allows deer and elk to manage body temperature at a desirable condition with out undo energetic stress. Thermal cover is often defined as either marginal or satisfactory. Marginal cover maintains a minimum canopy closure of 40% and a generally single story stand condition at least 40' in height. Satisfactory cover maintains at least a 60% canopy closure, with at least pole sized trees (Thomas 1979) and often is demonstrated by multi-stored mature forest conditions.

In the MA-F22 (General Forest) habitat in the Project Area, 12,228 acres of marginal thermal cover exists, and 147 acres of satisfactory cover. The large disparity in marginal and satisfactory cover is a product of relatively intensive past timber harvest and vegetation management and generally lower site conditions that make achieving 60% plus canopy closures difficult. Approximately 62% of the project area is in a marginal or satisfactory cover condition. .

In MA-F20 (Winter Range) habitat in the Project Area, 66 acres of marginal thermal cover is present. Cover habitat in the MA-F20 land designations accounts for 31% of that designation.

Hiding/Security Cover

Hiding and security cover is prominent in much of the forested vegetation in the project area. Approximately 12,300 acres of hiding and security cover exists in the project area. The cover quality varies depending upon the amount of and time since previous non-commercial thinning treatments. Approximately two-thirds (2/3; approximately 8,000 acres) of the potential hiding and security cover habitat would be considered high quality hiding and security cover, with dense understory vegetation development.

Road Density

The existing open road density in the project area is 2.34 mi/mi². Of that, MA-F22 has an open road density of 2.18 mi/mi². Winter Range, MA-F20 has an open road density of 1.48 mi/mi². Roads are primarily lower maintenance level native surface roads, requiring high clearance vehicles to travel, particularly in poor weather conditions. Main arterial roads, including the 58 and 5870 roads are higher maintenance roads and are suitable for passenger cars. The project area is a part of the Rager Green Dot road closure program. During the deer and elk rifle seasons, non-green dot roads are closed to vehicle traffic unless otherwise authorized by the USFS (administrative use, special permitted use). This closure runs the length of October and November. Open road densities are reduced to 1.99 mi/mi² with implementation of this annual closure.

Direct and Indirect Effects – Alternative 1

Thermal Cover

Alternative 1 would not result in direct or indirect effects to thermal cover in the Project Area. Existing thermal cover indices (% in cover, thermal cover acres, and cover quality) would remain the same. This would be true for both MA-F20 and MA-F22 designated habitats. Over time, as other stands not currently meeting cover requirements develop, additional thermal cover habitat, as defined, may develop. Some existing cover habitat, as a result of insect and disease related mortality, would decline. These declines would be in a small patchy nature across the landscape, rather than entire cover blocks of habitat being removed from cover condition.

Hiding/Security Cover

Hiding and security cover would remain unchanged with the implementation of Alternative 1. No commercial or non-commercial thinning would occur with the implementation of this alternative. Existing cover conditions would persist into the mid to long term (0-50 years+). Over time, additional acres would be expected to develop into hiding and security cover as understory vegetation, conifer reproduction, and shrub habitat developed.

Road Density

Road densities would remain the same in both MA-F20 and MA-F22 habitats in the project area. Road densities would remain below the Forest Plan standard for MA-F22, and slightly above for MA-F20.

HEI values

The Habitat Effectiveness Index (HEI) values for the Project Area would remain the same. Table 34 below identifies the HEI values that currently exist and would remain the same with implementation of Alternative 1.

Table 34. Habitat Effectiveness Index Values for Alternative 1/Existing Condition

Management Area	HE Cover Quality	HE Cover Quantity	HE Open Roads	HEI Alternative 2
MA-F20	1.0	10	.6	6
MA-F22	1.0	85	.45	38.25

Cumulative Effects

Appendix A identifies an array of past and present activities and actions that have affected the project area. Relative to big game habitat, timber harvest and vegetation management, fire suppression and changes to fire regimes, livestock grazing, and road construction have had the greatest effect on habitat quality and Rocky Mountain elk and mule deer populations. Cumulatively, these actions have helped shaped the current habitat condition described in the Affected Environment section.

Past timber harvest and vegetation management actions have affected the quality, condition and distribution of thermal and hiding and security cover across the project area. These effects have generally been short to mid term effects, as most timber harvest and vegetation treatments have been intermediary in nature. No clear-cuts or other large scale changes in vegetation have occurred in the project area. What has occurred, primarily in the form of understory and middle story thinning, has affected the quantity, quality, and distribution of satisfactory thermal cover and hiding and security cover. Effects to Satisfactory cover have been long term. However, site limitations and the amount of vegetation the forested communities can support may have as much to do with the lack of satisfactory cover (less than 1%) in the Project Area. Changes in hiding security cover have been more profound. However, due to the influences of fire suppression and changes in fire regimes, the time frame of effect has been relatively short, measured in the short to mid term time periods (0-30 years).

Wildfire suppression and the changes to the fire regimes in the project area has likely had the greatest cumulative effect on cover habitat in the project area. Through wildfire suppression and the change in effective fire regimes in the project area, stand densities and thus canopy closure have developed to levels outside of historic conditions. Current percent of area in cover is 4 to 7 times the recommended area in cover as per the Forest Plan. Suppression of wildfire and the changes in fire regimes have allowed for fire intolerant species (Douglas fir, grand fir, western juniper) to invade historically ponderosa pine communities, and mature into the middle and upper canopy levels. This has converted more habitat that historically wasn't in a cover condition to cover habitat for deer and elk. By in large, this has benefited elk and deer by reducing their vulnerability to predation and hunter mortality, and to some degree reduced the disturbance associated with open roads. A negative, however, has been in forage production, in particular browse forage which often respond to fire stimuli. Recent prescribed fire activities have helped some in forage production, but have largely not changed the amount of cover habitat present in the Project Area.

Livestock grazing has resulted in cumulative effects to big game habitat in terms of the quality, condition and quantity of forage available to elk and deer. The greatest impact has been in browse species, where combined with the effects of tightening canopy closures and lack of fire stimulation, have declined since historic, pre-management times. With riparian dependent browse species in particular, historic grazing practices have resulted in largely absent riparian browse forage for elk and deer. Upland browse forage, such as Scouler's willow, ribes species, chokecherries and bittercherries, and other browse (mountain mahogany and bitterbrush) has likewise declined. Overall affect on elk and deer populations is not documented for the project area, however, information from Starkey Research Station indicate forage quality and quantity are key factors in fecundity and over winter survival of elk and deer (Cook et al. 2004).

Open roads have also affected elk and deer populations. Road densities have increased over time, hitting a high of over 3 mi/mi² in considering all system roads in the Project Area. Closures and

decommissions have since reduced that road density to 2.34 mi/mi². Open roads affect the distribution of deer and elk and their access to cover and forage habitat (Wisdom et al. 2005; Rowland et al. 2005). Open roads also affect individual deer and elk's risk of hunter related mortality. Johnson et al. also found ties to roads and effects upon nutritional condition of deer and elk, particularly associated with hunting season activity (2005). The Rager Green Dot road closure helps alleviate some of those effects, but they do persist.

Alternative 1 would not contribute additional effects to those that are described above. The existing condition of big game habitat would be maintained in the short term. Existing trends in changes to habitat, primarily in the form of increases in cover habitat, would continue into the short and long term. In the mid to long term, percent of area in cover would increase, cover quality would increase, and the quality and quantity of hiding and security cover would increase.

Direct and Indirect Effects – Alternative 2

Thermal Cover

Thermal cover would be affected with implementation of Alternative 2. Marginal cover habitat would be reduced by a total of 3,211 acres. This would leave a total of 9,164 acres of thermal cover habitat total. This is 46% of the project area, and a total reduction of approximately 16%. Thermal cover quantity in the project area would continue for both ponderosa pine and mixed conifer in the second decade. Cover quality would be calculated at 40.6%, and would be below both ponderosa pine and mixed conifer standards for the second decade. This would only be a .4% change from the existing condition.

Hiding/Security Cover

Approximately 3,943 acres of non-commercial thinning is proposed in Alternative 2. This would result in a reduction in hiding and security cover on all of those acres within the project area with this alternative. This would result in 8,357 acres of potential hiding and security cover remaining in the Project Area. This is roughly a 32% reduction in hiding cover in the project area. Some minor reduction in hiding and security cover quality would be expected with the prescribed fire activities proposed in this alternative. However, the spotty, discontinuous nature of that change would not result in measurable reductions in hiding cover effectiveness.

Road Density

Short term road densities would increase with the implementation of this alternative. A total of 4.5 miles of new road would be constructed with Alternative 2. This alternative would also re-open 20 miles of existing closed roads in the project area. This would result in an open road density of 3.11 mi/mi² during the duration of the project. This would be a maximum of about five (5) years. These opened or newly created roads, however, would not contribute to open road density, as they would be unavailable to public use due to harvest operations and wildlife concerns. After harvest and haul operations are complete, the 4.5 miles of new road and 20 miles of re-opened road would be decommissioned and no longer available, returning the open road density to 2.34 mi/mi². All new roads created for implementation of this project would be in the MA-F22 habitat areas. Road densities would be below Forest Plan Standards with implementation of this alternative.

Habitat Effectiveness Index Values

Table 35 below identifies the HEI values calculated for the effects of Alternative 2 on big game habitat.

Table 35. Habitat Effectiveness Index Values for Alternative 2

Management Area	HE Cover Quality	HE Cover Quantity	HE Open Roads	HEI Alternative 2
MA-F20	1.0	10	.6	6
MA-F22	1.0	99	.45	44.5

The HEI for MA-F20, which would not change from the existing condition, would remain above Forest Plan Standards for winter range. The HEI for MA-F22 would remain well above HEI standard for ponderosa pine, of which the Project Area is predominantly composed of (mixed conifer makes up less than 5% of the project area). HEI change from the existing condition is approximately 6 points, and improves with this alternative.

Cumulative Effects

The activities and actions that have contributed to cumulative effects to big game habitat are described in the Cumulative Effects section for Alternative 1. Refer to them for additional discussion.

Alternative 2 would add cumulative effects to such action as the recent non-commercial thinnings (Bird) and commercial thinnings (Sunny, South Aspen) that have resulted in changes to cover habitat, mostly in the reduction in marginal thermal cover and the amount of hiding and security cover (603 acres). Older activities, dating 20 or more years ago, no longer affect cover condition relative to the additive effects of Alternative.

The proposed fuel treatments, coupled with commercial and non-commercial thinnings, would reverse some of the effects of wildfire suppression and fire regime changes by opening canopies and re-introducing fire into the forest communities. Big game forage and a better overall mosaic of cover and forage habitats would result.

Forage habitat would be improved with the thinning and prescribed fire actions proposed, further reducing the cumulative effects of fire suppression and changes to fire regimes. Incremental improvements to browse forage and herbaceous forage would be expected.

Road densities would largely remain unchanged. Alternative 2 would result in additional cumulative effects of increased miles of open road and open road densities over the short term (0-5 years). However, those roads would be decommissioned after project implementation is complete, and existing miles of road and open road density would return to existing condition levels. In addition, the newly created or re-opened roads would be closed to public access for safety and wildlife concerns, and thus would not contribute to open road densities as it is considered for wildlife effects. Cumulative effects would be short term.

Direct and Indirect Effects – Alternative 3

Thermal Cover

Thermal cover would be affected with implementation of Alternative 3. Marginal cover habitat would be reduced by a total of 2,551 acres. This would leave a total of 9,824 acres of thermal cover habitat total. This is 49% of the project area, and a total reduction of approximately 13%. Thermal cover quantity in the project area would continue for both ponderosa pine and mixed conifer in the second decade. Cover quality would be calculated at 40.3%, and would be below both ponderosa pine and mixed conifer standards for the second decade. This would only be no change from the existing condition.

Hiding/Security Cover

Approximately 3,313 acres of non-commercial thinning is proposed in Alternative 3. This would result in a reduction in hiding and security cover on all of those acres within the project area with this alternative. This would result in 8,987 acres of potential hiding and security cover remaining in the Project Area. This is roughly a 27% reduction in hiding cover in the project area.

Some minor reduction in hiding and security cover quality would be expected with the prescribed fire activities proposed in this alternative. However, the spotty, discontinuous nature of that change would not result in measurable reductions in hiding cover effectiveness.

Road Density

Short term road densities would increase with the implementation of this alternative. A total of 3.9 miles of temporary road would be constructed with Alternative 3. An additional 11.3 miles of closed roads would be re-opened, and then closed after implementation with this alternative. This would result in an open road density of 2.82 mi/mi² during the duration of the project. This would be a maximum of about five (5) years. These opened or newly created roads, however, would not contribute to open road density, as they would be unavailable to public use due to harvest operations and wildlife concerns. After harvest and haul operations are complete, the 3.9 miles of new road and 11.3 miles of re-opened road would be decommissioned and no longer available, returning the open road density to 2.34 mi/mi². All new roads would be opened in the MA-F22 habitat areas. Road densities would be below Forest Plan Standards with implementation of this alternative.

Habitat Effectiveness Index Values

Table 36 below identifies the HEI values calculated for the effects of Alternative 3 on big game habitat.

Table 36. Habitat Effectiveness Index Values for Alternative 3

Management Area	HE Cover Quality	HE Cover Quantity	HE Open Roads	HEI Alternative 3
MA-F20	1.0	10	.6	6
MA-F22	1.0	99	.45	44.5

The HEI for MA-F20, which would not change from the existing condition, would remain above Forest Plan Standards for winter range. The HEI for MA-F22 would remain well above HEI

standard for ponderosa pine, of which the Project Area is predominantly composed of (mixed conifer makes up less than 5% of the project area). HEI change from the existing condition is approximately 6 points, and improves with this alternative. There would be no difference between HEI values for Alternatives 2 and 3.

Cumulative Effects

The activities and actions that have contributed to cumulative effects to big game habitat are described in the Cumulative Effects section for Alternative 1. Refer to them for additional discussion.

Alternative 3 would add cumulative effects to such action as the recent non-commercial thinnings (Bird) and commercial thinnings (Sunny, South Aspen) that have resulted in changes to cover habitat, mostly in the reduction in marginal thermal cover and the amount of hiding and security cover (603 acres). Older activities, dating 20 or more years ago, no longer affect cover condition relative to the additive effects of Alternative 3.

The proposed fuel treatments, coupled with commercial and non-commercial thinnings, would reverse some of the effects of wildfire suppression and fire regime changes by opening canopies and re-introducing fire into the forest communities. Big game forage and a better overall mosaic of cover and forage habitats would result.

Forage habitat would be improved with the thinning and prescribed fire actions proposed, further reducing the cumulative effects of fire suppression and changes to fire regimes. Incremental improvements to browse forage and herbaceous forage would be expected.

Road densities would largely remain unchanged. Alternative 3 would result in additional cumulative effects of increased miles of open road and open road densities over the short term (0-5 years). However, those roads would be decommissioned after project implementation is complete, and existing miles of road and open road density would return to existing condition levels. In addition, the newly created or re-opened roads would be closed to public access for safety and wildlife concerns, and thus would not contribute to open road densities as it is considered for wildlife effects. Cumulative effects would be short term.

The relative cumulative effects of Alternative 3 would be less than Alternative 2, as fewer acres would be treated by commercial and non-commercial thinning and fuels treatments and fewer miles of temporary road would be created.

Summary of Effects and Conclusions

Thermal Cover

Alternative 1 would maintain existing thermal cover conditions. Thermal cover conditions would be expected to improve over the mid to long term (5-50+ years) as habitat that is not currently suitable would develop dense canopy structures to function as thermal cover.

Alternative 2 would result in the greatest reduction of thermal cover of the three alternatives. A 16% reduction in thermal cover would result with implementation of this alternative. Post treatment percent of area in cover would be 46%. Over the mid to long term (5-50+ years),

additional thermal cover habitat would develop as stand canopies and densities develop and improve.

Alternative 3 would result in a lesser reduction in thermal cover habitat than Alternative 2. A 13% reduction in thermal cover would result with the implementation of this alternative. Post treatment percent of area in cover would be 49%. Over the mid to long term (5-50+ years), additional thermal cover habitat would develop as stand canopies and densities develop and improve.

All three alternatives would continue to meet big game thermal cover needs.

Hiding/Security Cover

Alternative 1 would maintain existing hiding and security cover in the short term (0-5 years), and would result in a slow increase in hiding cover in the mid to long term (5-50+ years). Alternative 2 would reduce hiding and security cover by 32% in the Project Area. This would still maintain approximately 42% of the Project Area in potential hiding and security cover. Alternative 3 would reduce hiding and security cover by 27% in the Project Area. This would maintain 45% of the Project Area in potential hiding and security cover.

The activities proposed that would affect hiding and security cover in the Project Area in Alternatives 2 and 3 would not adversely affect elk and deer distribution or disturbance patterns in the Project Area.

Road Density

There would be no effective change to road density with any of the three alternatives. Both Alternatives 2 and 3 propose road construction or re-opening of existing roads. However, these roads would not be available to public access due to concerns with logging operations safety and wildlife concerns. Effective open road density would remain at current levels below Forest Plan standards.

Habitat Effectiveness Index

Habitat Effectiveness Index (HEI) values would change little with the implementation of Alternatives 2 and 3. HEI values would actually improve with the implementation of the action alternatives, indicating an improvement in cover ratios and quality of habitat. HEI values would improve 6.3 points with the implementation of Alternatives 2 and 3 as compared to the existing condition over the mid to long term.. In the short term, HEI values would decline by 5.58 points with Alternative 2 and 1.62 points with Alternative 3. Table 37 provides a comparison of HEI and cover related values by alternative and the Forest Plan standards.

Table 37. Summary by Alternative and Comparison to Forest Plan Standards for HEI.

	MA-F20 General Forest Winter Range				MA-F22 General Forest			
	HE _{Cover}	HE _{Cover Qual}	HE _{Open Road}	HEI	HE _{Cover}	HE _{Cover Qual}	HE _{Open Road}	HEI
Forest Plan Standards				4				7
Alternative 1	1.0	10	.6	6	1.0	85	.45	38.25
Alternative 2	1.0	10	.6	6	1.0	99	.45	44.5
Alternative 3	1.0	10	.6	6	1.0	99	.45	44.5

LRMP Standards

Road Density

Forest Plan Standards would be met with the implementation of either of the three proposed. Existing road densities are currently at 2.34 mi/mi². This density is below Forest Plan standards of 3 mi/mi².

Habitat Effectiveness Index

Forest Plan Standards would be met with the implementation of any of the three proposed alternatives (Table 37).

Purpose and Need

No specific points in the Purpose and Need in Chapter 2 of the EA specifically identify changes or improvements for big game habitat. Suitable big game habitat would maintain with any of the three alternatives. Viable populations of elk and deer would be maintained.

Desired Condition

A desired condition of well distributed thermal and hiding and security cover, as well as low road densities would be maintained with implementation of any of the three alternatives. The HEI values would improve with implementation of Alternatives 2 and 3, indicating achieving a better mix of cover and openings for elk and deer habitat. A desired condition for elk and deer habitat would be achieved.

Wildlife Other Concerns – National Forest Management Act Consistency – Management Indicator Species: Primary Cavity Excavators

Introduction

The Ochoco National Forest Land and Resource Management Plan (Forest Plan) identifies the pileated woodpecker, northern flicker and other primary cavity excavator species as Management Indicator Species (MIS) as directed by the National Forest Management Act of 1976. The pileated woodpecker serves as an indicator of late and old structure habitat, or “old growth”, consisting of dense multi strata mixed conifer stands and higher densities of snags and down logs. The northern flicker is an indicator of old growth western juniper habitats. Very old juniper trees provide suitable nesting habitat for these birds. Other primary cavity excavators serve as indicators for snag habitats for these species, and others that use woodpecker cavities for reproductive, foraging, and roosting habitats. This section assesses the effects of the proposed alternatives on these species.

The Regional Forester’s Eastside Forest Plan Amendment #2 (Screens), which amends the Ochoco National Forest Land and Resource Management Plan (Forest Plan), identifies specific standards for the management and protection of cavity excavator habitat. The Project Area falls under Scenario A (Standard 6.d.), as one or more late and old structure (LOS) stages falls below HRV for several of the forest types present. Standard 4)a)(1) prescribes that “all sale activities...will maintain snags and green replacement trees of ≥ 21 inches dbh, (or what ever is the representative dbh of the overstory layer if it is less than 21 inches), at the 100% population level for primary

cavity excavators.” The 100% potential population level, according to Thomas (1979) is 2.25 snags per acre, or 225 snags per 100 acres, of which 14 snags must be greater than ≥ 21 ” dbh. Thomas (1979) was considered the best science available from the time it was published until the Screens were issued in 1994.

The Decayed Wood Advisor, DecAID (PSW-GTR-181) is an advisory tool to help land managers evaluate effects of forest conditions and existing or proposed management activities on organisms that use snags, down wood, and other wood decay elements. DecAID is not a model, it is a synthesis of wildlife research and forest inventory data, and provides information regarding abundance of snags and down wood on forested landscapes and their use by wildlife. DecAID can provide a basis for determining the number and distribution of snags needed for species needs. In this analysis, DecAID will provide a source of information describing species habitat needs as it relates to snag densities and diameters.

Measures

Change in Acres of Habitat Over Time

The Wildhab model will be used to measure changes in acres of habitat over time for the primary cavity excavator species assessed below. Wildhab assesses suitable habitat based upon the Viable Ecosystems Management Guide (VEMG). Existing science and field experience identifies suitable habitat types for each species using the Viable Ecosystems Analysis parameters. Suitable habitat conditions assume snag density and diameter requirements are met relative to the Forest Plan standards, unless otherwise described.

Forest Plan standards for snag densities, modified by Regional Forester’s Forest Plan Amendment #2, prescribes the management of snag densities for 100% potential population levels, as determined by the best science available. The Ochoco National Forest published VEMG in April, 1994. This document looked in depth at structural conditions of the various plant communities found on the Forest. These conditions included naturally occurring densities of dead wood habitat. Upon review by the Regional Office “Screen Implementation Team”, the Regional Office concurred with the Ochoco National Forest that the snag levels in VEMG would constitute the best science available where VEMG was equal to or greater than the snag densities published in Thomas (1979). Table 38 shows the snag retention densities required on the Ochoco National Forest to meet 100 percent of the biological potential as required by the screens.

Table 38. Snag Retention Rates for Plant Association Groups on the Ochoco National Forest.

PAG	VEMG Range Snags/Acre <20”dbh	VEMG Range Snags/Acre >20”dbh
MGF	4.4---10.0	1.5 – 4.9
DGF	3.2---7.1	1.0 – 3.3
DF	1.3---3.1 Min = 2.11 based upon RO agreement	.2 --- 1.6
MP	1.2---2. Min = 2.11 based upon RO agreement 7	.2 --- 1.6
DP	0---.3 Min = 2.11 based upon RO agreement	.1--- .7 Min = .14 based upon RO agreement

Affected Environment

Pileated Woodpecker

Dedicated Old Growth and Feeding Areas

Three Dedicated Old Growth areas exist in the Project Area. Table 39 below describes them in general location and acres associated with them.

Table 39. Dedicated Old Growth Habitat in the Willow Pine Project Area.

Dedicated Old Growth	Acres	Location
OG-D2-03	300	Bear Creek
OG-D2-09	308	Porcupine Creek
OG-D2-13	318	Jackass Creek

Habitat within the Dedicated Old Growth habitat blocks varies. Relative to pileated woodpecker habitat needs, habitat quality is poor. Only OG-D2-13 has any forest community types considered conducive or preferred by pileated woodpecker. Approximately 40 acres of the 318 is identified as suitable pileated woodpecker habitat. This is roughly 12% of the old growth area. The remaining 88% is made up of ponderosa pine and Douglas fir dominated middle aged stands. Large trees are limited, although canopy closures are relatively high, usually greater than 45-50%. Snags are

limited to moister riparian areas and the suitable habitat. Else where, snags are generally small, patchy in distribution. Large wood habitats are limited in distribution as well.

Dedicated Old Growth units OG-D2-03 and 09 lack suitable habitat, either in the form of expressed forest community type or structural condition. These two Dedicated Old Growth units are dominated by ponderosa pine and Douglas fir overstories, and Douglas fir and ponderosa pine understories. Past harvest management and site limitations have limited the canopy development and structural stages currently expressed. Snag habitat is generally lacking in these two Dedicated Old Growth units, averaging less than 2 large snags per acre. Smaller snags (<21" dbh) are more abundant, a result of insect and disease related mortality. Down log habitat is largely absent.

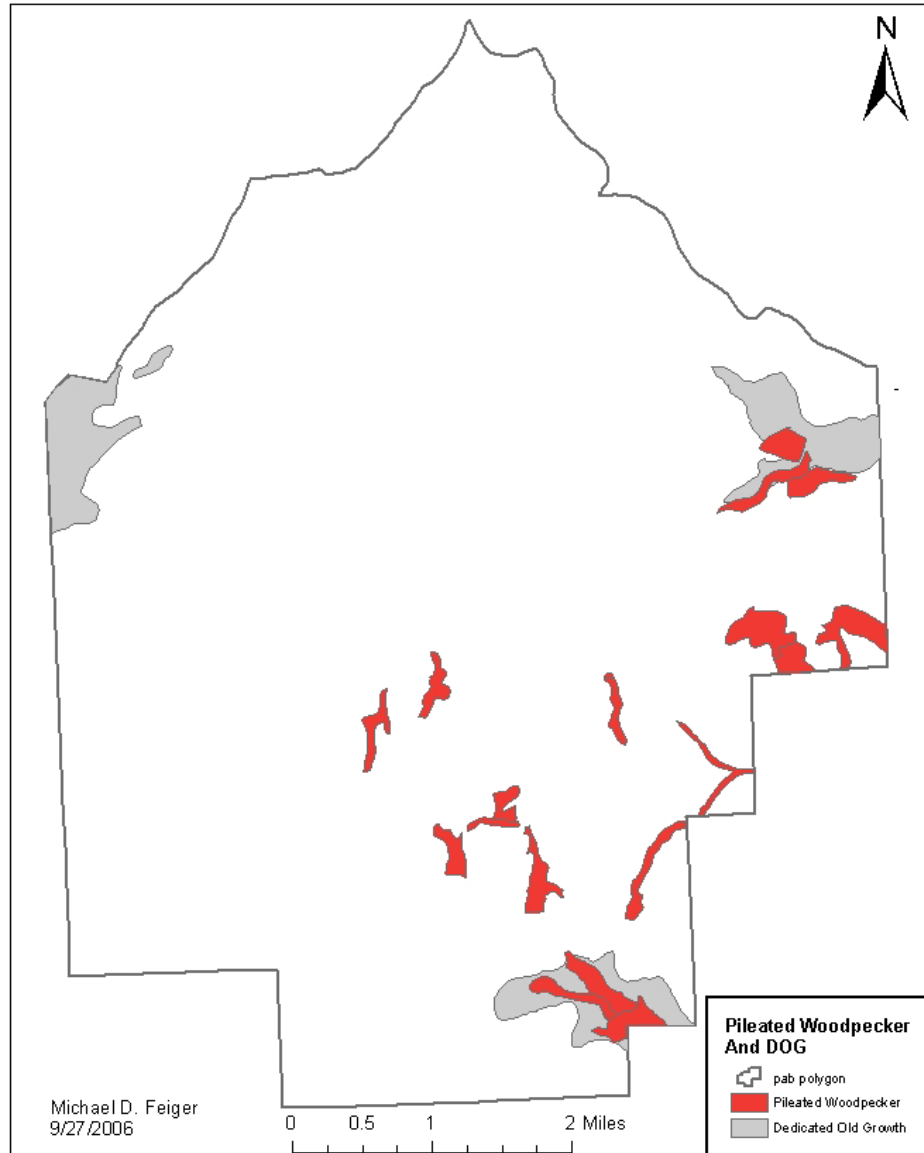
Late and Old Structure Habitat

Suitable pileated woodpecker habitat is largely absent in the project area. Queries of forest habitat databases, using the Viable Ecosystems definitions of habitat (forest type and structure) queried against those habitat types conducive to pileated woodpeckers found 1,239 total acres of habitat in the Project Area. All habitats identified are either dry grand fir or Douglas fir plant association group types. This habitat is scattered across the project area, as demonstrated in Map 5. Individual habitat sizes run from 1 acre to 70 acres. Most of the individual blocks are independent of each other and do not create large contiguous blocks of suitable habitat.

Snag densities in these habitats are not known. Given habitat conditions that are required for the species, relative to the Wildhab data base query, it is assumed that snag densities meet the needs of the pileated woodpecker on these habitats. However, due to the small patchy distribution of individual blocks of habitat, these habitats as a whole may not meet the needs of pileated woodpeckers, which select for more contiguous habitat blocks (Bull and Holthausen 1993).

Map 5.

Willow Pine Fuels and Vegetation Management Project
Pileated Woodpecker Habitat And
Dedicated Old Growth



Other Primary Cavity Excavators

White-headed and Lewis' Woodpeckers and Williamson's Sapsucker

Existing Late and Old Structure, Single-Strata and Multi-Strata Ponderosa Pine

Late and old structure ponderosa pine habitat for the white-headed and Lewis' woodpecker is largely absent in the project area. Habitat for the Williamson's sapsucker is relatively abundant. Historic harvest activity, targeting the largest old growth ponderosa pine trees has limited the availability of such habitat. Large tree structure is present, but largely scattered and at very low densities, or has developed multi-strata characteristics as a result of fire suppression, with fire intolerant species such as grand fir, Douglas fir, and western juniper invading these stands. Such habitat conditions are less conducive to productive habitat for the white-headed and Lewis' woodpeckers. Williamson's sapsuckers, which also use areas of high density small diameter snags, likely finds suitable habitat in the multi-strata LOS and mature habitats. Based upon Wildhab queries of the available habitat in the Project Area, a total of 95 acres of suitable habitat for the white-headed and Lewis' woodpeckers was identified. The 95 acres is broken up into numerous small blocks of habitat in 5-30 acre sized blocks. This habitat is not provided in a larger, contiguous habitat condition. Assessment of potential Williamson's sapsucker habitat (mature and LOS single strata and multi strata habitat in ponderosa pine) found approximately 8,107 acres of suitable habitat for this species. Habitat is much more continuous and better distributed for this species.

Snags and Primary Foraging Habitat

Snag data was not specifically assessed for this analysis, however, some general statements can be made about snag habitat for these three species.

- Large snags (greater than 20" dbh) are generally absent across the project area, with the exception of some over stocked mature and LOS Douglas-fir and ponderosa pine habitats (approximately 500 acres). Historic harvest of green-tree snag replacements and firewood cutting are largely the culprits of this condition.
- Small to medium diameter snags are generally abundant in the overstock habitats with some presence of large ponderosa pine trees. This accounts for approximately 4,911 acres. Snags are clumped in patches of 5-20 snags, depending upon the size of the individual insect outbreak in these stands. The snags are relatively new, being created from insect activity over the past 3-5 years. Foraging use by various woodpeckers is high.

Based upon this information, coupled with available habitat data, nesting snag and foraging habitat for the white-headed and Lewis' woodpeckers is very low. Historic Range of Variability analysis (HRV) indicates that suitable habitat for these two species is well below HRV (6,871 acres below HRV). This is a compounding of the lack of single strata mature and LOS habitat in the Project Area, coupled with the lack of snag habitat. Habitat for the Williamson's sapsucker is below HRV, primarily with the lack of single strata LOS habitat. However, approximately 4,911 acres of suitable habitat does exist with the presence of some large ponderosa pine structure and high stand densities that produces relatively high snag densities of small to medium sized snags. An additional 3,196 acres of suitable habitat, although with lower snag densities, also exists in the project area.

Black-backed Woodpecker

The Wildhab assessment of habitat for the black-backed woodpecker indicates only 420 acres of suitable habitat in the Project Area. However, as noted above, this assessment may underestimate available habitat in the Project area, because high density Douglas-fir and ponderosa pine habitats were not considered in that assessment. This is confirmed based upon field observations. Due to the high degree of bark beetle and wood borer activity in the high density, over stocked Douglas-fir and ponderosa pine habitats, additional suitable habitat for the black-backed woodpecker exists in the project area. Based upon the Silviculture Report, a total of 11,209 acres of overstocked conifer forest habitat exists in the project area.

In 2002, the Murray Fire, which burned in the northern end of the Project Area, burned around 850 acres of ponderosa pine and juniper woodland. Much of this fire resulted in stand replacement fire effects. This created an abundance of snag habitat in the fire area. Black-backed woodpeckers commonly respond to stand replacement fire events. The species are dependent upon high densities of snags and bark beetle populations common with these fire events. This event, coupled with insect outbreaks in surrounding forest types not affected by the fire, may explain the common sightings of black-backed woodpeckers in a habitat type (ponderosa pine dominated) they are not commonly associated with.

Snags and Primary Foraging Habitat

As previously noted, snag habitat was not specifically surveyed for in the project area. However, assessment of stand conditions and a correlation between high density/over stocked stands and snag densities of small to medium sized snags was noted. As described above, approximately 11,209 acres of over stocked conifer habitat exists in the project area. These habitats provide snags larger than 6" dbh (nearest unit breakdown to the 8" dbh breakdown in the DecAID advisor data summary, Appendix K, Table C). As described for the Williamson's sapsucker above, these over stocked stand are providing patches of small to medium diameter snags, 5-20 snags per patch. Field observations indicate that these habitats are being used extensively by black-backed woodpeckers. Indeed, the black-backed woodpecker was the second most commonly noted woodpecker in field surveys next to the hairy woodpecker, in the project area. While primary habitat in the form of mesic and dry grand fir habitat may be limiting, suitable habitat in the form of overstocked Douglas-fir and ponderosa pine habitats are abundant and provide additional suitable habitat for this species.

As noted above, the Murray Fire which burned in 2002 has created an abundance of snag habitat on roughly 850 acres of fire affected habitat. While no specific monitoring has occurred in the fire area, it is suspected that the abundant snag habitats created by the fire attracted black-backed woodpeckers to the Project Area. It is likely that the fire area still provides suitable habitat for the species.

Hairy Woodpecker

Habitat for hairy woodpeckers is abundant and well distributed in the project area. No specific Wildhab analysis exists for this species. However, as would be expected, hairy woodpeckers show strong association to the over stocked conifer forest habitats in the project area. Hairy woodpeckers were frequently noted in those over stocked stands, where higher densities of small to medium sized snags are abundant. Approximately 11,209 acres of suitable high snag density

habitat exists in the project area. Hairy woodpeckers demonstrate preferences to relatively smaller snag diameters, as illustrated in discussion of this species' habitat requirements.

Northern Flicker

The Wildhab assessment of suitable habitat for the northern flicker only identifies 621 acres of suitable habitat for this species in the Project Area. This is composed of open mature ponderosa pine and juniper woodland habitat. Indeed, both habitat types are not abundant in the project area. However, other habitats, potentially less suitable to the northern flicker, are available in the project area. Specifically looking at western juniper habitat, a total of 3,324 acres of habitat exists in the project area, although only 416 acres of mature or LOS western juniper habitat exists in the project area.

Direct and Indirect Effects – Alternative 1

Pileated Woodpecker

The existing condition of habitat for the pileated woodpecker would be maintained in the project area with this alternative. There would be no direct or indirect effects to this species or its habitat with implementation of Alternative 1. Due to the fragmented nature of suitable habitat in the project area (Map 5) and the lack of large contiguous habitat blocks preferred by this species, habitat conditions would not be expected to change in the short, mid, or long term. Habitat conditions for this species would remain poor.

Other Primary Cavity Excavators

White-headed and Lewis' Woodpeckers and Williamson's Sapsucker

There would be no direct effects associated with Alternative 1 on the white-headed and Lewis' woodpeckers or the Williamson's sapsucker. No change to existing habitat would occur with this alternative. Indirect effects would include the maintenance of the current condition when compared to changes that would occur under Alternatives 2 and 3. With this alternative, existing habitat would be maintained into the long term, with little change, either in increases or decreases in acres of habitat. For white-headed and Lewis' sapsuckers, suitable habitat would maintain around 95 acres, or may decline if these habitats develop closed canopy multi-stratum habitats. Williamson's sapsuckers would maintain 8,107 acres of habitat in the Project Area. Snag densities would likely slowly increase particularly in Williamson's sapsucker habitat, as insect related mortality continues.

Snags and Primary Foraging Habitat

Snag densities in both large snag (>21" dbh) and small snags (10"-21" dbh) would increase over time with this alternative. Large snags would be created as a result of insect mortality related to high stand density conditions. Approximately 500 acres of ponderosa pine dominated forest currently contains large tree structure (>21" dbh) and are in an overly dense stand condition that leaves them susceptible to insect related mortality. In these areas, large snags are already developing, and would continue to increase in large snag densities due to insect related mortality. This would continue to provide higher quality nesting habitat for the Williamson's sapsucker. However, due to the continued high density stand conditions that would persist, such snag development would not benefit white-headed or Lewis' woodpeckers as other habitat features would not develop. An additional 6,149 acres of habitat with average tree diameters of 9-21" dbh in the ponderosa pine dominated habitat types would also continue to provide snag habitat for the

Williamson's sapsucker. These acres are also overstocked, and likely contain some large diameter trees (>21" dbh) plus trees in the 15-21" dbh that would provide some suitable nesting habitat. This alternative would provide little suitable habitat for the white-headed and Lewis' woodpecker, other than the existing 95 acres currently in a suitable habitat condition.

Black-backed Woodpecker

With implementation of Alternative 1, no direct or indirect effects would be noted for suitable habitat for this species. In the short, mid and long term, roughly 888 acres of identified suitable habitat would exist. It would be likely that additional suitable habitat would also develop over that time, for a gradual increase in suitable habitat.

More importantly, habitat not typically identified with black-backed woodpeckers would be maintained as well in the short to mid term, and likely continue to increase in the long term. Ponderosa pine and Douglas fir habitats are not traditionally considered black-backed woodpecker habitat. However, due to the high stand densities, and resulting creation of patches of small diameter snags from insect mortality, additional effective habitat for this species is present. Based upon acres of forest habitat at risk of insect attack due to high stand densities, approximately 11,209 acres of effective habitat is present in the Project Area. With this alternative, those acres of habitat would be maintained in the short to mid-term, and likely continue into the long term as well. Given trends of stand densities, additional acres of effective habitat may also develop in the mid to long term, further increasing the amount of effective habitat for the black-backed woodpecker in the Project Area.

Snags and Primary Foraging Habitat

Snag habitat for the black-backed woodpecker would be maintained or increase over time with the implementation of this alternative. On approximately 11,209 acres of habitat in the Project Area, high stand densities are resulting in high snag densities in the small to medium diameter snag sizes (10"-15" dbh). The bulk of the 11,209 acres of high density stands are abundant in these tree diameters and are proving susceptible to insect related mortality. This habitat, in addition to the 888 acres of traditional suitable habitat that exists in the Project Area is providing abundant snags for foraging and nesting for this species. Over the mid to long term, snag densities would be expected to remain high in these areas as insect related mortality continues under those stand conditions.

Hairy Woodpecker

With implementation of Alternative 1, no direct or indirect effects to this species or its habitat would be anticipated. Approximately 11,209 acres of suitable habitat exists in the Project Area, and would remain in a suitable habitat condition over the early to long term. No changes to existing habitat would occur with this alternative, as no activities are proposed. It would be likely that in the mid to long term, additional acres of suitable habitat would develop as other conifer stands develop denser stand densities, and become more prone to insect mortality and snag creation.

Northern Flicker

With implementation of Alternative 1, no direct or indirect effects to this species or its habitat would be anticipated. Approximately 621 acres of suitable habitat was identified with the Wildhab analysis of existing vegetation data. Acres of suitable habitat would not be expected to change over the short to long term.

Cumulative Effects – Alternative 1

The primary indicator for cumulative effects of past management actions on habitat for the pileated woodpecker and other primary cavity excavators is the comparison of current conditions with the historic range of variability (HRV) for habitats in the Project Area. As noted in the silvicultural section of this proposed EA and the Silviculture Report, all plant association groups (PAG) and their associated seral stages are outside the HRV. Some PAGs and associated seral stages are above the HRV expected for that combination, while others are below HRV. Table 40 below comes from the Silviculture Report and displays each of the PAGs and seral stages present in the Project Area.

Table 40. Seral Stage, Abundance, Dominant Tree Species, and Departure from HRV for Each PAG.

PAG	Seral Stage	Dominant Species Composition	Area of PAG	Proportion of PAG	Departure from HRV
Dry Grand Fir					
	Early	PP	78 ac.	8%	404 ac. below
	Mid	PP, DF, GF	424 ac.	44%	144 ac. above
	Late	GF, DF	468 ac.	48%	273 ac. above
Douglas-fir					
	Early	PP, WJ	758 ac.	28%	722 ac. below
	Mid	PP, DF, WJ	1,511 ac.	56%	1,333 ac. above
	Late	DF, PP	439 ac.	16%	48 ac. above
Mesic Ponderosa					
	Early	PP, WJ	716 ac.	10%	206 ac. above
	Mid	PP, WJ, DF	3,547 ac.	48%	3,325 ac. above
	Late	PP, DF	3,111 ac.	42%	2,862 ac. below
Dry Ponderosa					
	Early	WJ	704 ac.	23%	118 ac. above
	Mid	PP, WJ	1,312 ac.	42%	1,157 ac. above
	Late	PP	1,098 ac.	35%	564 ac. below
Western Juniper					
	Early	WJ	1,360 ac.	41%	1,500 ac. below
	Mid	WJ	1,549 ac.	47%	1,383 ac. above
	Late	WJ	416 ac.	12%	231 ac. above

Source: Willow Pine Viable Ecosystem HRV spreadsheet, Silviculture Report, Appendix G.

Notes: The western juniper woodland and steppe PAGs have been combined.

PP = ponderosa pine, DF = Douglas-fir, GF = grand fir, WJ = western juniper

The Douglas-fir and mesic and dry ponderosa pine PAGs in particular show strong differences between HRV and current conditions. The column on the far right shows the estimated departure of acres of current habitat from HRV. In the mid seral stages (generally dense middle sized stand structure condition [9-21" dbh]), all three PAGs are well above HRV levels. Mesic ponderosa pine, the most abundant PAG in the Project Area, demonstrates a particular large skew above HRV. In contrast, the late seral stages, representing large tree structure (>21" dbh), are at or just above HRV for the Douglas-fir PAG and below HRV for the mesic and dry ponderosa pine PAGs. For early seral stages all three PAGs are also above HRV, but not nearly as dramatic as the two later stages.

In the dry grand fir PAG, middle and late seral stages are above HRV, with early seral conditions below HRV. The dry grand fir PAG represents only 6% of the Project Area.

What this demonstrates is an abundance of middle seral stages in the Douglas-fir and ponderosa pine PAGs, which substantially exceed what occurred historically and a deficit of late seral, large tree structured communities in ponderosa pine PAGs. The amount of habitat present in each seral stage and PAG influences the habitats and species of primary cavity excavators present in the Project Area.

Snag distribution and diameter classes are affected by this current condition. In absence of large tree structure, large snags are generally scarce, with the exception of some high density large structure stands where insect mortality has recently created large snags. For the remainder of the Project Area, however, large snags are scarce or absent. Small snags, however, are abundant and generally well distributed in the Project Area. This is a function of the abundance of high density mid seral habitats that are prone to insect and disease mortality. Snags are generally smaller in diameter (9-15" dbh) and distributed in clumps of 3-15 or more. These clumps, in turn, are scattered through out the project area. Small diameter snags are likely more abundant than what occurred historically, due to the changes in forest stand structure and density.

For the pileated woodpecker, habitat historically was not abundant, due primarily to the lack of suitable PAGs and associated seral stages. Current conditions again reflect very limited habitat available for the species, particularly when compared to the habitat's distribution across the landscape. For the white-headed and Lewis' woodpeckers, habitat historically was more abundant, where late successional ponderosa pine and Douglas-fir PAGs provided the more open, large tree ponderosa pine habitats these species prefer. These habitats were lower in snag densities as well, and snags were primarily composed of large snags (>21" dbh). Current conditions, reflected in the deviation from HRV for the late seral ponderosa pine PAGs show a substantial absence of that primary habitat type. For the Williamson's sapsucker, habitat historically was likely less abundant. This species selects for very high snag densities in both large and small diameter snag classes. Middle seral habitat conditions for the Douglas-fir and ponderosa pine SAGs were much less abundant historically. It's these habitats, now in abundance and well above HRV that are providing for higher densities of small snags (9-21" dbh). Habitat for this species has increased over time. Likewise, the black-backed and hairy woodpeckers which select for areas of high snag densities, found less habitat historically than what is present currently. Again, the abundance of mid seral habitats, above HRV levels, has created stand conditions that produce higher densities of small diameter snags. Such conditions were not as common or abundant historically.

The northern flicker, because of its habitat generalist tendencies, probably has not seen much of a shift in populations or potential habitat. However, it does share similar habitat preferences to the white-headed and Lewis' woodpeckers, selecting for mature open ponderosa pine habitats. As such, suitable habitat may have been more abundant historically.

Past management actions and activities have cumulatively contributed to the current condition of primary cavity excavator habitat in the project area. Activities include past timber harvest and thinning activities, suppression of fire and the changes to effective fire regimes, and the harvest of commercial and/or personal use firewood from the project area. Cumulatively, these actions have affected the density and size classes of snag habitats and the general condition for forest habitat for primary cavity excavators.

Appendix A of the EA highlights the list of past timber sale and other thinning actions that have occurred in the project area. Details of specific prescriptions and harvest were not readily available, and some actions occurred while the forest habitat was under private ownership. As such, specific effects of each action are not well documented or known, however, in reviewing the differences in HRV and current conditions (Table 40), particularly the lack of late seral habitats and documented scarcity of large trees, its clear that historic harvest and thinning activities adversely affected the condition of habitats for several species (white-headed and Lewis' woodpecker) and the abundance of large snags.

Fire suppression and the effective change of fire regimes have also cumulatively contributed to the changes in forest structure and snags in the Project Area. Fire historically was an active disturbance in the Project Area, and influenced the development of the open, large tree structure ponderosa pine habitats that were abundant. Frequent, low severity fires helped develop the open stand and mature tree conditions that were present. This in turn provided habitat for species like the white-headed and Lewis' woodpecker and the northern flicker. However, coupled with timber harvest, which removed much of the large pine structure, the absence of these frequent low severity fire events allowed for a denser and more diverse forest habitat to develop. Where open, large structure ponderosa pine forests historically occurred, a combination of harvest and lack of fire disturbance has resulted in dense, younger ponderosa pine and mixed conifer stands, generally multi-storied, with little or no large tree structure present. This is reflected in Table 40. The high density conditions of these stands have made them susceptible to insect and disease effects, in turn creating more abundant small snags. As a result of these changes, species such as the Williamson's sapsucker and black-backed and hairy woodpeckers, have found more abundant habitat conditions, particularly with the relatively recent increase in small snags through insect mortality.

Prescribed fire actions have recently occurred in the Project Area. The Sunflower Natural Fuels Project has just less than 4,500 acres of ponderosa pine habitat scheduled for broadcast burning. Roughly 1/3 of the scheduled burning has occurred to date. Most of the burning is designed to maintain relatively open forest conditions that already exist, with little change in forest structure or density.

Finally, commercial and/or personal use firewood cutting has also affected snag habitats in the project area. Current regulations prohibit the felling of ponderosa pine, Douglas-fir and grand fir snags in the project area for personal use firewood. However, no such regulation applies to firewood used for campfires within the forest. Also, such regulations may not completely prohibit the felling of snags for personal firewood. Illegal felling and harvest of snags under the personal use firewood program is documented elsewhere on the district and is suspected in the project area. The bulk of firewood harvest is associated with the existing road network in the project area. Larger blocks of habitat are less affected by snag harvest through firewood gathering than those of smaller blocks with higher road densities.

Alternative 1 would contribute to the cumulative effects of past management actions in the project area. In particular management actions that have created the mid seral, high density, small diameter stands that are currently abundant and well above HRV. Alternative 1 would not implement any management actions in the Project Area, and thus maintain the existing condition. Absence of any management action, particularly thinning and fuels treatment, would continue and add to the cumulative effects of past harvest and fire suppression, which have developed these dense, smaller diameter stands. This would maintain an abundance of smaller snags (< 21" dbh), lack of large snags (>21" dbh), and denser forest conditions through the long term. Species such as the white-headed woodpecker and Lewis' woodpecker would have little habitat available for use, while other species like the black-backed and hairy woodpeckers and Williamson's sapsucker would have abundant snag and forest habitat well into the long term.

Direct and Indirect Effects – Alternative 2

Fuels Treatments

The following effects analysis focuses on the mechanical treatments of vegetation through the proposed commercial and noncommercial thinning described in Chapter 2 for this alternative. The

other prominent activity proposed for this alternative is the use of prescribed fire to treat both post treatment fuels (logging and thinning slash) and natural fuels in the Project Area. The prescribed fire activities proposed have the potential to affect cavity excavators through modification of habitat. Specifically, changes in densities of snags and down logs that provide nesting and foraging opportunities for many of these species.

Prescribed fires will both consume and create snag and down log habitats, depending upon site specific conditions and the prescriptions that are implemented. The degree to which these effects occur varies and is not easily predicted. It is assumed that some existing snags and down logs would be consumed with the 7,070 acres of prescribed burning that would be implemented. The exact number is not predictable. At the same time, it is also assumed that new snags would be created as a result of fire induced mortality on existing live trees. This would occur by both direct effects (fire kills the tree, creating the snag) and indirect effects (fire stresses or weakens the tree, and secondary mortality agents [insects and disease] kill the tree). Factors affecting whether or not snags or down logs are consumed or created are not predictable as to provide an accurate accounting of changes in snag and down log numbers.

In regards to snags consumed versus those created, a trend towards smaller, harder snags would likely result. This is due to a) existing snag and down log habitats, particularly larger habitats (<15" dbh/diameter), are older and softer, and more likely to be consumed by fire, and b) the newly created snags and down logs will be from smaller, fire killed trees that would be fire hardened and have less/no internal rot or other decomposition. This would be particularly true in the short to mid term.

Due to the lack of large blocks of suitable habitat, pileated woodpeckers would be minimally affected by this activity. Burning would primarily occur in the ponderosa pine and Douglas-fir forest communities, further reducing the risk to habitat effects.

White-headed woodpeckers and Lewis' woodpeckers may see reductions in suitable habitat through the consumption of large, soft ponderosa pine snags. However, those effects would likely be minimal due to the existing poor habitat conditions, in the form of a lack of large ponderosa pine snags and suitable LOS habitat. Fire created snags, particularly where large snags may be created, would improve habitat for this species in the mid to long term.

Williamson's sapsucker habitat would improve on the acres burned as additional small foraging snags and small to medium nesting snags were created through the burning. Likewise, the black-backed and hairy woodpeckers would find additional habitat in the snags created by the prescribed fire in the short to mid term. Increased foraging, and some increase in nesting habitat would result. Northern flickers would generally see no change in habitat through the prescribed fire activities proposed.

Pileated Woodpecker

Alternative 2 would result in a reduction of suitable habitat for the pileated woodpecker in the Project Area. With implementation of this alternative, 777 acres of suitable habitat would remain. The reduction in suitable habitat by 462 acres would be the result of commercial thinning in four stands of existing habitat. Each of these stands are isolated patches of suitable habitat that essentially do not function as pileated woodpecker habitat. This is due to the lack of large blocks of suitable habitat needed for the species. While a reduction in habitat would occur, it would not likely affect pileated woodpeckers as suitable habitat in larger continuous blocks are largely absent.

Other Primary Cavity Excavators

White-headed and Lewis' Woodpeckers and Williamson's Sapsucker

There would be indirect effects to white-headed and Lewis' woodpeckers and Williamson's sapsuckers with the implementation of Alternative 2. Implementation of Alternative 2 would result in an increase in suitable habitat for the white-headed and Lewis' woodpeckers and a decline in suitable habitat for the Williamson's sapsucker. White-headed and Lewis' woodpecker habitat would increase by 2,619 acres to a total of 2,714 acres of suitable habitat. This would be the result of commercial thinning actions in ponderosa pine dominated stands that have existing high stand densities and multiple canopy layers. The thinning would reduce stand densities and reduce canopy complexity such that habitat would be suitable for white-headed and Lewis' woodpeckers. In the long term, additional acres of habitat thinned through this alternative would develop into suitable white-headed and Lewis' woodpecker habitat, increasing the total acreage of habitat to 3,273 acres.

Suitable habitat for the Williamson's sapsucker would be reduced by 829 acres of 7,278 acres of suitable habitat. The reduction in habitat would coincide with the reduction in stand densities that would be associated with commercial thinning on those 829 acres. Suitable habitat for this species would still be abundant and would meet the needs of this species. Over the long term, additional acres of habitat would develop, and an expected acreage of habitat at 8,625 acres. Existing snag densities would be maintained with this alternative in the short term. In the mid to long term, as insect related mortality continues in the denser ponderosa pine and Douglas fir stands, snag densities would be expected to maintain (replacement of existing snags that fall) or increase.

Snags and Primary Foraging Habitat

No snags would be harvested under Alternative 2, other than for compliance with OSHA regulations. Snags located at landings and immediately adjacent to skid trails may be felled if deemed a hazard to harvest operations. Design criteria would be implemented to minimize the potential for conflict with snag presence and harvest operations.

With Alternative 2, existing large snags would be maintained in the units commercially and non-commercially thinned. Most of the large snags present were recently created from insect related mortality. Exact snag densities are not known. On the 2,714 acres of newly created suitable habitat for the white-headed and Lewis' woodpeckers, snag densities would likely meet the 50% (1.8 snags/acre) to 80% (3.8 snags/acre) tolerance levels for large snag densities. This would equate to high quality habitat for both species. These conditions would be expected to maintain into the mid to long term.

Primary foraging habitat for both species is generally not tied to snags, as both feed on airborne insects or on seed/mast crops from various vegetation. As such, high snag densities in the smaller diameters would not be required. Existing small diameter snags in the 2,619 acres of treated habitat would be maintained, but over the mid to long term would decline as they deteriorate and fall, and are not replaced.

For the Williamson's sapsucker, existing snag habitat on the 7,278 acres of suitable habitat would be maintained in the short term. Current snag densities are not known. Over the mid to long term, snag habitats would be maintained or increased as insect related mortality continues in the high density ponderosa pine dominated stands. Snag densities would be expected to achieve the 50%

tolerance level (28.4 snags/acre >10" dbh; 8.6 snags/acre >20" dbh) and possibly the 80% tolerance level (49.7 snags/acre >10" dbh; 16.6 snags/acre >20" dbh) in the mid to long term on the 7,278 acres of habitat. As snags deteriorate and fall, they would be replaced by new insect created snags over time.

Black-backed Woodpecker

Alternative 2 would result in a decrease in suitable habitat for the black-backed woodpecker habitat in the Project area. This would result in indirect effects. A total of 351 acres of suitable habitat would be lost with this alternative, resulting in a total acreage of 537 acres of habitat. This would be the result of commercial thinning in several stands of grand fir habitat resulting in reduced stand densities and canopy closures. Over the long term, additional habitat would develop as other stand increase in stand density. By the long term, an estimated 589 acres of suitable habitat would be present, an increase in 52 acres. Snags would not be directly affected by this alternative, as snag harvest would not occur. The only exception would be in the need to maintain OSHA safety requirements where a snag would be felled to provide for worker safety.

With the implementation of Alternative 2, there would also be a reduction in suitable habitat in forest types not typically considered black-backed woodpecker habitat. With this alternative, the number of acres of overly dense habitat which provides suitable habitat for the black-backed woodpecker would be reduced by 3,519 acres to 7,690 acres of habitat. The reduction of 3,519 acres of habitat would be the result of commercial thinning that would reduce stand densities, and thus the potential for insect related mortality.

In the short term, the 3,519 acres of habitat affected by harvest would likely continue to function, as existing snags would be maintained and be available for foraging and nesting black-backed woodpeckers, however, in the mid to long term, as these smaller diameter snags fall, they would not be replaced in these open, low forest density habitats, and thus no longer provide suitable habitat. In the long term, total acres of suitable habitat in these vegetation types (Douglas-fir and ponderosa pine types) would increase as stand densities in other stand increase. The increase in acres of habitat that would be expected is not known.

Snags and Primary Foraging Habitat

No snags would be harvested under Alternative 2, other than for compliance with OSHA regulations. Snags located at landings and immediately adjacent to skid trails may be felled if deemed a hazard to harvest operations. Design criteria would be implemented to minimize the potential for conflict with snag presence and harvest operations.

With Alternative 2, suitable snag habitat would be maintained on the existing 12,097 acres of traditional and suitable habitat in the project area. Since no snags are identified for harvest, and only those needed to be felled for OSHA compliance, snag densities on these acres would not be expected to change such that habitat quality would be affected. However, in the mid to long term, The 3,519 acres of suitable habitat that would be thinned with this alternative would decline in habitat quality. Snag densities on these acres would decline as existing snags deteriorate and fall and are not replaced.

The thinning treatments proposed would reduce stand densities, reducing their susceptibility to insect related mortality. On the remaining 7,690 acres of suitable habitat, snag densities would be expected to remain high as insect related mortality continues, particularly in the smaller snag

diameters. On these acres, snag densities would be expected to maintain at least a 50% tolerance level for small snags (>10" dbh; 13.6 snags/acre) and likely an 80% tolerance level for small snags (29.2 snags/acre). Large snag diameter tolerance levels would likely reach 50% (>20" dbh; 1.4 snags/acre), but may not reach 80% tolerance levels (5.7 snags/acre) due to the general absence of large trees on most of those acres.

Hairy Woodpecker

Implementation of Alternative 2 would result in indirect effects to hairy woodpeckers through the reduction in suitable habitat for the species. A reduction of 3,519 acres of suitable habitat, to a total of 7,690 acres of habitat would result from this alternative. In the short term, existing snags on the 3,519 acres of habitat that would be commercially harvested would continue to function, as most of the snags would not be affected by the harvest actions. However, in the mid to long term, as those existing snags fall to the ground, they would not be replaced. The open stand densities created by the thinning actions would not be conducive to new snag creation as the remaining stand would be much less prone to insect induced mortality. Over the long term, an increase in suitable acres would likely occur as currently unsuitable habitat develops higher stand densities, and as a result, increased snag creation through insect induced mortality. The number of increased acres in the long term is not known.

Northern Flicker

Alternative 2 would result in the increase in acres of suitable habitat for the northern flicker. A total of 3,240 acres of suitable habitat would be available with the implementation of this alternative. This would be an increase of 2,619 acres of habitat from the existing condition. The increase in acres would come from the commercial thinning of ponderosa pine habitats that are in a high density condition. The thinning proposed with this alternative would open up those stands, maintaining existing large tree structure, and provide a more suitable habitat condition.

Cumulative Effects – Alternative 2

The Cumulative Effects section for Alternative 1 describes in some detail the past, present, and reasonably foreseeable future actions that have occurred in the Project Area and their effect upon primary cavity excavator species. Refer to that section for more information on those effects.

Implementation of Alternative 2 would result in additional cumulative effects to primary cavity excavators in the Project Area. The commercial and non-commercial thinning and prescribed fire actions proposed would result in changes to habitat conditions for white-headed, Lewis', black-backed, and hairy woodpeckers, Williamson's sapsuckers, and northern flickers.

The activities proposed would create additional habitat for the white-headed and Lewis's woodpecker and the northern flicker, thereby counteracting many of the cumulative effects of past timber harvest, fire suppression and changes to effective fire regimes. It would add to the cumulative effects of recent harvest and thinning treatments which were designed to promote habitat for these species (Sunny Timber Sale). The 2,619 acres of treatment that would create an open ponderosa pine type habitat would add to the 63 acres of the Sunny Timber Sale that created similar suitable habitat in the project area. In the mid to long term, the level of effect would further increase as additional suitable habitat develops in ponderosa pine habitat that is thinned.

The activities proposed would reduce the amount of habitat for the Williamson's sapsucker and black-backed and hairy woodpeckers by reducing habitat quality on 3,519 acres of conifer habitat. This reduction would be cumulative to the 531 acres of habitat reduced in quality by the Sunny Timber Sale and the Bird non-commercial thinning project. These effects would counter the cumulative effects of historic timber harvest and the suppression of fire and changes to effective fire regime on those acres.

Direct and Indirect Effects – Alternative 3

Fuels Treatments

The following effects analysis focuses on the mechanical treatments of vegetation through the proposed commercial and noncommercial thinning described in Chapter 2 for this alternative. The other prominent activity proposed for this alternative is the use of prescribed fire to treat both post treatment fuels (logging and thinning slash) and natural fuels in the Project Area. The prescribed fire activities proposed have the potential to affect cavity excavators through modification of habitat. Specifically, changes in densities of snags and down logs that provide nesting and foraging opportunities for many of these species.

Prescribed fires will both consume and create snag and down log habitats, depending upon site specific conditions and the prescriptions that are implemented. The degree to which these effects occur varies and is not easily predicted. It is assumed that some existing snags and down logs would be consumed with the 6,575 acres of prescribed burning that would be implemented. The exact number is not predictable. At the same time, it is also assumed that new snags would be created as a result of fire induced mortality on existing live trees. This would occur by both direct effects (fire kills the tree, creating the snag) and indirect effects (fire stresses or weakens the tree, and secondary mortality agents [insects and disease] kill the tree). Factors affecting whether or not snags or down logs are consumed or created are not predictable as to provide an accurate accounting of changes in snag and down log numbers. In regards to snags consumed versus those created, a trend towards smaller, harder snags would likely result. This is due to a) existing snag and down log habitats, particularly larger habitats (<15" dbh/diameter), are older and softer, and more likely to be consumed by fire, and b) the newly created snags and down logs will be from smaller, fire killed trees that would be fire hardened and have less/no internal rot or other decomposition. This would be particularly true in the short to mid term.

Due to the lack of large blocks of suitable habitat, pileated woodpeckers would be minimally affected by this activity. Burning would primarily occur in the ponderosa pine and Douglas-fir forest communities, further reducing the risk to habitat effects.

White-headed woodpeckers and Lewis' woodpeckers may see reductions in suitable habitat through the consumption of large, soft ponderosa pine snags. However, those effects would likely be minimal due to the existing poor habitat conditions, in the form of a lack of large ponderosa pine snags and suitable LOS habitat. Fire created snags, particularly where large snags may be created, would improve habitat for this species in the mid to long term.

Williamson's sapsucker habitat would improve on the acres burned as additional small foraging snags and small to medium nesting snags were created through the burning. Likewise, the black-backed and hairy woodpeckers would find additional habitat in the snags created by the prescribed fire in the short to mid term. Increased foraging, and some increase in nesting habitat would result.

Northern flickers would generally see no change in habitat through the prescribed fire activities proposed.

Pileated Woodpecker

Alternative 3 would result in a reduction of suitable habitat for the pileated woodpecker in the Project Area. With implementation of this alternative, 905 acres of suitable habitat would remain. The reduction in suitable habitat by 334 acres would be the result of commercial thinning in four stands of existing habitat. Each of these stands are isolated patches of suitable habitat that essentially do not function as pileated woodpecker habitat. This is due to the lack of large blocks of suitable habitat needed for the species. While a reduction in habitat would occur, it would not likely affect pileated woodpeckers as suitable habitat in larger continuous blocks are largely absent.

Other Primary Cavity Excavators

White-headed and Lewis' Woodpeckers and Williamson's Sapsucker

There would be indirect effects to white-headed and Lewis' woodpeckers and Williamson's sapsuckers with the implementation of Alternative 3. Implementation of Alternative 3 would result in an increase in suitable habitat for the white-headed and Lewis' woodpeckers and a decline in suitable habitat for the Williamson's sapsucker. White-headed and Lewis' woodpecker habitat would increase by 2,108 acres to a total of 2,203 acres of suitable habitat. This would be the result of commercial thinning actions in ponderosa pine dominated stands that have existing high stand densities and multiple canopy layers. The thinning would reduce stand densities and reduce canopy complexity such that habitat would be suitable for white-headed and Lewis' woodpeckers. In the long term, additional acres of habitat thinned through this alternative would develop into suitable white-headed and Lewis' woodpecker habitat, increasing the total acreage of habitat to 2,649 acres.

Suitable habitat for the Williamson's sapsucker would be reduced by 826 acres of 7,281 acres of suitable habitat. The reduction in habitat would coincide with the reduction in stand densities that would be associated with commercial thinning on those 826 acres. Suitable habitat for this species would still be abundant and would meet the needs of this species.

Over the long term, additional acres of habitat would develop, and an expected acreage of habitat at 8,383 acres. Existing snag densities would be maintained with this alternative in the short term. In the mid to long term, as insect related mortality continues in the denser ponderosa pine and Douglas fir stands, snag densities would be expected to maintain (replacement of existing snags that fall) or increase.

Snags and Primary Foraging Habitat

No snags would be harvested under Alternative 3, other than for compliance with OSHA regulations. Snags located at landings and immediately adjacent to skid trails may be felled if deemed a hazard to harvest operations. Design criteria would be implemented to minimize the potential for conflict with snag presence and harvest operations.

With Alternative 3, existing large snags would be maintained in the units commercially and non-commercially thinned. Most of the large snags present were recently created from insect related mortality. Exact snag densities are not known. On the 2,203 acres of newly created suitable

habitat for the white-headed and Lewis' woodpeckers, snag densities would likely meet the 50% (1.8 snags/acre) to 80% (3.8 snags/acre) tolerance levels for large snag densities (>20" dbh). This would equate to high quality habitat for both species. These conditions would be expected to maintain into the mid and long term. Primary foraging habitat for both species is generally not tied to snags, as both feed on airborne insects or on seed/mast crops from various vegetation. As such, high snag densities in the smaller diameters would not be required. Existing small diameter snags in the 2,108 acres of treated habitat would be maintained, but over the mid to long term would decline as they deteriorate and fall, and are not replaced.

For the Williamson's sapsucker, existing snag habitat on the 7,281 acres of suitable habitat would be maintained in the short term. Current snag densities are not currently known. Over the mid to long term, snag habitats would be maintained or increased as insect related mortality continues in the high density ponderosa pine dominated stands. Snag densities would be expected to achieve the 50% tolerance level (28.4 snags/acre >10" dbh; 8.6 snags/acre >20" dbh) and possibly the 80% tolerance level (49.7 snags/acre >10" dbh; 16.6 snags/acre >20" dbh) in the mid to long term on the 7,281 acres of habitat. As snags deteriorate and fall, they would be replaced by new insect created snags over time.

Black-backed Woodpecker

Alternative 3 would result in a decrease in suitable habitat for the black-backed woodpecker habitat in the Project area. This would result in indirect effects. A total of 414 acres of suitable habitat would be lost with this alternative, resulting in a total acreage of 474 acres of habitat. This would be the result of commercial thinning in several stands of grand fir habitat resulting in reduced stand densities and canopy closures. Over the long term, additional habitat would develop as other stand increase in stand density. By the long term, an estimated 488 acres of suitable habitat would be present, an increase in 14 acres. Snags would not be directly affected by this alternative, as snag harvest would not occur. The only exception would be in the need to maintain OSHA safety requirements where a snag would be felled to provide for worker safety.

With the implementation of Alternative 3, there would also be a reduction in suitable habitat in forest types not typically considered black-backed woodpecker habitat. With this alternative, the number of acres of overly dense habitat which provides suitable habitat for the black-backed woodpecker would be reduced by 2,750 acres to 8,473 acres of habitat. The reduction of 2,750 acres of habitat would be the result of commercial thinning that would reduce stand densities, and thus the potential for insect related mortality.

In the short term, the 2,750 acres of habitat affected by harvest would likely continue to function, as existing snags would be maintained and be available for foraging and nesting black-backed woodpeckers. However, in the mid to long term, as these smaller diameter snags fall, they would not be replaced in these open, low forest density habitats, and thus no longer provide suitable habitat. In the long term, total acres of suitable habitat in these vegetation types (Douglas-fir and ponderosa pine types) would increase as stand densities in other stand increase. The increase in acres of habitat that would be expected is not known.

Snags and Primary Foraging Habitat

No snags would be harvested under Alternative 3, other than for compliance with OSHA regulations. Snags located at landings and immediately adjacent to skid trails may be felled if

deemed a hazard to harvest operations. Design criteria would be implemented to minimize the potential for conflict with snag presence and harvest operations.

With Alternative 3, suitable snag habitat would be maintained on the existing 12,097 acres of traditional and suitable habitat in the project area in the short term. Since no snags are identified for harvest, and only those needed to be felled for OSHA compliance, snag densities on these acres would not be expected to change such that habitat quality would be affected, however, in the mid to long term, the 2,750 acres of suitable habitat that would be thinned with this alternative would decline in habitat quality. Snag densities on these acres would decline as existing snags deteriorate and fall and are not replaced.

The thinning treatments proposed would reduce stand densities such that they would no longer be susceptible to insect related mortality. On the remaining 8,473 acres of suitable habitat, snag densities would be expected to remain high as insect related mortality continues, particularly in the smaller snag diameters. On these acres, snag densities would be expected to maintain at least a 50% tolerance level for small snags (>10" dbh; 13.6 snags/acre) and likely an 80% tolerance level for small snags (29.2 snags/acre). Large snag diameter tolerance levels would likely reach 50% (>20" dbh; 1.4 snags/acre), but may not reach 80% tolerance levels (5.7 snags/acre) due to the general absence of large trees on most of those acres.

Hairy Woodpecker

Implementation of Alternative 3 would result in indirect effects to hairy woodpeckers through the reduction in suitable habitat for the species. A reduction of 2,750 acres of suitable habitat, to a total of 8,473 acres of habitat would result from this alternative. In the short term, existing snags on the 2,750 acres of habitat that would be commercially harvested would continue to function, as most of the snags would not be affected by the harvest actions, however, in the mid to long term, as those existing snags fall to the ground, they would not be replaced.

The open stand densities created by the thinning actions would not be conducive to new snag creation as the remaining stand would be much less prone to insect induced mortality. Over the long term, an increase in suitable acres would likely occur as currently unsuitable habitat develops higher stand densities, and as a result, increased snag creation through insect induced mortality. The number of increased acres in the long term is not known.

Northern Flicker

Alternative 3 would result in the increase in acres of suitable habitat for the northern flicker. A total of 2,619 acres of suitable habitat would be available with the implementation of this alternative. This would be an increase of 1,998 acres of habitat from the existing condition. The increase in acres would come from the commercial thinning of ponderosa pine habitats that are in a high density condition. The thinning proposed with this alternative would open up those stands, maintaining existing large tree structure, and provide a more suitable habitat condition.

Cumulative Effects – Alternative 3

The Cumulative Effects section for Alternative 1 describes in some detail the past, present, and reasonably foreseeable future actions that have occurred in the Project Area and their effect upon primary cavity excavator species. Refer to that section for more information on those effects.

Implementation of Alternative 3 would result in additional cumulative effects to primary cavity excavators in the Project Area. The commercial and non-commercial thinning and prescribed fire actions proposed would result in changes to habitat conditions for white-headed, Lewis', black-backed, and hairy woodpeckers, Williamson's sapsuckers, and northern flickers.

The activities proposed would create additional habitat for the white-headed and Lewis's woodpecker and the northern flicker, thereby counteracting many of the cumulative effects of past timber harvest, fire suppression and changes to effective fire regimes. It would add to the cumulative effects of recent harvest and thinning treatments which were designed to promote habitat for these species (Sunny Timber Sale). The 2,108 acres of treatment that would create an open ponderosa pine type habitat would add to the 63 acres of the Sunny Timber Sale that created similar suitable habitat in the project area. In the mid to long term, the level of effect would further increase as additional suitable habitat develops in ponderosa pine habitat that is thinned.

The activities proposed would reduce the amount of habitat for the Williamson's sapsucker and black-backed and hairy woodpeckers by reducing habitat quality on 2,750 acres of conifer habitat. This reduction would be cumulative to the 531 acres of habitat reduced in quality by the Sunny Timber Sale and the Bird non-commercial thinning project. These effects would counter the cumulative effects of historic timber harvest and the suppression of fire and changes to effective fire regime on those acres.

Summary of Effects and Conclusions

Pileated Woodpecker

Suitable habitat for the pileated woodpecker is limited in the Project Area. Three dedicated old growth areas are identified in the Project area (Table 39). They were designated to provide habitat for pileated woodpeckers. Across the project area, 1,239 acres of suitable habitat exists in the project area. However, as demonstrated in Map 5, the existing habitat is fragmented and dispersed across the entire project area. Suitable plant association groups (dry grand fir) only make up 6% of the project area as a whole. Pileated woodpeckers, while documented in the project area (mostly associated with or near existing dedicated old growth habitat), are not abundant, due to habitat limitations.

Alternative 1 would maintain the current condition for pileated woodpecker habitat. The bulk of the existing habitat would be associated with the dedicated old growth blocks in the project area.

Alternative 2 would reduce pileated woodpecker habitat by 462 acres across the project area, to a total of 777 acres. However, the 462 acres of habitat affected are not associated with or within the designated old growth blocks where the bulk of the habitat exists. As such, the effects to pileated woodpeckers would be minimal or non-existent.

Alternative 3 would reduce pileated woodpecker habitat by 334 acres across the project area, to a total of 905 acres. Similar to Alternative 2, the affected acres are not associated with dedicated old growth areas where the majority of suitable habitat for this species exists. As such, effects to the pileated woodpeckers would be minimal or non-existent.

Due to the fragmented nature and distribution of potential pileated woodpecker habitat in the project area, none of the three alternatives are expected to have adverse effects to pileated woodpeckers in the Project Area.

White-headed and Lewis' Woodpecker

Habitat for this species is very limited, with only 95 acres of suitable habitat detected through the Wildhab assessment. Historically, habitat for both species was much more abundant, and was a dominant feature across the landscape. HRV analysis indicates this condition and change over time.

Alternative 1 would maintain the current condition and absence of suitable habitat for these species across the Project Area. No additional habitat would be created in the short term. In the mid to long term, existing habitat would be maintained or further decline as stand densities in these habitats increase and make the habitat unsuitable.

Alternative 2 would increase suitable habitat for this species to 2,714 acres in the Project Area in the short term. The commercial and non-commercial thinning proposed would convert currently unsuitable habitat to suitable habitat in the short term by reducing stand density and structure complexity and maintaining existing large trees in those stands. Over the long term, 559 acres of additional habitat would develop, creating a total of 3,273 acres of suitable habitat after 30-40 years. This would be the result of 559 acres of currently unsuitable habitat being treated by commercial and non-commercial thinning with this alternative.

In the short term, those acres would still be unsuitable, primarily due to the lack of large tree structure. However, over the following 30-40 years, large tree structure would develop at an accelerated rate due to the open growing conditions created by the thinning and provide suitable habitat conditions for these species at that time. Large snags would be present on these acres in the short to long term, and in densities that would meet a 50-80% tolerance level based upon DecAID information.

Alternative 3 would increase suitable habitat for this species to 2,203 acres in the Project Area in the short term. The commercial and non-commercial thinning proposed would convert currently unsuitable habitat to suitable habitat in the short term by reducing stand density and structure complexity and maintaining existing large trees in those stands. Over the long term, 446 acres of additional habitat would develop, creating a total of 2,649 acres of suitable habitat after 30-40 years. This would be the result of 446 acres of currently unsuitable habitat being treated by commercial and non-commercial thinning with this alternative.

In the short term, those acres would still be unsuitable, primarily due to the lack of large tree structure. However, over the following 30-40 years, large tree structure would develop at an accelerated rate due to the open growing conditions created by the thinning and provide suitable habitat conditions for these species at that time. Large snags would be present on these acres in the short to long term, and in densities that would meet a 50-80% tolerance level based upon DecAID information.

Alternative 2 would provide the greatest amount of habitat for white-headed and Lewis' woodpeckers in the short to long term. Alternative 3 would provide a slightly lesser amount of habitat in the short to long term. Alternative 1 would provide no additional suitable habitat for this species, and may see additional declines in suitable habitat in the long term.

Black-Backed Woodpecker

Traditional black-backed woodpecker habitat is not abundant in the project area. Dry grand fir forest types are limited in the project area, with only 888 acres of habitat in a suitable condition. However, due to high stand densities and insect related mortality that is occurring in the Douglas-fir and ponderosa pine habitats, additional functional habitat is present and being utilized. Based upon assessment of stand density levels and structural conditions, approximately 11,209 acres of functioning habitat occurs in the Douglas-fir and ponderosa pine habitats. Field reconnaissance indicates black-backed woodpeckers are using these habitats associated with the patches of newly created snags. The snags are the result of bark beetle infestations that have killed those pockets of trees. In addition, the Murray Fire area, roughly 850 acres, provides additional habitat for this species, and has contributed to more sightings of this species that would be expected.

Alternative 1 would maintain the existing condition, with a total of 12,097 acres of suitable and functioning habitat in the project area. This habitat would be maintained in the short term and likely maintained into the long term. Additional habitat may also develop in the long term as additional acres of Douglas-fir and ponderosa pine habitat dense enough stand conditions to increase snag creation through insect mortality.

Alternative 2 would decrease the acres of suitable and functioning habitat for this species to approximately 8,227 acres of habitat. Commercial and non-commercial thinning would reduce habitat suitability on 3,870 acres of habitat in the mid to long term. The proposed treatments would open stands and reduce the risk of insect related mortality, and thus snag creation. In the mid to long term, snag densities would decline with out the new recruitment.

Alternative 3 would decrease the acres of suitable and functioning habitat for this species to approximately 8,947 acres of habitat. Commercial and con-commercial thinning would reduce habitat suitability on 3,150 acres of habitat in the mid to long term. The proposed treatments would open stands and reduce the risk of insect related mortality, and thus snag creation. In the mid to long term, snag densities would decline with out the new recruitment.

Alternative 1 would provide the most habitat for this species in the mid to long term. Alternative 3 would provide less habitat for this species in the mid to long term. Alternative 2 would provide the least amount of habitat for the black-backed woodpecker in the mid to long term.

Hairy Woodpecker

Habitat for the hairy woodpecker is abundant in the Project Area. The high stand density conditions on 11,209 acres of habitat provide relatively abundant small snag densities due to increased insect related mortality. Historically, habitat for this species was less abundant, due to low snag densities associated with the large tree open structure of the dominant ponderosa pine habitats that were present.

Alternative 1 would maintain existing habitat for this species. No activities would be implemented, maintaining the existing 11,209 acres of suitable habitat in its current condition. In the mid to long term, this habitat would be expected to provide suitable snags and foraging habitat for the species. Additional acres may also develop in the mid to long term as other stands develop high stand densities resulting in increased insect mortality in the ponderosa pine and Douglas-fir and increase snag development.

Alternative 2 would reduce the amount of suitable habitat for this species by 3,519 acres to a total of 7,690 acres of suitable habitat. The commercial and non-commercial thinning of 3,519 acres of habitat would reduce stand densities to levels that would reduce insect related tree mortality. In the mid to long term, snag densities would decline as snags were not replaced on those 3,519 acres. In the long term, however, additional acres, above the 7,690 that would exist after harvest, may develop as other stands increase in stand density and subsequently develop snags through insect related mortalities.

Alternative 3 would reduce the amount of suitable habitat for this species by 2,750 acres to a total of 8,473 acres of suitable habitat. The commercial and non-commercial thinning of 2,750 acres of habitat would reduce stand densities to levels that would reduce insect related tree mortality. In the mid to long term, snag densities would decline as snags were not replaced on those 2,750 acres. In the long term, however, additional acres, above the 8,473 that would exist after harvest, may develop as other stands increase in stand density and subsequently develop snags through insect related mortalities.

Alternative 2 would have the greatest impact on hairy woodpecker habitat of the three alternatives. Alternative 3 would have a slightly lesser impact. Alternative 1 would have no impact on this species.

Northern Flicker

Alternative 1 would not result in direct or indirect effects to northern flickers or northern flicker habitat. Existing habitat conditions would be maintained. The existing 621 acres of habitat would be maintained in its current condition. Over time, habitat quality may decline as existing habitats become more dense and crowded. However, given the habitat-generalist tendencies of this species, viable populations and alternative habitat would be provided for.

Alternative 2 would result in expansion of existing habitat through the commercial and non-commercial thinning of conifer habitats as proposed. An increase of 2,619 acres of suitable habitat, to a total of 3,240 acres across the Project Area would result from this alternative.

Alternative 3 would result in expansion of existing habitat through the commercial and non-commercial thinning of conifer habitats as proposed. An increase of 1,998 acres of suitable habitat, to a total of 2,619 acres across the Project Area would result from this alternative.

LRMP Standards

The existing condition of the Project Area does not meet the Amended Forest Plan Standards for primary cavity excavators. Snag densities for snags ≥ 21 " dbh do not meet the amended standards across the project area. As noted previously, the amended standard is 2.25 snags ≥ 21 " dbh, or 225 snags ≥ 21 " dbh over 100 acres. The absence of large tree structure on much of the Project Area has prevented attainment of this standard. The cumulative effects of past timber harvest, firewood harvest, changes to fire regimes and fire suppression, and other factors have reduced the number of large snags present and removed green tree replacements that would provide for current and future snags. A review of late and old structure habitats present historically indicates that the existing single strata late and old structure habitat is well below historic levels (deficient by 6,871-10,810 acres) (see Table 58, Chapter 3). Where late and old structure habitat still exists, Amended Forest Plan Standards are likely met. This accounts for 757 acres of habitat out of 14,164 acres of conifer forested habitat. On most of the 14,164 acres of conifer habitat that does not meet late and old

structure conditions, Amended Forest Plan Standards are not be met. This is due to low densities of large trees (≥ 21 " dbh) or their absence all together and the inability for those stands to "create" large snags as a result.

All three alternatives would not harvest snags, other than to insure compliance with OSHA regulations for harvest operations, as such; each of the three alternatives would meet the Amended Forest Plan Standards by maintaining existing snag densities as they currently occur. Additional snags may be created through incidental mortality of large trees associated with the prescribed fire activities proposed in Alternatives 2 and 3.

Purpose and Need

The Purpose and Need for action does not specifically address management indicator species and primary cavity excavators and a need for action to improve habitat or address habitat or species needs. However, the Purpose and Need is consistent for several of the species identified in the analysis, specifically the white-headed and Lewis' woodpecker, and to a lesser degree the northern flicker. The purpose and need for vegetation identifies the need for late and old structure stands that are more reflective of historic conditions and are more resilient to insect and fire disturbances than what currently exists. Such habitats would support white-headed and Lewis' woodpeckers and northern flickers. The relatively open, large tree structured habitat that dominated the Project Area historically would provide suitable habitat for these species. Existing habitat conditions do not meet the needs of these species.

Alternative 1 would not meet the purpose and need for the project, and as such would not meet or improve habitat conditions for the white-headed and Lewis' woodpecker and the northern flicker. Habitat for these species would be largely absent in the short through long term.

Alternative 2 would meet the purpose and need for the project, and as such would improve habitat conditions and expand total habitat available for these species. Of the three alternatives, Alternative 2 would create the most habitats and affect the most change to the benefit of these species in the short through long term.

Alternative 3 would meet the purpose and need for the project, and as such would improve habitat conditions and expand total habitat for the white-headed and Lewis' woodpecker and the northern flicker. Alternative 3 would create fewer habitats than Alternative 2, because of fewer acres treated with the alternative. Alternative 3 would create habitat and affect change to the benefit of these three species in the short through long term.

Desired Condition

A desired condition for the Project Area would include suitable habitat for a host of primary cavity excavators, including all identified in the preceding analysis. According to the analysis, habitat for the pileated woodpecker, white-headed woodpecker, Lewis' woodpecker, and the northern flicker is limited in the project area. For the pileated woodpecker, forest types and the fragmented nature of existing potential habitat limits the potential for this species' habitat. For the white-headed and Lewis' woodpecker and northern flicker, however, habitat limitations are the result of unsuitable habitat conditions in potential vegetation communities.

These changes reflect the cumulative affects of past management activities. To some degree, these changes are either reversible or can be counter acted with the proposed management activities in

Alternatives 2 and 3. The activities proposed in these alternatives would meet the desired condition for the white-headed and Lewis' woodpecker and the northern flicker in the Project Area. Alternative 2 would provide the most acres. Alternative 3 would provide fewer acres. Alternative 1 would not meet the Desired Condition for these three species.

Wildlife Other Concerns - Forest Plan Consistency –Connectivity

Measures

Connectivity Standard Criteria, Acres of Connectivity Habitat

Time Frames:

Short Term – 0-5 years (duration of direct effects expected to last on habitat quality and condition)

Mid Term – 5-30 years (time frame for which many/most of the indirect effects on habitat quality and condition would be realized)

Long Term – 30 plus years (time frame for which mature forest characteristics are expected to develop with the implementation of activities proposed in the action alternatives)

Introduction

The Regional Forester's Eastside Forest Plan Amendment #2, which amends the Ochoco National Forest Land and Resource Management Plan (Forest Plan), identifies specific standards for connectivity between LOS habitat patches. LOS habitat is defined for this analysis as those stands containing greater than 13 trees per acre that are greater than 21" diameter at breast height (dbh). The intent of this management strategy is to provide LOS habitat for species dependent upon that habitat type and allow movement and dispersal opportunities of LOS dependent species to and from isolated patches of habitat. The Interim Wildlife Standards (Standard 6.) identify criteria for the management of connectivity habitat in a planning area. Standard 6.d.3) of the Amendment #2 to the Forest Plan directs the maintenance of connectivity habitat between patches of existing LOS habitat. Specifically, Standard 6.d.3)a)(1) directs that each LOS and Old Growth habitat would be connected within and outside the watershed in a contiguous network by at least two different directions/connections.

Standard 6.d.3)a)(2) defines a suitable connectivity corridor as stands where medium or large trees are common with canopy closures in the upper one-third of the site potential. These stands would be a minimum of 400' wide at the narrowest point. Exceptions to this standard exist where suitable connectivity habitat is not available to or from LOS/Old Growth Habitat. In such situations, the next best habitat is to be selected and managed for connectivity.

Affected Environment

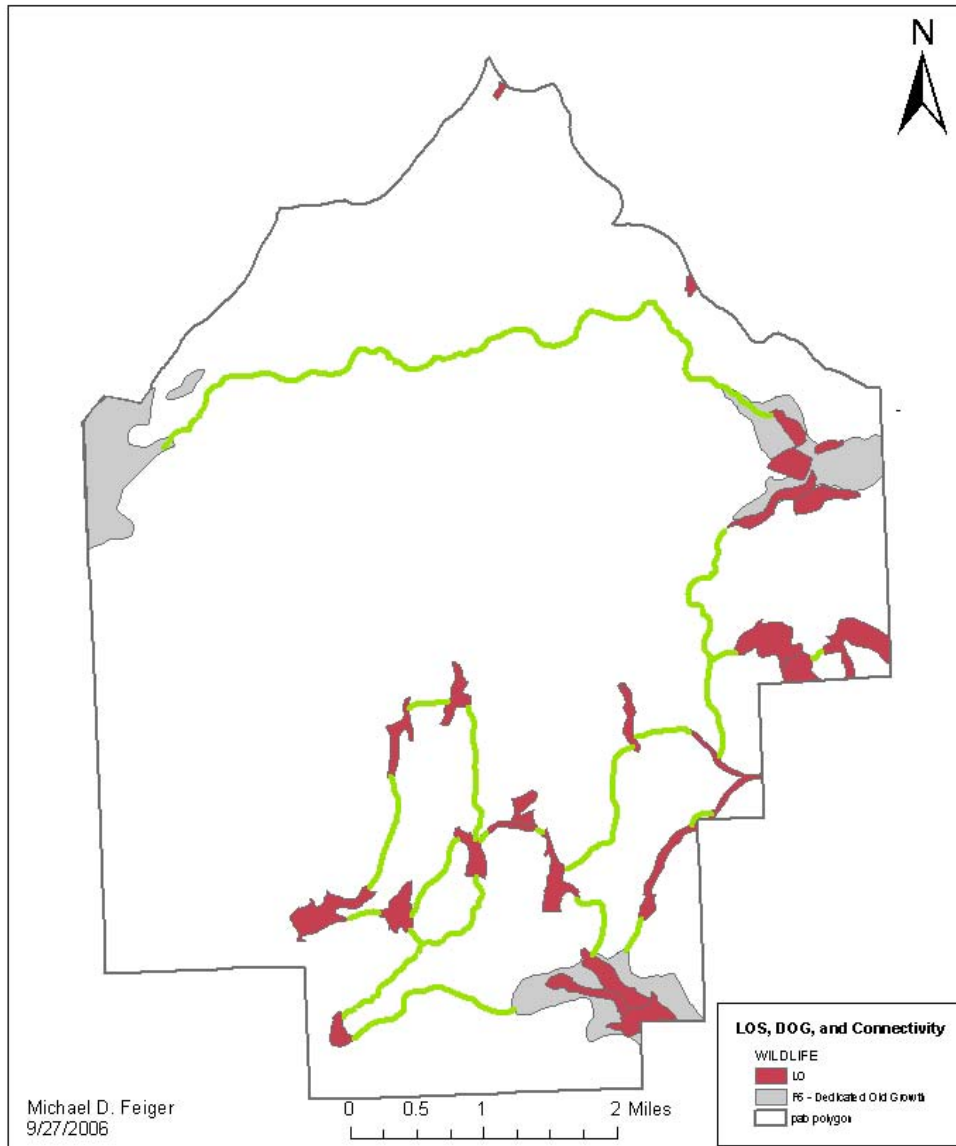
Connectivity Habitat

Connectivity habitat was identified in the Project Area (see Map 6, next page). Standards described in the Amended Forest Plan were met for each connection. A few of the selected corridors (identified by the project wildlife biologist) did not meet standards for width or upper 1/3 site potential. In these cases, the next best habitat was selected based upon digital orthophoto data and Viable Ecosystems information. A total of approximately 959 acres of connectivity habitat is identified in the project area. Connectivity habitat is maintained to all of the LOS habitat that is present in the Project Area, per amended Forest Plan Standard 6.d.3)a)(1). Two exceptions occur,

silvicultural stand #3 and #5. Both stands are isolated within the Project Area, with no connectivity habitat present to connect to other LOS. Both stands area also small, less than 5 acres each in size, and as such do not function as LOS habitat for LOS dependent species.

Map 6.

Willow Pine Fuels and Vegetation Management Project Dedicated Old Growth, LOS and Connectivity Corridors



Direct and Indirect Effects – Alternative 1

Connectivity Habitat

Existing connectivity habitat would be maintained in its existing condition in the short to mid term. As forested habitats continue to increase in density and complexity in the corridors, corridor habitat would be expected to improve in the long term, as a gradual increase in large tree structure occurs, and canopy closure increases. In absence of a stand replacement event, connectivity habitat would be maintained in its current network.

Cumulative Effects – Alternative 1

Past timber harvest actions, suppression of natural fire disturbance regimes, livestock grazing, and road building have affected the presence and distribution of connectivity habitat in the Project Area. Appendix A of the EA lists and briefly describes all known past, present and reasonably foreseeable actions that have occurred in the Willow Pine Project Area.

Past timber harvest has occurred across the Project Area, and has likely contributed most to the condition and availability of connectivity habitat. Historic timber harvest actions were focused on larger trees for mills and lumber production. In the Project Area, large ponderosa pine trees were particularly targeted because of the relatively easy logging conditions (open stands, relatively flat topography). The bulk of the timber harvest within the Project Area occurred 20-60 years ago when much of the analysis area was in private ownership, and as a result, accurate information on the types of harvest and acres harvested is not readily available. This has resulted in fragmentation and deficiency in LOS habitat (See Silviculture Report). Similarly, the lack of large tree structure in much of the connectivity habitat can be associated with historic timber harvest.

Fire suppression and what has essentially been the change in fire regimes has also affected connectivity habitat in the Project Area. Primary effects have been in the lack of or slow development of large tree structure in overly dense stands that make up connectivity habitat. Large tree structure is largely absent from the connectivity corridors identified for the project. The loss of large tree through past harvest management has compounded these effects. Overall canopy closures, however, have increased in the connectivity corridors as a result of fire suppression and changes to fire regimes. The absence of natural wildfire has allowed seedling and sapling reproduction to survive and develop into lower and middle canopies, and increase canopy closure in these stands. To that end, connectivity habitat has likely improved over time. Fire suppression effects to some degree have counteracted past timber harvest actions, particularly those greater than 40 years old.

The grazing of livestock compounded the effects of fire suppression actions and policies. Intense livestock grazing in the later 1800's and early 1900's contributed to the suppression and prevention of larger scale fires that shaped these forests.

Roads have played a minor role in the condition of connectivity habitat in the project area. Road densities are relatively low, but do have some fragmentation effect on continuity of larger patches of LOS. These effects, however, are relatively minor.

The Sunflower Natural Fuels Project is partially through implementation of the prescribed fire activities that are to be implemented with that decision. Broadcast burning is being implemented with that project. Some indirect effects to connectivity habitat has occurred and would occur in foreseeable future. Effects are primarily the small patches of canopy that are opened up associated with fire mortality from burning implementation. The patches of canopy closure reduction are small (less than ¼ acre) and do not adversely affect the function of the connectivity habitat.

Direct and Indirect Effects – Alternative 2

Connectivity Habitat

Alternative 2 would result in indirect effects to connectivity habitat in the project area. Approximately 295 acres (31%) of identified connectivity habitat would be affected by either commercial or non-commercial harvest treatments with this alternative. Map 7 illustrates the alternative overlaid with the connectivity corridor habitat. Table 41 lists the commercial and non-commercial thinning units that would affect connectivity habitat.

Map 7.

Willow Pine Fuels and Vegetation Management Project Dedicated Old Growth, LOS and Connectivity Corridors Alternative 2

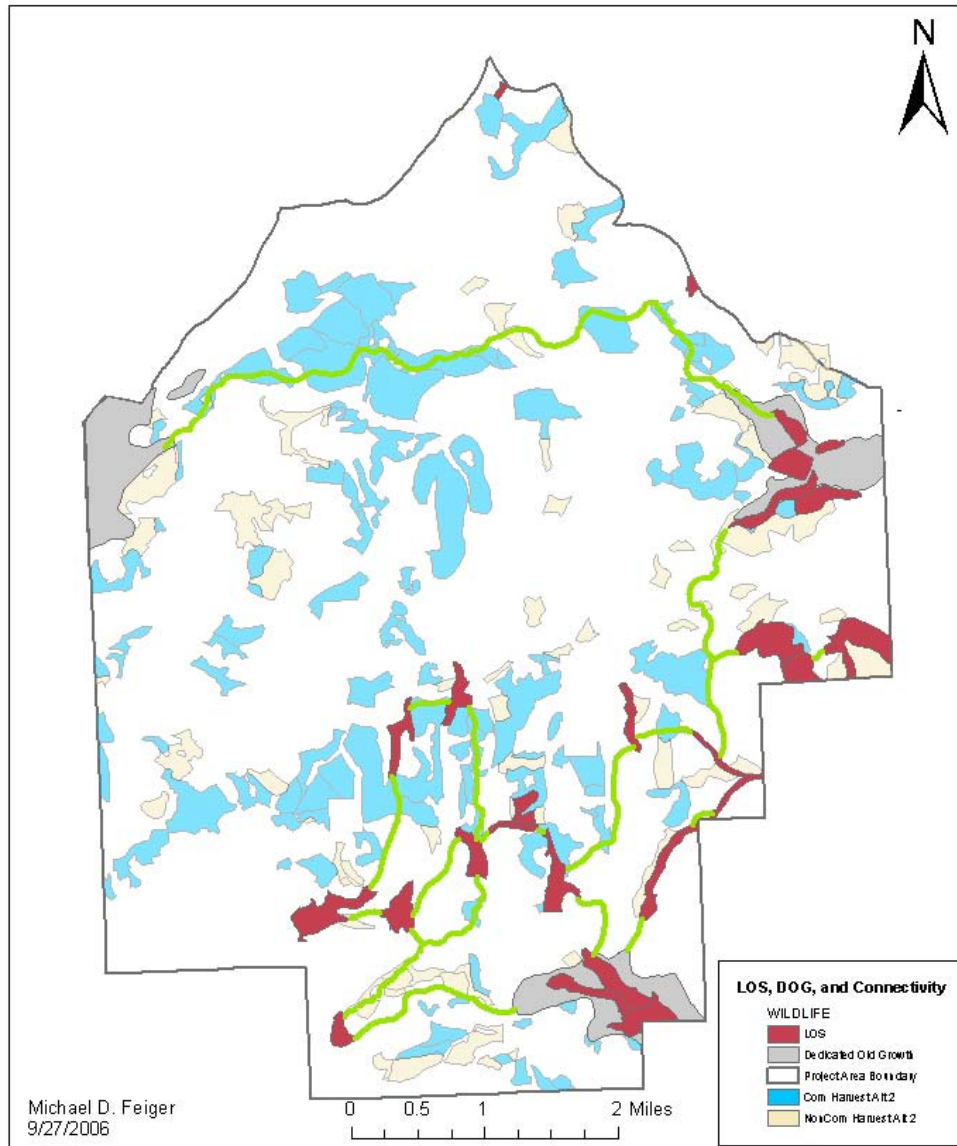


Table 41. List of Harvest Units by Treatment Type Affecting Connectivity Habitat for Alternative 2

Treatment Type	Units Affecting Connectivity
Commercial Thin	1, 18, 22, 23, 24, 25, 28, 30, 31, 32, 33, 38, 41, 44, 58, 59, 60, 61, 62, 90, 101, 102, 103, 118, 124, 128,
Non-Commercial Thin	209, 211, 240, 246, 247, 257, 258, 260, 265, 270

Silviculture prescriptions for portions of the above units where the 400' wide connectivity corridor passes through would maintain the corridor in an upper 1/3 management zone stocking level. This would meet amended Forest Plan standards for connectivity habitat (Standard 6.d.3)a)(2)). Prescriptions would maintain multiple canopies in the corridor portion of the stand, maintain quality connectivity habitat. This would allow those portions of the connectivity corridor to continue to function as connectivity habitat between LOS habitats in the project area.

There would be no loss of connectivity habitat with Alternative 2. In the long term, with slightly reduced stand densities, the development of large tree structure would occur at an increased rate when compared to no treatment (Alternative 1). It would be expected that many of the treated corridors would develop large tree and LOS conditions in the long term (30-50 years).

Cumulative Effects – Alternative 2

The cumulative effects from the past, present, and reasonably foreseeable future actions that have occurred in the Project Area described in the cumulative effects section for Alternative 1 are the same for Alternative 2. Please refer to that section for a summary of those actions that have affected connectivity in the Project Area.

Connectivity Habitat

Alternative 2 would result in indirect effect to connectivity habitat with its implementation. A total of 295 acres of connectivity habitat would be affected. This would result in cumulative effects to those acres of habitat and overall connectivity in the Project Area. Relative to past timber harvest actions, an incremental decrease in canopy closure would result on those 295 acres, compounded from the proposed activities plus past harvest actions. The reduced canopy closure that would result may decrease the quality of connectivity habitat, although the habitat would continue to meet the amended Forest Plan standards referenced above.

The indirect effects of this alternative would reverse the trend and changes to the connectivity corridors from fire suppression and changes to fire regimes. On the 295 acres that would be treated, increases and stand densities as a result of fire suppression and changes to fire regimes would be reversed.

Connectivity corridor habitat would still remain within amended Forest Plan standards with the cumulative effects of Alternative 2 and the past, present and reasonably foreseeable future actions that have or would occur.

Direct and Indirect Effects – Alternative 3

Connectivity Habitat

Alternative 3 would result in indirect effects to connectivity habitat in the project area. Approximately 265 acres (28%) of identified connectivity habitat would be affected by either commercial or non-commercial harvest treatments with this alternative. Map 8 illustrates the alternative overlaid with the connectivity corridor habitat. Table 42 lists the commercial and non-commercial thinning units that would affect connectivity habitat.

Table 42. List of Harvest Units by Treatment Type Affecting Connectivity Habitat for Alternative 3

Treatment Type	Units Affecting Connectivity
Commercial Thin	1, 18, 24, 25, 28, 30, 31, 32, 33, 41, 44, 58, 59, 60, 61, 62, 90, 101, 102, 103, 118, 124
Non-Commercial Thin	209, 211, 240, 246, 247, 257, 258, 260, 265, 270

Silviculture prescriptions for portions of the above units where the 400' wide connectivity corridor passes through would maintain the corridor in an upper 1/3 management zone stocking level. This would meet amended Forest Plan standards for connectivity habitat (Standard 6.d.3)a)(2)). Prescriptions would maintain multiple canopies in the corridor portion of the stand, maintain quality connectivity habitat. This would allow those portions of the connectivity corridor to continue to function as connectivity habitat between LOS habitats in the project area.

There would be no loss of connectivity habitat with Alternative 3. In the long term, with slightly reduced stand densities, the development of large tree structure would occur at an increased rate when compared to no treatment (Alternative 1). It would be expected that many of the treated corridors would develop large tree and LOS conditions in the long term (30-50 years).

Cumulative Effects – Alternative 3

The cumulative effects that have occurred in the Project Area described in the cumulative effects section for Alternative 1 are the same for Alternative 3. Please refer to that section for a summary of past, present, and reasonably foreseeable future actions that have affected connectivity in the Project Area.

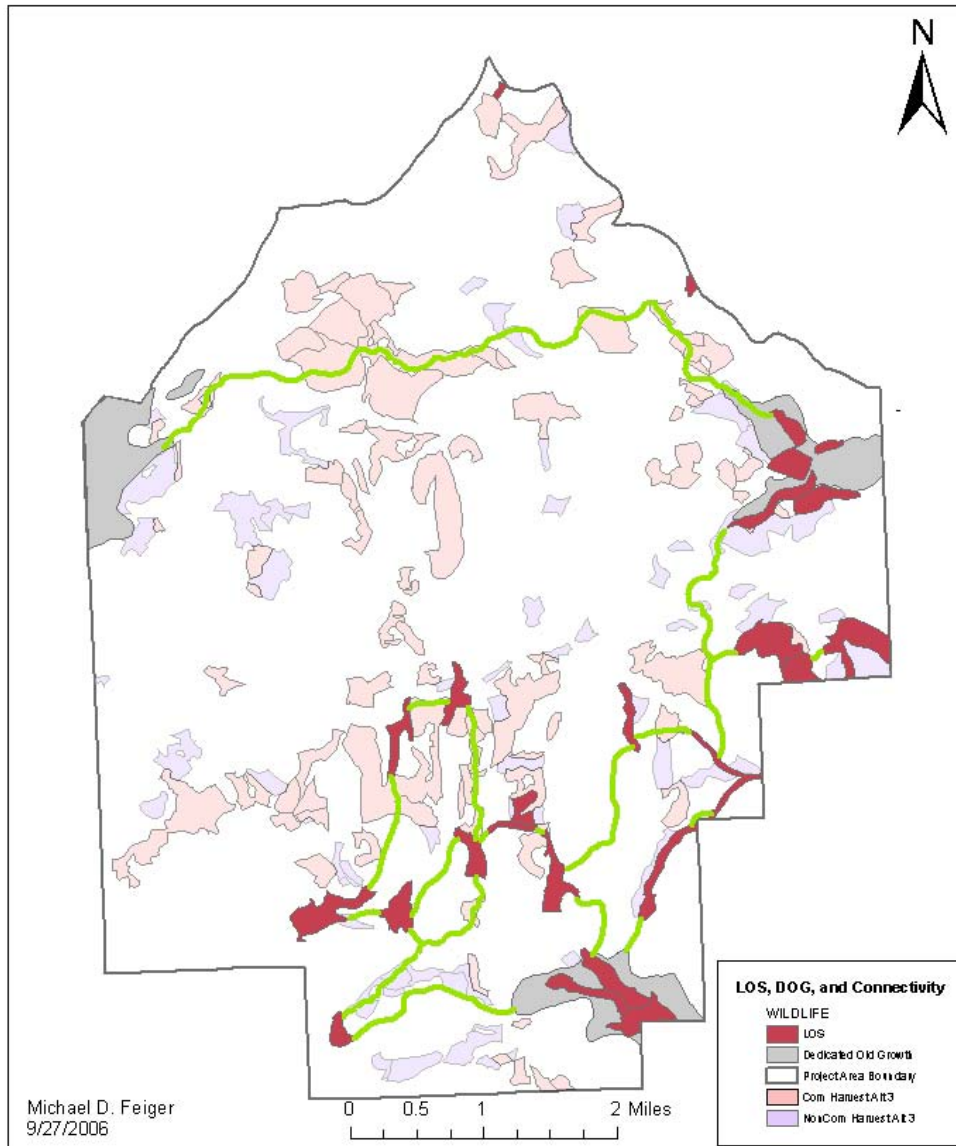
Connectivity Habitat

Alternative 3 would result in indirect effect to connectivity habitat with its implementation. A total of 265 acres of connectivity habitat would be affected. This would result in cumulative effects to those acres of habitat and overall connectivity in the Project Area. Relative to past timber harvest actions, an incremental decrease in canopy closure would result on those 265 acres, compounded from the proposed activities plus past harvest actions. The indirect effects of this alternative would reverse the trend and changes to the connectivity corridors from fire suppression and changes to fire regimes. On the 265 acres that would be treated, increases and stand densities as a result of fire suppression and changes to fire regimes would be reversed.

Connectivity corridor habitat would still remain within amended Forest Plan standards with the cumulative effects of Alternative 3 and the past, present and reasonably foreseeable future actions that have or would occur.

Map 8.

Willow Pine Fuels and Vegetation Management Project Dedicated Old Growth, LOS and Connectivity Corridors Alternative 3



Summary of Effects and Conclusions

Alternative 1 would maintain existing connectivity habitat in its current canopy closure, stand densities, and canopy structure in the short, mid, and long term. Large tree structure, which is largely absent currently, would slowly develop with this alternative. LOS stand conditions would be achieved well into the long term (70-100 years). Canopy closures would remain highest with this alternative in the short to mid term. No cumulative effects would result from this alternative.

Alternative 2 would maintain existing connectivity habitat in the Project Area. On 295 acres (31% of total connectivity habitat), canopy closure and structure diversity would be reduced through commercial thinning or non-commercial thinning treatments that are proposed with this alternative. However, stand stocking levels and densities would be maintained in the upper 1/3 management level zone, meeting the amended Forest Plan standard requiring connectivity corridors to be managed for the upper 1/3 site potential. Connectivity habitat would be maintained on the 295 acres treated. Canopy Closures would be reduced in the short to mid term, slowly recovering in the long term.

Large tree structure and LOS stand conditions would be achieved in the early long term (30-50 years) on the treated 295 acres. This would be the result of improved growing conditions that come with the proposed treatments. Some cumulative effects (additive to past timber harvest actions, counteractive to fire suppression and changes to fire regimes) would occur on the 295 acres treated. The effects to species which may use these corridors (such as northern goshawk, woodpeckers, and small mammals) would be minimal and not measurable.

By meeting amended Forest Plan standards by maintaining stand densities at the upper 1/3 site potential, suitable stand densities and canopy closures would be maintained to provide corridor habitat for these species. Connections between existing LOS habitat would be maintained, and allow species that are dependent upon those habitat to get to and from those habitats.

Alternative 3 would maintain existing connectivity habitat in the Project Area. On 265 acres (28% of total connectivity habitat), canopy closure and structure diversity would be reduced through commercial thinning or non-commercial thinning treatments that are proposed with this alternative. However, stand stocking levels and densities would be maintained in the upper 1/3 management level zone, meeting the amended Forest Plan standard requiring connectivity corridors to be managed for the upper 1/3 site potential. Connectivity habitat would be maintained on the 265 acres treated. Canopy Closures would be reduced in the short to mid term, slowly recovering in the long term.

Large tree structure and LOS stand conditions would be achieved in the early long term (30-50 years) on the treated 265 acres. This would be the result of improved growing conditions that come with the proposed treatments. Some cumulative effects (additive to past timber harvest actions, counteractive to fire suppression and changes to fire regimes) would occur on the 265 acres treated. The effects to species which may use these corridors (such as northern goshawk, woodpeckers, and small mammals) would be minimal and not measurable.

By meeting amended Forest Plan standards by maintaining stand densities at the upper 1/3 site potential, suitable stand densities and canopy closures would be maintained to provide corridor habitat for these species. Connections between existing LOS habitat would be maintained, and allow species that are dependent upon those habitat to get to and from those habitats.

Alternative 1 would maintain the highest canopy closures of the three alternatives, while Alternatives 2 and 3 would allow for the quickest development of large tree structure when compared to Alternative 1. Alternatives 2 and 3 would continue to meet amended Forest Plan standards for connectivity corridor habitat.

LRMP Standards

Amended Forest Plan standards (Regional Forester's Eastside Forest Plan Amendment #2, Standard 6.d.3) would be maintained and met with each of the alternatives considered for this project. Standard 6.d.3)(a)(1), requiring the maintenance of a network of connectivity habitat across the Project Area insuring a minimum of 2 connections to each stand of LOS would also be met with each alternative.

Purpose and Need

A specific purpose and need does not address connectivity corridor habitat for the Project Area.

Desired Condition

Alternative 1 would best meet a desired condition of high canopy closure and structural diversity in the short to mid term. This alternative would be slower to develop large tree structure in the connectivity habitat, as high stand densities would limit the rate that large trees reach and exceed 21" dbh.

Alternatives 2 and 3 would best meet the desired condition of large tree structure development in the shortest period of time on 31% and 28% of existing connectivity habitat respectively. In the long term, these alternatives would meet the desired condition of high canopy closures and stand structure diversity, as the stand develops and increases stand density through natural reproduction and limited fire suppression and management.

Project Design Criteria

With the implementation of Alternatives 2 and 3, specific silviculture prescriptions would need to be implemented for those commercial and non-commercial thinning units that are within or include connectivity corridor habitat as identified in Maps 7 and 8 and Tables 41 and 42. Prescriptions must maintain stand densities in the upper 1/3 management level zone to insure that amended Forest Plan standards are met.

Wildlife – Other Concerns - Migratory Bird Treaty Act – Migratory Birds

In December of 2002, the US Fish and Wildlife Service (USFWS) released the Birds of Conservation Concern list (USFWS 2002). This was a part of an initiative to insure actions and activities of Federal Agencies were working to protect and conserve migratory bird species. It was recognized that past management and changes to the landscape has affected migratory bird species, which are protected by the Migratory Bird Treaty Act of 1918. The USFWS broke down the country by geographic region, and of each region, provided a list of bird species that were of conservation concern, based upon changes in habitat availability or trends in populations (USFWS 2002).

In January 2001, an Executive Order signed by President William J. Clinton directed Federal Agencies to consider the effects of federal activities on migratory birds, and to comply with the

Migratory Bird Treaty Act of 1918. Subsequent direction from the Chief of the USFS directed that management actions should be taken to conserve and enhance migratory bird habitat.

Measures

Change in acres of suitable habitat by species/habitat type

Introduction

In May of 2000, the American Bird Conservancy developed a conservation strategy for landbirds (including migratory birds) for the Oregon-Washington Partners In Flight organization. The *Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington* (Altman 2000) provides conservation recommendations for species and habitats that occur in the Blue Mountains of Oregon and Washington. This area includes the Project Area. The conservation strategy provides a basis for considering the effects of activities on landbirds and migratory birds, as well as providing recommendations for the management and enhancement of those habitats and for those species identified. The conservation strategy breaks down the region by habitat type, and identifies focal species that are representative of those habitat conditions. This conservation strategy will form the basis for this analysis.

In the project area, one general habitat type has the potential to be affected by the activities proposed. The Dry Forest habitat type is the primary focus of activities that would be affected. Within the Dry Forest habitat type, there are two Habitat Features/Conservation Focuses that would be affected by the three alternatives proposed. The Habitat Feature/Conservation Focus and identified Focal Species to be considered are as follows:

- Large patches of old forest with large trees and snags – White-headed woodpecker
- Old forest with interspersed openings and dense thickets – Flammulated owl

The analysis of the effects of the three proposed alternatives will address these two Habitat Features/Conservation Focuses and corresponding Focal Species.

Habitat Needs

Dry Forest Dependent Species

Large Patches of Old Forest with Large Trees and Snags – White-headed Woodpecker

Analysis of the white-headed woodpecker is included in the section of the document addressing the effects to Management Indicator Species (MIS). Please refer to that section and its assessment of effects to the white-headed woodpecker, and thus this Habitat Feature/Conservation Focus.

Old Forest with Interspersed Openings and Dense Thickets – Flammulated Owl

Features of this habitat include the presence, in abundance, of large ponderosa pine trees. Forest condition is generally open with relatively low canopy closures. Structural diversity in the forest canopy is generally limited, and primarily made up of a mature overstory of ponderosa pine. Interspersed in this forest condition are grassy openings and small meadows which provide primary prey sources for the flammulated owl. Also interspersed in some of the canopy openings are patches of young reproduction, primary ponderosa pine, or dense shrub habitat. This provides important hiding and roosting habitat for the flammulated owl, and may also serve as habitat for prey species. Nesting occurs in large ponderosa pine snags, generally greater than 21" dbh.

This forest condition was historically abundant in the dry ponderosa pine habitat types. Frequent low intensity wildfire, of natural or aboriginal in origin, maintained this forest condition. Across the Interior Columbia Basin, this habitat feature has declined substantially. A 58% reduction since pre-settlement times has been noted in the Blue Mountains (Altman 2000). Across the Interior Columbia Basin, nearly 70% of the watersheds have experienced moderate or strongly declining habitat trends for this habitat condition (Altman 2000).

The flammulated owl is identified as a Bird of Conservation Concern for Bird Conservation Region 10 (Northern Rockies – US Portion).

Affected Environment

Old Forest with Interspersion of Grassy Openings and Dense Thickets – Flammulated Owl

Approximately 4,560 acres of habitat exists within the project area based upon a Wildhab query of the Project Area. The quality of this habitat varies. This is below habitat levels that historically existed. HRV analysis indicates potential habitat acreage of 8,500 existed historically. This forest condition was abundant and a dominant habitat feature across the Project Area historically. Past timber harvest management, suppression of wildfire and changes to fire regime and other management actions have all but eliminated this habitat feature in the project area. Flammulated owls within the Project Area are utilizing less than ideal habitat to exist. Large tree structure and large snags are generally absent in the habitat condition described for this species.

Direct and Indirect Effects – Alternative 1

Old Forest with Interspersion of Grassy Openings and Dense Thickets – Flammulated Owl

There would be no direct effects associated with Alternative 1 relative to this habitat feature. Roughly 4,560 acres of suitable habitat exists in the project area. Indirect effects of this alternative would be the short term maintenance of this habitat condition, and mid to long term further decline in suitable habitat for the flammulated owl. This alternative would not create or otherwise enhance suitable habitat in the short (0-5 years) to mid (5-30 years) term. In the long term (30+ years), additional habitat would not develop. In dry forest types, where ponderosa pine is a dominant over story species, dense, multi-storied stands would continue to develop. While large tree structure would eventually develop and expand over time, the high density conditions that would develop along with it would not provide suitable habitat for the flammulated owl or other species that use the old forest/grassy openings/dense thickets habitat that historically was present and abundant.

Cumulative Effects – Alternative 1

Old Forest with Interspersion of Grassy Opening and Dense Thickets – Flammulated Owl

Alternative 1 would not contribute additional effects to the cumulative effects on this dry forest habitat type. No activities would occur under this alternative, and thus would not result in direct or indirect effects to the habitat or the species that utilize this habitat.

Timber sales and other vegetation management actions have occurred across the project area over the past 50-70 years. Much of the harvest that has occurred is undocumented as to location and type of harvest that occurred because much of the project area was under private ownership at the time of harvest. Early harvest on federally administered lands was also poorly documented as to location, amount of timber removed, or harvest systems used. The end result of the cumulative timber sales and vegetation management actions has left very little late and old structure dry forest habitat in the project area. Most of the dry forest habitat types are in middle aged single to multi-

storied forest types. Understory and large tree structure is generally absent, other than the presence of patches of reproduction.

Fire suppression and the resulting changes to effective fire regimes has cumulatively affected dry forest habitats in the Project Area. The open, late and old structured forest type that was common in the dry forest communities was largely shaped by frequent, low intensity wildfires of natural and aboriginal origin. With the creation of the National Forest System and associated direction to aggressively manage and prevent wildfire events, dry forest systems evolved into very different forest systems. Stand densities increased as new reproduction was allowed to develop and mature. Shade and fire tolerant species also expanded into the historically dry, open, and frequently disturbed habitats.

The low density of large snag habitat is also a function of the cumulative effects of past activities. Most notable is the harvest of firewood for personal use. The lack of large tree structure and replacement green trees, a result of past harvest management and fire suppression, also play a role in the lack of large snags present in the project area.

Direct and Indirect Effects – Alternative 2

Old Forest with Interspersion of Grassy Openings and Dense Thickets – Flammulated Owl

Alternative 2 would see a reduction in this habitat type in the short term (0-5 years). Approximately 4,219 acres of habitat would be available after treatment (7% reduction). Over the mid (5-30 years) and long (30+ years) term, additional acres of suitable habitat would develop as a result of the proposed thinning treatments. By year 30-40, an estimated 5,059 acres of suitable habitat would develop and be available for flammulated owls. This would be a 10% increase over existing conditions. Over even longer time periods, additional habitat would also develop.

Cumulative Effects – Alternative 2

Alternative 1 described past and present management actions that have contributed to the cumulative effects on dry forest habitats and the species that utilize them. Refer to that section for more information on those activities and actions.

Alternative 2 would not add cumulative effects to those past and present management actions in continuing to affect existing suitable habitat. Implementation of Alternative 2 would work to reverse many of those adverse cumulative effects by creating some habitat in the short term, and work to develop additional habitat over the long term. Alternative 2 would reverse the trend that past management actions have set for this habitat type.

Direct and Indirect Effects – Alternative 3

Old Forest with Interspersion of Grassy Openings and Dense Thickets – Flammulated Owl

Alternative 3 would see an increase in this habitat type in the short term (0-5 years). Approximately 4,872 acres of habitat would be available after treatment (a 7% increase). Over the mid (5-30 years) and long (30+ years) term, additional acres of suitable habitat would develop as a result of the proposed thinning treatments. By year 30-40, an estimated 5,372 acres of suitable habitat would develop and be available for flammulated owls. This would be a 18% increase over existing conditions. Over even longer time periods, additional habitat would also develop.

Cumulative Effects – Alternative 3

Alternative 1 described past and present management actions that have contributed to the cumulative effects on dry forest habitats and the species that utilize them. Refer to that section for more information on those activities and actions.

Old Forest with Interspersion of Grassy Opening and Dense Thickets – Flammulated Owl

Alternative 3 would not add cumulative effects to those past and present management actions in continuing to affect existing suitable habitat. Implementation of Alternative 3 would work to reverse many of those adverse cumulative effects by creating some habitat in the short term, and work to develop additional habitat over the long term. Alternative 3 would reverse the trend that past management actions have set for this habitat type.

Summary of Effects and Conclusions

Old Forest with Interspersion of Grassy Opening and Dense Thickets – Flammulated Owl

Alternative 1 would result in no change to the current condition and amount of habitat available in this habitat type and for this species. Currently, 4,560 acres of suitable habitat exists within the Project Area. Alternative 2 would result in the short term reduction of suitable habitat, down to 4,219 acres. In the long term, 30 years +, a total of 5,059 acres of suitable habitat for the flammulated owl would exist in the Project Area. Alternative 3 would result in the short term creation of suitable habitat, with 4,872 acres of suitable habitat being developed. In the long term, 5,372 acres of suitable habitat would develop as a result of the activities proposed in this treatment.

In the short and long term, Alternative 3 would create or develop the most habitats for the flammulated owl. Alternative 2 would achieve similar goals at a slightly lower level.

Desired Condition

Alternative 1 would not achieve a desired condition for species such as the flammulated owl, which select for old forest habitat of ponderosa pine with an interspersion of grassy openings and dense thickets. Existing habitat essentially does not exist. This alternative would not develop additional habitat.

Alternatives 2 and 3 would work to meet the desired condition for the old forest habitat type interspersed with grassy openings and dense thickets. Habitat would be developed in the short, mid and long term with both of these alternatives. Alternative 2 would create and develop slightly more habitat than Alternative 3.

Wildlife – Other Concerns -Public Concern – Wild Turkeys

With the public scoping of the Proposed Action and Purpose and Need, a responding public identified the concern of potential adverse affects to nesting wild turkeys in the Project Area. A sizeable population of wild turkeys resides in the Willow Pine Project Area. The wild turkey is a ground nesting bird that generally nests between the first week of April though early June, depending upon weather conditions, breeding activity, nest failures, and other factors. Such nesting periods coincide with potential spring burning actions, which may result in the consumption of active nests, or mortality of sitting hens or very young, relatively immobile polts. Such effects could affect over all populations of wild turkeys in the project area if the effects occur at a sufficient scale.

Measures

Acres of effected nesting habitat

Introduction

The wild turkey is not a native bird species to the Project Area, Paulina Ranger District, or the Ochoco National Forest. It's presence in the project area is the result of introductions through the release of wild birds captured elsewhere and released in the Project Area vicinity. Earliest undocumented releases of wild turkeys in the vicinity of the Project Area are thought to have occurred around 1966 in the South Fork John Day River drainage near the confluence of Murderer's Creek. Additional releases in and around the Project Area have occurred sporadically through the 1970's and early 1980's. In the late 1980's, a more concerted effort to bolster wild turkey populations in the state of Oregon resulted in more frequent and organized turkey releases across the Paulina Ranger District. This has continued through the 1990's to the present day. Over the last several years, turkey releases were targeted at existing populations that had lower than desired populations.

Source populations for the released birds over the past 20 years have come from southwest Oregon. The Rio Grande subspecies has been the primary subspecies of release. Documented information indicates the Merriam's subspecies being released on the Lookout Mountain Ranger District.

The US Forest Service considers the wild turkey a desirable non-native species and has worked cooperatively with the Oregon Department of Fish and Wildlife and the National Wild turkey Federation in its management of habitat on the Paulina Ranger District. The wild turkey is a popularly pursued species by hunters and bird watchers.

Affected Environment

Nesting Habitat

Nesting habitat is generally abundant through out the Project Area. Most of the various vegetation communities in the Project Area provide some level of nesting cover and habitat. Ponderosa pine woodland and forest communities, with a shrub understory, Douglas fir mixed conifer forest types with shrub understories and/or down logs, denser juniper woodlands with a sagebrush shrub-steppe component, and shrub dominated riparian areas provide suitable habitat for nesting wild turkeys. Approximately 16,000 acres of potential nesting habitat exists in the project area. Nesting habitat availability is generally not a limiting factor in wild turkey populations in the project area.

Direct and Indirect Effects – Alternative 1

Nesting Habitat

Implementation of Alternative 1 would not result in direct or indirect effects to nesting wild turkeys or nesting habitat. The existing condition would be maintained over the short and mid term. Over the long term, a steady decline in habitat quality would likely occur as forested habitat increases stand densities and lower canopy complexity. No disturbance activities, such as spring prescribed fire operations, would occur, and as such would not affect nesting turkeys.

Cumulative Effects – Alternative 1

Nesting Habitat

On-going fuels treatments in the form of broadcast fuels reduction burns and activity fuels treatments using prescribed fire are other actions and activities that have the potential to contribute to cumulative effects upon wild turkey nesting success. The Sunflower Natural Fuels project has or would burn approximately 4,500 acres of forested habitat in the project area. Implementation began in 2004. Burning operations are primarily fall burn operations. Effects of the fall burning are generally short term effects (0-5 years) where nesting habitat in the form of brush, slash, down log, residual grasses, and shrub cover is consumed in the fire event. Over the mid term, nesting habitat is replaced by additional log habitat and limb litter and stimulated shrub and grass vegetation.

The Sunny timber sale was implemented in 2004 and 2005 in the project area. Approximately 63 acres of ponderosa pine habitat were commercially thinned. Stand densities were reduced, improving turkey nesting habitat.

The South Aspen timber sale thinned approximately 9 acres of aspen and ponderosa pine habitat. Stand densities were reduced, improving turkey nesting habitat.

Several Bird Planning Area non-commercial thinning treatment units were implemented in the late 1990's/early 2000's. 531 Acres of habitat was created in the short term with these thinnings. Post thinning fuels treatments in the form of broadcast and pile burning reduced available turkey nesting habitat. Thinning slash provided short term nesting cover that was largely lost after fuels treatments were implemented.

These four activities have generally improved habitat on the acres that they have occurred. Approximately 5,000 acres of habitat has been or would be incrementally improved as a result of these two actions.

Implementation of Alternative 1 would not add additional cumulative effects to those described above. Because no activities that would directly or indirectly affect nesting habitat would be implemented, there would be no additional cumulative effects to nesting wild turkeys or nesting habitat.

Direct and Indirect Effects – Alternative 2

Nesting Habitat

Alternative 2 proposes 7,069 acres of fire and fuels treatments over the life of the decision to implement this project. This accounts for 44% of potential habitat in the project area being affected. Any where from 130 to 1,300 acres of annual natural and mechanical fuels treatment would occur in the project year between fall of 2006 and spring of 2013. Up to 8% of the total potential suitable nesting habitat would be treated on a given year. Such actions would have the potential to affect the quality and condition of nesting habitat in the short term (0-5 years) by removing potential nesting cover and structure. This would have potential indirect effects to nesting wild turkeys in subsequent years. Note that fuels treatments are generally incomplete, and within acres that are treated, portions of suitable nesting habitat would remain.

Of the acres of natural and mechanical fuels treated annually, approximately 140 to 915 acres would be treated during the spring burning season, depending upon the year. Up to 6% of potential suitable habitat for nesting would be affected during spring nesting periods in five (5) of the seven (7) years the project would be implemented. Spring burning would occur any time between early March and middle May, depending upon burning conditions and windows. There would be the potential for direct effects to nesting wild turkeys through the burning of active nests or mortality to very young, relatively immobile poults.

While individual nests may be lost to burning activities, adverse effects to overall population reproductive effort would be negligible. Only a very small portion of the total suitable habitat would be affected at any one time, with very low risk of individual nests being affected based upon existing populations and the availability of habitat.

Cumulative Effects – Alternative 2

Nesting Habitat

The Cumulative Effects section for Alternative 1 describes the past, present and reasonably foreseeable future actions that have resulted in cumulative effects to wild turkey nesting habitat and nesting success. Refer to that section for more information.

The implementation of alternative 2 would result in cumulative effects to the quality and condition of potential nesting habitat in the Project Area. The acres of habitat affected by the Sunflower Natural Fuels project and the Bird Vegetation Treatment project would be added to cumulatively by the acres of natural and mechanical fuels treatments implemented under this alternative. However, in worse case scenario, on any given year, only about 14% of the total potential nesting habitat would be affected. Suitable alternate habitat would be available. Further, given existing populations densities when compared to available habitat (more nesting opportunities than nesting wild turkeys to take advantage of), the risk of individual turkeys and nests affected by proposed activities would be low.

Direct and Indirect Effects – Alternative 3

Nesting Habitat

Alternative 3 proposes 6,764 acres of fire and fuels treatments over the life of the decision to implement this project. This accounts for 42% of potential nesting habitat. Any where from 130 to 1,300 acres of annual natural and mechanical fuels treatment would occur in the project year between fall of 2006 and spring of 2013. Up to 8% of the total potential suitable nesting habitat would be treated on a given year. Such actions would have the potential to affect the quality and condition of nesting habitat in the short term (0-5 years) by removing potential nesting cover and structure. This would have potential indirect effects to nesting wild turkeys in subsequent years. Note that fuels treatments are generally incomplete, and within acres that are treated, portions of suitable nesting habitat would remain.

Of the acres of natural and mechanical fuels treated annually, approximately 140 to 915 acres would be treated during the spring burning season, depending upon the year. Up to 6% of potential suitable habitat for nesting would be affected during spring nesting periods in five (5) of the seven (7) years the project would be implemented. Spring burning would occur any time between early March and middle May, depending upon burning conditions and windows. There would be the

potential for direct effects to nesting wild turkeys through the burning of active nests or mortality to very young, relatively immobile poults.

While individual nests may be lost to burning activities, adverse effects to overall population reproductive effort would be negligible. Only a very small portion of the total suitable habitat would be affected at any one time, with very low risk of individual nests being affected based upon existing populations and the availability of habitat.

Cumulative Effects – Alternative 3

Nesting Habitat

The Cumulative Effects section for Alternative 1 describes the past, present and reasonably foreseeable future actions that have resulted in cumulative effects to wild turkey nesting habitat and nesting success. Refer to that section for more information.

The implementation of alternative 3 would result in cumulative effects to the quality and condition of potential nesting habitat in the Project Area. The acres of habitat affected by the Sunflower Natural Fuels project and the Bird Vegetation Treatment project would be added to cumulatively by the acres of natural and mechanical fuels treatments implemented under this alternative. However, in worse case scenario, on any given year, only about 14% of the total potential nesting habitat would be affected. Suitable alternate habitat would be available. Further, given existing populations densities when compared to available habitat (more nesting opportunities than nesting wild turkeys to take advantage of), the risk of individual turkeys and nests begin affected by proposed activities would be low.

Summary of Effects and Conclusions

Alternative 1 would maintain existing nesting conditions as they currently exist. There would be no risk of direct effects in the form of nest loss, mortality in young poults or nesting hens, or the loss of suitable nesting habitat and cover.

Alternatives 2 and 3 would likely result in direct and indirect effects to nesting wild turkeys in the form of potential nest loss or failure resulting from burning operations, mortality in very young poults or nesting hens, and the loss of nesting habitat in the short term (0-5 years). The risk of mortality in young poults and hens would be negligible, as both are mobile and generally able to avoid prescribed burns. The risk, however, would exist. Nest loss would also be possible, as any nests initiated prior to burning operations, and scheduled to hatch after implementation of burning, would be at risk for consumption by fire. Based upon populations, however, risk of consumption would be relatively low due to low nest densities (nesting habitat is not a limiting population factor). A maximum of 6% of potential habitat would be affected on any given spring burning season. Suitable habitat outside implemented burning units would provide alternate nest areas.

This is only a two percent (2%) difference between burning proposals in the two alternatives. Neither alternative would result in adverse effects to wild turkey populations or over all reproductive success within the project area.

Desired Condition

All three alternatives would meet a desired condition over time. Alternatives 2 and 3 would result in short term (0-5 years) effects to nesting habitat availability over a portion of the project area on an annual basis. In the mid to long term (5+ years) after full implementation of the decision with the action alternatives, a desired nesting habitat condition would be achieved across the project area.

Botany

Issue: Sensitive Plants

Measure #1

Long-term species viability

Introduction

Sensitive plants receive management emphasis to ensure viability and to preclude trends toward endangerment that would result in the need for federal listing (Forest Service Manual 2672.1). Extensive surveys have occurred for vascular sensitive plants within the Willow Pine Project Area. Limited surveys were conducted for nonvascular plants. Table 43 below lists 15 plant species on the Regional Forester's Sensitive Species List (July 2004) that occur or have suitable habitat within the project area. Sensitive plant population data used in the analysis was obtained from the Oregon Natural Heritage Program database and Paulina Ranger District records.

The desired future condition for sensitive species analyzed in this report is to ultimately remove them from the U.S. Fish and Wildlife Service's Species of Concern list, and from the Regional Forester's Sensitive Species list. Ensuring that habitat is well distributed with viable, increasing populations within the Ochoco National Forest can contribute to this effort. The LRMP does not specifically identify a desired future condition for sensitive plant species. It does address riparian areas, which provide important habitat for many sensitive species within the Willow Pine Project Area. The LRMP states that most of the riparian areas will be in excellent condition within 50 years, characterized by vigorous stands of forbs, grasses and grass-like species on stable stream banks.

Affected Environment

The project area comprises 20,170 acres in three subwatersheds, and has a wide variety of suitable sensitive plant habitat throughout. Elevation ranges from 3,880 feet to 6,170 feet, and corresponding precipitation from 17" to 23" annually (majority receives 19 inches). The geology and soils in this part of the district is unique. Much of the area is considered "exotic terrain", sedimentary conglomerates scraped up from the ocean. Soils therefore, are sandier compared to the rest of the district (Gordon 2003). Human use has affected the project area. Modifications such as deep soil compaction and construction of roads are effectively permanent. Other effects such as erosion, dropping water tables due to stream entrenchment, livestock grazing, and activities such as fire suppression and recreational use are likely to continue, which may limit opportunities for achieving desired conditions.

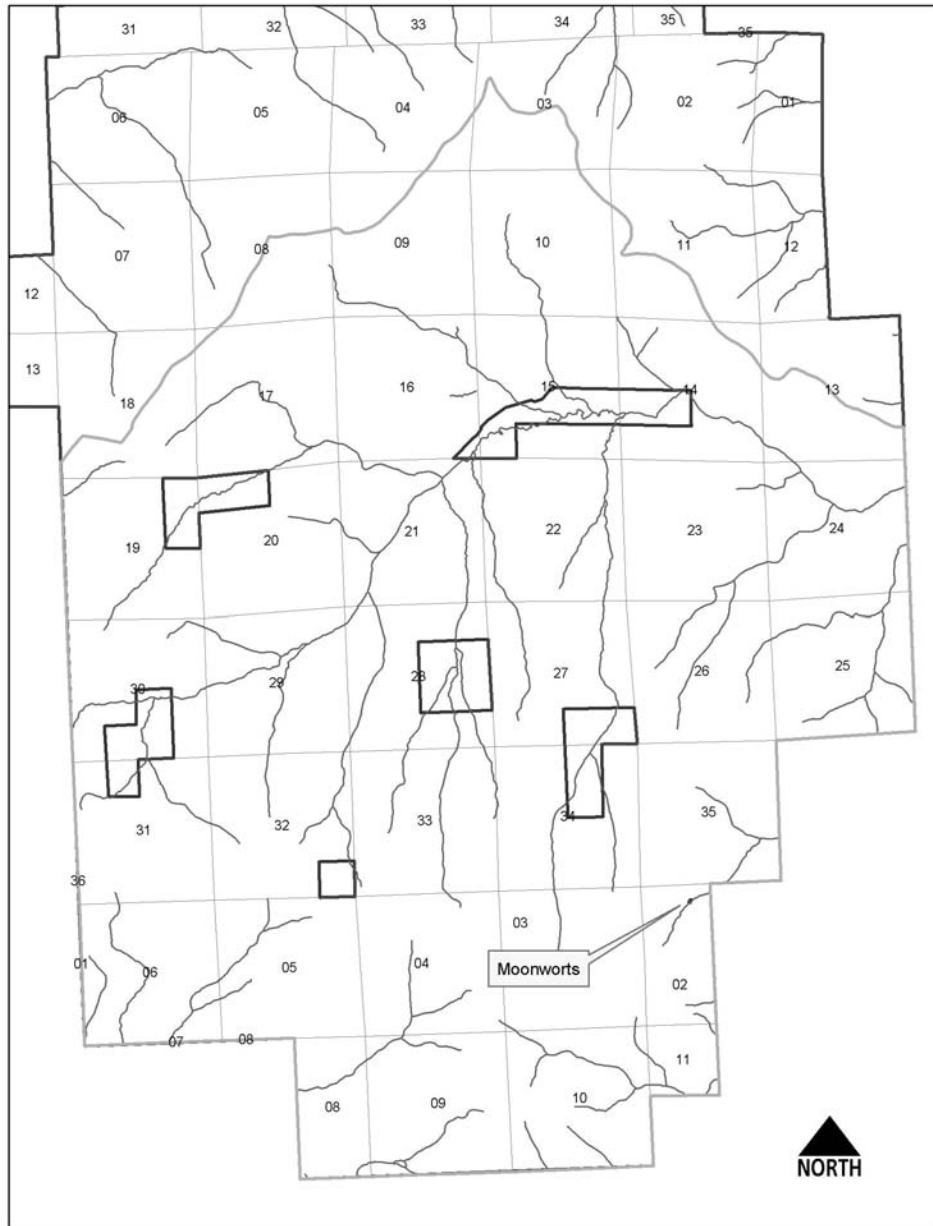
There is one sensitive plant location, with two species present, within the project area (see Figure 9 for the location). This site is a moonwort genus cluster of upswept moonwort and crenulate

moonwort. The site and surrounding habitat is fenced. There is an all-animal enclosure fence on half the area and a cattle enclosure on the other half.

Table 43. Sensitive Plant Species with Suitable Habitat or Known Locations within the Willow Pine Project Area

Species	Common Name
<i>Achnatherum hendersonii</i>	Henderson's ricegrass
<i>Achnatherum wallowensis</i>	Wallowa ricegrass
<i>Astragalus tegetarioides</i>	Deschutes milkvetch
<i>Botrychium ascendens</i>	Upswept moonwort
<i>Botrychium minganense</i>	Mingan moonwort
<i>Botrychium crenulatum</i>	Crenulate moonwort
<i>Botrychium montanum</i>	Western goblin
<i>Botrychium paradoxum</i>	Paradox moonwort
<i>Botrychium pinnatum</i>	Northwestern moonwort
<i>Carex hystericina</i>	Porcupine sedge
<i>Carex interior</i>	Inland sedge
<i>Calochortus longebarbatus</i> var. <i>peckii</i>	Peck's mariposa lily
<i>Dermatocarpon luridum</i> (<i>meiophyllizum</i>)	Silverskin lichen
<i>Scouleria marginata</i>	Margined black knotmoss
<i>Thelypodium eucosmum</i>	World thelopody
<i>Calochortus longebarbatus</i> var. <i>peckii</i> is managed with guidance from a draft Conservation	

Figure 9. Sensitive Plant Locations within the Willow Pine Project Area



Quantity of suitable plant habitat for suspected and documented sensitive species is average to low within the Willow Pine Project Area compared to the rest of the Paulina District. Table 45 lists the total acreage of suitable habitat by species for the project area. The analysis file contains descriptions and maps of habitat for each species.

Table 44. Sensitive Plant Species That Do Not Have Potential Habitat within the Willow Pine Area

Species	Habitat
<i>Artemisia ludoviciana</i> ssp. <i>estesii</i>	Riparian zones along the Deschutes River, which is outside of the Project Area.
<i>Astragalus diaphanus</i> var. <i>diurnus</i>	Sagebrush scablands of the lower slopes along the So. Fork John Day River, potential habitat for this species is unlikely, due to elevation, in the Project Area.
<i>Astragalus peckii</i>	Sandy, pumice soils of Deschutes and Klamath Co's, which is outside the Project Area.
<i>Calochortus longebarbatus</i> var. <i>longebarbatus</i>	Seasonally wet meadow and stream margins. Ochoco NF has variety <i>peckii</i> , a sterile triploid form of variety <i>longebarbatus</i> . Variety <i>longebarbatus</i> has not been found on the Ochoco NF.
<i>Camissonia pygmaea</i>	Sagebrush steppe at 1800' – 2000' elevation, this is well below the elevation of the Willow Pine Project Area.
<i>Carex backii</i>	Wet meadows, streams, springs, seeps/moist conifer forest. Dropped from the 2004 Oregon Natural Heritage Program list due to misidentification.
<i>Carex stenophylla</i>	Open, dry to moist grassy plains. Possible misidentification, thought to be <i>Carex duriuscula</i> , a plant not on the ONHP list.
<i>Cypripedium calceolus</i> var. <i>parviflorum</i>	Moist grand fir plant associations, heavily shaded environments. All these associations were surveyed in Willow Pine and were found to be aspen communities, not typical habitat.
<i>Lomatium ochocense</i>	Exposed fractured basalt bedrock outside and lower elevation than the Project Area.
<i>Mimulus evanescens</i>	Vernally moist springs and seeps; one population in Lake County, not within the Ochoco NF.
<i>Penstemon peckii</i>	Ponderosa pine forests of the Metolius Basin on the Deschutes NF.
<i>Rorippa columbiae</i>	Sandy, rocky margins of streams & lakes; near Silver Lake, not within the Ochoco NF.
<i>Thelypodium howellii</i>	Alkaline river valleys and moist plains at 3200' elevation. Below Project Area elevation and thought to be extinct in Oregon.

Table 45. Suitable Habitat for Sensitive Species in the Willow Pine Project Area

<u>SPECIES TYPE</u>	<u>ACRES</u>	<u>HABITAT</u>
<i>Acnatherum hendersonii</i> and <i>A. wallowensis</i>	2,387	Scabland
<i>Astragalus tegetarioides</i>	5,226	Upland
<i>Botrychium species</i>	635	Riparian
<i>Calochortus longebarbatus var. peckii</i>	642	Riparian
<i>Carex hystericina</i>	106	Riparian
<i>Carex interior</i>	106	Riparian
<i>Dermatocarpon luridum</i>	12 miles of stream	Riparian
<i>Scouleria marginata</i>	12 miles of stream	Riparian
<i>Thelypodium eucosmum</i>	3,692	Upland

Environmental Effects

Introduction

This part of the report displays the direct, indirect and cumulative effects of the activities proposed for each alternative. Direct and indirect effects are based on the project area, which contains Forest Service land within the Middle South Fork John Day River Watershed. Cumulative effects are based on the defined project area and the surrounding private and BLM land. Species are grouped by habitat type to those occurring within riparian (including meadows), scablands and uplands. Table 46 has a list of the proposed activities by alternative. Short-term impacts are defined for this analysis as those effects lasting less than 5 years. Long-term impacts are defined as those lasting more than 25 years.

Table 46. Summary of Proposed Activities By Alternative

ACTIVITY	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Improvement Cutting and burning of slash	0	560 ac.	412 ac.
Commercial Thinning and burning of slash	0	2,651 ac.	2,139 ac.
Noncommercial Thinning and Burning	0	3,943 ac.	3,313 ac.
Grapple Piling of Slash and Burning of Piles	0	640 ac.	361 ac.
Natural Fuels Underburning	0	2,519 ac.	2,765 ac.
Road Reconstruction	0	2.0 miles	2.0 miles
Construction of temporary roads	0	4.5 miles	3.9 miles

Direct and Indirect Effects - Alternative 1

The No Action Alternative would result in a biological evaluation determination of “No Impact” for all sensitive species. The proposed activities including timber thinning and burning, would not occur, providing stable sensitive plant populations and habitat in the short-term. Long-term species viability may be at risk due to overstory density, competition, and increased effects from severe wildfire.

There would be no direct physical effects to vegetation under this alternative. Indirect effects of not doing the project are discussed below by habitat type. Three factors affected by the proposed activities will be analyzed: 1) changes in tree density, 2) changes in vegetation succession, and 3) operational impacts of soil compaction and sediment.

Riparian Species

Tree density would continue to increase, which is expected to have a detrimental effect on long-term species viability for the vascular species. There are more trees on the landscape compared to historic conditions. Dense stands of small trees are in excess, while open park-like stands of large trees are lacking across the project area (Deppmeier 2006). Increased tree density results in shading and encroachment onto stream terraces. Peck’s mariposa lily, porcupine sedge, and inland sedge thrive in full sunlight. Peck’s lily occupies the transition area on the stream terrace and toe-slope between herbaceous vegetation and the tree line. This type of habitat is particularly vulnerable to increases in tree density. Encroachment in this area would take up growing space and supply too much shade for lily survival. Moonworts often occur on hummocks or at the bases of scattered trees, which keeps out of saturated soils. Most moonwort populations on the Paulina District appear to have either full or partial sunlight. Dense stands of trees can utilize available water deep in the watertable and decrease meadow habitat needed by moonworts. The nonvascular plants, black margined knotmoss and silverskin lichen also appear to inhabit open areas with full sunlight, but as they grow within the stream channel, tree density increase has less of an effect.

Absence of disturbance results in succession (changes in vegetation composition) to more shade-tolerant species such as Douglas-fir and white fir. These species are also more tolerant of wetter soil conditions, allowing further encroachment in the riparian area, sometimes shading out shrubs and other deep-rooted plants that provide stream bank stability. Loss of bank stability can result in stream entrenchment, thus separating riparian vegetation from the water table. Peck’s mariposa lily and the moonworts are considered early successional species, needing disturbance to become established and reproduce. In the absence of disturbance, plant communities move towards climax and early successional habitat is reduced. Riparian habitats have natural sources of disturbance such as flooding, which makes this less of a concern compared to upland habitat. The successional status of inland sedge and porcupine sedge is unknown, but their morphology and fire tolerance (USDA 2006) indicate they may be climax species, in which case lack of disturbance would be beneficial for these species. The nonvascular plants, margined black knotmoss and silverskin lichen are not expected to be impacted by successional changes as their habitat is mainly boulders within the stream channel.

This alternative would have no operational impacts that would have direct effects to habitat, such as soil compaction or displacement. Indirect effects of sediment delivery to riparian habitat would not occur. No new temporary roads would be built, leaving the ground undisturbed.

Upland Species

Current stand densities, especially of ponderosa pine and western juniper saplings, within the dry ponderosa pine plant association types is detrimental to the preferred habitat of upland sensitive plant species. A further increase in tree density under Alternative 1 would not be beneficial for world thelopody or Deschutes milkvetch habitat in the long term. These species need full sunlight to light shade. Deschutes milkvetch in particular is a poor competitor, where thick duff or dense overstory can inhibit establishment (Croft et al. 1997).

These species are early successional plants that need periodic disturbance to proliferate. Lack of disturbance, such as wildfire, results in movement towards climax species, a change in composition that could eliminate early seral sensitive species habitat in the long term.

No direct or indirect effects to habitat from operational activities such as compaction or road building would occur under this alternative, which is beneficial to the species and habitats.

Scabland Species

Tree density increase would not affect scabland ricegrass species. These plants occur in barren, gravelly sites with little vegetation.

Successional movement towards climax can affect scabland habitat. The lack of disturbance often allows encroachment of shrubs and eventually trees into areas that were otherwise kept in herbaceous plant communities by means of periodic fires. Personal observation shows that scablands have grown somewhat smaller through time, especially from edge encroachment by western juniper.

No direct or indirect effects to scabland habitat would occur under this alternative, which is beneficial to the species and habitats. There would be no soil compaction from harvest or land taken out of production due to road building.

Cumulative Effects – Alternative 1

Past management in the cumulative effects analysis area, including a century of historic livestock use, big game and wild horse grazing, and road construction, has resulted in a variety of vegetation and soil conditions. Many stream channels have widened and incised, thus losing some amount of floodplain area and the associated vegetation that depends on wet conditions. Stream banks become raw with the loss of soil holding root masses provided by willows, sedges and rushes. As stream channel morphology changes and degrades, loss of riparian sensitive plant habitat is imminent. This project area is the headwaters of each of the subwatersheds, therefore no sediment delivery from upstream is occurring in the area. Placement of major roads like the 58 road along Sunflower Creek confines the stream channel and delivers sediment to the creek. It is likely that this is having some affect on moonwort, porcupine and inland sedges, silverskin lichen, and margined black knotmoss habitat. Roads alter stream drainage patterns by confining the stream, reducing the area within the floodplain, so floodplain interaction is disturbed. This in turn affects riparian habitat and its function. It is speculated that Peck's mariposa lily is spread by bulblets moving downstream during high water flow. Roads that cross drainages can affect bulblet dispersal. Roads and clearcuts also provide cattle easier access to streams occupied by sensitive plants.

Past timber harvest within the Willow Pine Project Area was extensive. Table 47 shows that timber harvest after the late 1950's has occurred on 10,539 acres, which is over 52% of the project area. This results in both beneficial and detrimental effects on sensitive plant habitat. Removing trees mimics the low intensity, frequent fires that occurred before European settlement. Harvest helps keep the amount of overstory shade low, reduces competition, and keeps plant communities in an early successional state, which is beneficial to upland and scabland habitat. The slash from the harvest acres listed in Table 47 were likely burned, which also helps keep plant associations in an early successional condition. Detrimental effects include compaction from logging equipment. Some of this is naturally abated through time by soil freeze/thaw cycles. General harvest areas recover from compaction within several years, while skid roads, temporary roads and machine piled areas will recover naturally only down to 4" (David 2006). Based on these figures, it is estimated that approximately 95% of the acreage in Table 6 has recovered from soil compaction down to a four-inch depth. Recent harvest areas, Sunny and Windy John, are still compacted at the surface. A deep-rooted plant such as Deschutes milkvetch may be inhibited by compacted soils, however, it is often found within and adjacent to skid trails.

Table 47. Past Harvest Activity in the Willow Pine Project Area

Type of Activity	Acres	Years	Timber Sale/Project Names
Regeneration harvest	4,189	1973 through 1991	Cougar, Coyote, Frazier, Roadrunner, Sedge Spring, Spur, Telephone, Willow
Intermediate harvest	6,350	1953 through 2006	Columbus, Coyote, Frazier, Hardscrabble, Porcupine, Sunflower, Sunny, South Aspen, Wildhorse, Willow, Windy John
Machine piling	2,331	1976 to 1990 (est.)	Cougar, Coyote, Spur Butte, Wildcat
Grapple piling/slash grinding	1,500	1975 through 2000	Bird, Columbus, Sunflower, Tomahawk 1975
Noncommercial thinning	1,389	1969 through 2003	Rager Aspen, Roadrunner, Spur Butte, Sunflower, Sunflower Flats, Telephone, Telephone Juniper, TNT, Wildhorse, Willow, Windy John

Various other small projects have had minor, localized impacts to sensitive plant habitat, including spring developments, wildlife guzzler installation, and fence construction.

The Murray Fire burned approximately 320 acres the summer of 2002. The fire occurred in the northwest part of the planning area. This was a high intensity fire, herbaceous vegetation and plant litter were consumed down to bare soil, and resulted in tree death over the majority of the area. Hydrophobic soil was rated as low over 77% of the area however (USFS 2003), and vegetation has responded well over the last three years. Despite some colonization by non-aggressive noxious weeds (mullein and bull thistle), upland sensitive plant habitat is expected to fully recover.

Present activities in the project area include timber harvest on private land. Private land in sections 27 and 34 (approximately 160 acres) are currently being harvested using ground based equipment. This land is presumed to be mostly Deschutes milkvetch habitat, with Peck's mariposa lily habitat along the swales. The harvest is beneficial in the long-term to these habitats, with short-term effects from soil compaction. Grazing by domestic and native ungulates occurs every year. Cattle and big game have a two-fold effect on Peck's mariposa lily. Intensive, lengthy and repetitive

grazing can change the microclimate of streams and meadows in the long-term, and the plants themselves can be affected by trampling and by consumption of the basal leaf. Grazing of the basal leaf each year can reduce the life of an individual by limiting the amount of photosynthate available for bulb renewal (Fiedler 1987). However, Peck's mariposa lily does appear to tolerate moderate grazing pressure, and there is some indication that grazing helps keep habitat in a mid-seral successional stage that benefits this plant. Grazing also affects moonworts, inland sedge, and porcupine sedge habitat through changes in microclimate and trampling. This allotment is managed on a rest-rotation system which varies the temporal and spatial distribution of livestock, and rests approximately one-third of the allotment every third year. Alternating season of use (early, mid and late season) helps stabilize nutrient cycling by staggering timing, which is critical in arid ecosystems (USU 2001).

Future activities include a timber sale and natural fuels burning. The South Aspen Stewardship Timber Sale (<10 acres) will remove conifers from two aspen stands to promote aspen regeneration. This is expected to have short-term impacts on Peck's mariposa lily habitat from soil compaction, and in the long-term will push lily habitat outward to the toe-slope of the stream as young aspen crowd the floodplain. The Sunflower Natural Fuels project will burn 4,500 acres over the next several years. This activity is expected to have very short-term effects (1-2 years) through sediment delivery to riparian habitat and vegetative material consumption where mineral soil is exposed. Long-term benefits are expected for all sensitive species by hampering succession in the uplands, reducing competition in the riparian areas, and reducing the risk of severe wildfire. The risk of wildfire multiplies as tree density increases and successional advancement occurs. More trees means continuous horizontal and vertical fuel that can result in crown fires, and climax species are less tolerant of fire effects (Graham et al. 2004). Most early successional plants, in particular world thelopathy, are not tolerant of large fires of high intensity; these usually destroy seed beds. The riparian sensitive species would generally not be affected due to natural protection from moist habitat. One result of high severity wildfire that may affect even riparian habitat is the possible introduction of noxious weeds from either fire fighting equipment or the creation of bare ground.

Direct and Indirect Effects - Alternative 2

To meet natural resource needs within the project area, a variety of activities is proposed (see Table 46). These activities would result in a determination of "May Impact Individuals or Habitat But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species" for all the vascular sensitive species listed in Table 43. This is due to short-term effects to habitat. Long-term impacts are expected to be beneficial. For the nonvascular plants silverskin lichen and margined black knotmoss, a determination of "No Impact" is expected. No detrimental effects are anticipated to occur in required habitat of these two species.

Riparian Species

Tree density would be reduced adjacent to riparian areas from tree harvest and noncommercial thinning, which meets the need of reducing competition of coniferous vegetation, but does not generally go close enough to the stream to benefit most sensitive species. These buffers are to protect fish habitat and extend 300 feet on each side of perennial streams. This does not reduce shading within the riparian area and beyond. Natural fuels burning would occur within the buffers, staying 50 feet from riparian vegetation. This will help reduce the number of small trees, which reduces competition in the short-term and shading in the long-term. The objective for most burning units is also to kill lower branches to a height of 8-11 feet. This also helps reduce shade. Peck's mariposa lily and moonworts would benefit the most from proposed activities.

Approximately 48 acres of Peck's lily habitat would be thinned within swales that have no buffers. Noncommercial thinning would occur to within 50 feet of the stream on several units, which would reduce tree density on an additional 21 acres of Peck's lily habitat. Trees would be cut up to 7" diameter at an approximate 18-25' spacing depending on plant association. Unit 91 is within 500' of the moonwort population along Wildcat Creek. Although this unit is uphill from the site, indirect effects from sediment are not expected because the unit is far enough way and the 58-800 road borders the harvest unit on its lower boundary. Any possible sediment movement would be captured in the road ditch. Indirect effects from microsite changes are also not expected; Unit 91 is northwest of the site so shade or temperature changes are not anticipated.

Harvest would retard succession on only 9 acres within Peck's mariposa lily habitat. Units 17, 25, and 62 are improvement cuts that would target late seral tree species within Peck's lily habitat. The other units proposed for improvement cuts again, would not occur within habitat due to no-cut buffers. This would not benefit Peck's mariposa lily and moonwort species. Moving to a late seral condition is expected to benefit inland sedge and porcupine sedge however, as they are mid to late seral species that do not rely on periodic disturbance.

Direct effects of operational impacts from harvest equipment resulting in soil compaction and physical crushing of vegetation would be minor to Peck's mariposa lily habitat, and none to the other riparian sensitive species. Approximately 48 acres of lily habitat would have equipment impacts, 8% of the total habitat in the project area. The risk of indirect effects from sediment reaching habitat is low due to no-cut buffers and water control clauses, such as waterbars on skid roads. An intensive rain event (25-year) is more likely to deliver sediment to the riparian area from roads and associated drainage culverts within riparian areas. There are 92 acres (Units 2, 66, 80, 103, 11, 120, 124) that have potential to concentrate overland flow into Peck's lily habitat, and 15 acres (Units 103, 120) into sedge habitat (Sussmann 2006).

Other direct effects include temporary road construction, slash burning and natural fuels burning within Peck's mariposa lily habitat. Temporary roads would cross Peck's mariposa lily habitat in four areas. Road construction, even temporary, causes a direct effect to habitat, affecting site productivity. Indirect effects of roads on lily habitat include changes in drainage patterns and moisture regimes, effecting bulblet dispersal. It is assumed that the riparian habitats in which this species occurs were historically subject to low intensity, low frequency, late summer fires. It is likely that the fuels, which have accumulated with decades of fire suppression, may sustain fires of greater intensity than historically occurred, possibly damaging bulbs (if present). The majority of burning within Peck's lily habitat would occur in the fall when vegetation is dormant, which better mimics conditions under which the plants evolved.

Upland Species

Tree density would be reduced through tree harvest, noncommercial thinning, and natural fuels burning. The total acreage proposed for treatments within upland sensitive plant habitat is 5,236 acres, all of which helps meet the need for enhancing sensitive plant habitat by reducing shade and competition. Deschutes milkvetch and world thelopody would benefit from more light reaching the forest floor, increased nutrient availability, and duff reduction from burning.

Early seral conditions would be improved on 475 acres of upland sensitive species habitat. Douglas-fir and white fir would be favored for removal, leaving ponderosa pine as the dominant tree species. Noncommercial thinning, within both harvest and non-harvest areas, would also target western juniper for removal. Prescribed burning on 1,500 acres of Deschutes milkvetch and

world thelopody habitat would benefit the species by reducing juniper, the litter layer and creating small areas of mineral soil for a seedbed.

Operational impacts include soil compaction, especially on skid roads, grapple piled areas, and temporary haul roads. These areas can compact through multiple trips of heavy equipment down to 20” in depth (David 2006). The Ochoco LRMP does not allow more than 20% detrimental compaction within the activity area. Old skid roads and landings would be used where possible to avoid creating new disturbance. Twenty percent compaction within the area is likely to affect world thelopody, but does not appear to deter Deschutes milkvetch from reproducing (Croft et al. 1997). Many populations in the area, including the one present on the Paulina Ranger District, occur within and adjacent to skid trails and other areas of disturbance. Sediment movement may occur from skid trails and landings during an uncommon rain event, but is predicted to be low. Land not committed to skid trails or landings is not likely to contribute overland flow due to effective vegetative cover (Sussmann 2006). This is would be a short-term effect and is not expected to be detrimental to these two particular species that grow in disturbed areas, often on bare soil.

Scabland Species

There are 27 harvest units in Alternative 2 that border Henderson’s ricegrass habitat. Tree density would be reduced along the perimeter of the scablands, reducing shade and conifer encroachment to the scab edges, which would be beneficial to this plant’s habitat. An additional 427 acres (14 units) of noncommercial thinning would occur outside of harvest adjacent to scablands.

Noncommercial thinning would target western juniper to be cut in addition to the other conifers, and juniper up to 16” in diameter would be girdled. This is an additional benefit, as these are usually the first conifers to encroach on scabland edges. Prescribed burning is not designed to burn across scabs; however, no control lines will be constructed to keep fire out of these habitats. It is unlikely that high probability ricegrass habitat can carry a fire, by nature it is rocky and devoid of vegetation, and has no fuel accumulation. *Achnatherum hendersonii* probably evolved in an infrequent, light intensity fire regime in the surrounding forest stands, however effects of prescribed fire on these species is unknown. Natural fuels activities are not expected to have an impact on ricegrass habitat, and are expected to be beneficial by reducing the amount of small tree density directly adjacent to habitat.

The successional status of Henderson’s ricegrass is unknown. It is a deep-rooted perennial bunchgrass confined to a habitat that receives little disturbance. Therefore, it is likely this plant is an indicator of late seral condition. Because of the depauperate habitat, succession only affects this plant through encroachment by other species along the edges of scablands. This can decrease the amount of scabland habitat through time. Tree harvest, noncommercial tree cutting, and prescribed burning adjacent to habitat would be beneficial to the species.

Operational threats to Henderson’s ricegrass habitat are few. The greatest threat comes from soil disturbance. Scablands are particularly vulnerable to machinery impacts because of the shallow clay soils. Poor soil productivity does not allow recovery on these sites, and mechanical effects are long-term, basically permanent (LRMP 1989). No harvest would occur on these sites. Design elements listed in Chapter 2 of the EA would minimize effects from equipment within scabland habitat.

Cumulative Effects – Alternative 2

Cumulative effects of past and present forest activities on sensitive plants and habitat are the same as those analyzed under Alternative 1. Additional future activities to those listed under Alternative 1 include the timber harvest, noncommercial thinning, temporary road building, and prescribed burning proposed in Alternative 2 (see Table 46). Most of the effects from past harvest activities in the uplands have recovered. Stand densities are currently in excess of historic conditions, and soil compaction has naturally abated down to approximately four inches in depth. The incremental change of the proposed activities is beneficial to sensitive plant habitat in the long-term, with some degree of short-term and long-term detrimental impacts. Short-term impacts include soil compaction caused by mechanical harvesters and the creation of bare ground from equipment and prescribed burning. The risk of sediment delivery to streams via overland flow during concentrated storm events is low, but may also be a short-term indirect effect. Longer-term impacts include the creation of approximately 11 acres of new landings. Whole-tree yarding would take place and each landing is predicted to be ¼ acre in size. These landings would be high-use areas that are not expected to naturally recover from soil compaction, and soil productivity recovery would be slow.

Direct and Indirect Effects – Alternative 3

Alternative 3 proposes fewer acres of all activities to address soils, wildlife and water concerns. This alternative would also result in a determination of “May Impact Individuals or Habitat But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species” for all the vascular sensitive species listed in Table 43. This determination is due to short-term effects to habitat. Long-term impacts are expected to be beneficial. For the nonvascular plants silverskin lichen and margined black knotmoss, a determination of “No Impact” is expected. No detrimental effects are anticipated to occur in required habitat of these two species.

Riparian Species

Like Alternative 2, tree density would be reduced adjacent to riparian areas through harvest and noncommercial thinning, but does not generally go close enough to the floodplain to benefit most riparian sensitive species, due to no-cut buffers. Natural fuels burning would however, occur within the buffers, staying 50 feet from riparian vegetation. This will help reduce the number of small trees, which reduces competition in the short-term and shading in the long-term. The objective for most burning units is also to kill lower branches to a height of 8-11 feet. This also helps reduce shading. The reduction of competition and shading is a benefit to Peck’s mariposa lily and the moonworts. Approximately 28 fewer acres of Peck’s lily habitat would be thinned in Alternative 3, for an overall total of only 20 acres. There is no difference between the two alternatives for Peck’s lily habitat benefit from noncommercial thinning, 21 acres would occur to within a 50-foot buffer on several units, reducing tree density. Beyond the 50-foot buffer, noncommercial trees within the riparian area would be cut up to 7” diameter at an approximate 18-25’ spacing depending on plant association. Natural fuels burning in Alternative 3 increases the amount of acreage within Peck’s lily habitat. Several units near the headwaters of Sunflower Creek would be burned in 2007, an immediate benefit to lily habitat. Effects to the crenulate and upswept moonwort population remains neutral in this alternative, Unit 91 is proposed for harvest, with no expectation of beneficial or detrimental effects.

Harvest would retard succession on three acres in Units 17 and 62; this is six acres less than Alternative 2. These units are improvement cuts that target late seral tree species within Peck’s lily habitat. Again, harvest does not cut trees close enough to the stream channel to retard succession in most of the units proposed for harvest. This is not beneficial to Peck’s mariposa lily and moonwort species in the long-term. Moving to a late seral condition is expected to benefit inland

sedge and porcupine sedge, as they are mid to late seral species that do not rely on periodic disturbance.

Operational impacts to Peck's mariposa lily habitat would be minor (20 acres), which is about 3% of the total habitat in the project area. There would be no negative direct operational impacts to moonworts, the sedges or the nonvascular sensitive plants. Indirect effects from soil sediment reaching habitat is less likely in this alternative. Approximately 475 acres of harvest units adjacent to stream channels would be dropped, making even an uncommon rain event low risk for sediment delivery to streams. There are 30 fewer acres of particular concern in this alternative (Units 66, 80, 103, 124) where sediment has the potential to reach Peck's lily habitat (Sussmann 2006). Other direct effects include temporary road construction, slash burning and natural fuels burning within Peck's mariposa lily habitat. Temporary roads effects are the same between alternatives. There would be about 0.6 fewer miles of temporary roads built, none of which is connected to riparian areas. There are still four areas in Alternative 3 crossing Peck's mariposa lily habitat. Road construction, even temporary, causes a direct effect to habitat, affecting site productivity. Indirect effects of roads on lily habitat include changes in drainage patterns and moisture regimes, effecting bulblet dispersal. Operational effects of prescribed burning, intensity and bare ground creation, are slightly less in this alternative. Several units were dropped from harvest but would still be burned, however there would be no slash accumulation that could increase burn intensity.

Upland Species

Tree density would be reduced through tree harvest, noncommercial thinning, and natural fuels burning. The total acreage proposed within upland sensitive plant habitat is 5,185 acres, all of which helps meet the need for enhancing sensitive plant habitat by reducing shade and competition. Deschutes milkvetch and world thelopody would benefit from more light reaching the forest floor, increased nutrient availability, and duff reduction from burning. The total is only slightly fewer acres (51) than Alternative 2 making the effects the same. Tree harvest, however, would create the greatest benefit, would occur sooner in the planning cycle, and removes the most biomass. Fewer harvest acres would occur within upland sensitive plant habitat in this alternative, therefore this is less of an advantage than Alternative 2.

Early seral conditions would be improved on 475 acres of upland sensitive species habitat, the same as Alternative 2. Douglas-fir and white fir would be favored for removal, leaving ponderosa pine as the dominant tree species. Noncommercial thinning within both harvest and non-harvest areas, is the same for both alternatives, and would help defer succession by targeting western juniper for removal. Prescribed burning of 1,250 acres within habitat is less than Alternative 2 by 17%, less benefit for long-term species viability.

Soil compaction would occur from treatment activities, especially on skid roads, grapple piled areas, and temporary haul roads. Alternative 3 would harvest 305 fewer acres (6%) within upland habitat, and grapple pile 280 acres less. Effects of compaction are therefore slightly less (see description under Alternative 2).

Scabland Species

There are 24 harvest units in Alternative 3 that border scabland Henderson's ricegrass habitat, 54 acres less than Alternative 2. Tree density would be reduced along the perimeter of the scablands, reducing shade and conifer encroachment to the scab edges, which would be beneficial to this plant's habitat. Noncommercial thinning would target western juniper to be cut in addition to the other conifers, and juniper up to 16" in diameter would be girdled. This is an additional benefit, as these are usually the first conifers to encroach on scabland edges. The effects are very similar

between alternatives, there is only a 500-foot strip (Unit 201) adjacent to scabland would be dropped in this alternative. Prescribed burning acres adjacent to ricegrass habitat is the same in both alternatives. Natural fuels activities are not expected to have an impact on ricegrass habitat, and are expected to be beneficial by reducing the amount of small tree density directly adjacent to habitat.

The successional status of Henderson's ricegrass is unknown. It is a deep-rooted perennial bunchgrass confined to a habitat that receives little disturbance. Therefore, it is likely this plant is an indicator of late seral condition. Because of the depauperate habitat, succession only affects this plant through encroachment by other species along the edges of scablands. This can decrease the amount of scabland habitat through time. Tree harvest, noncommercial tree cutting, and prescribed burning adjacent to habitat would be beneficial to the species.

Operational threats to Henderson's ricegrass habitat would come from soil disturbance. Scablands are particularly vulnerable to machinery impacts because of the shallow clay soils. Poor soil productivity does not allow recovery on these sites, and mechanical effects are long-term, basically permanent (LRMP 1989). No harvest would occur on these sites. Design elements listed in Chapter 2 would minimize effects from equipment within scabland habitat.

Cumulative Effects – Alternative 3

Cumulative effects of past and present forest activities on sensitive plants and habitat are the same as those analyzed under Alternative 1. Additional future activities to those listed under Alternative 1 include the timber harvest, noncommercial thinning, temporary road building, and prescribed burning proposed in Alternative 3 (see Table 46). Most of the effects from past harvest activities in the uplands have recovered. Stand densities are currently in excess of historic conditions, and soil compaction has naturally abated down to approximately four inches in depth. The incremental change of the proposed activities is beneficial to sensitive plant habitat in the long-term, with some degree of short-term and long-term detrimental impacts. Short-term impacts include soil compaction caused by mechanical harvesters and the creation of bare ground from equipment and prescribed burning. There would be less soil compaction and less risk of sediment reaching sensitive plant habitat compared to Alternative 2. Longer-term impacts include the creation of approximately eight acres of new landings, three acres less than Alternative 2. These landings would be high-use areas that are not expected to naturally recover from soil compaction, and soil productivity recovery would be slow.

Summary

From a sensitive plant habitat standpoint, Alternatives 2 and 3 are very similar. Both meet the desired future condition to increase well-distributed habitat that is suitable for occupation and maintains long-term species viability. Neither alternative would affect the one sensitive plant population (moonworts) in the project area. Minor differences occur between the two alternatives concerning short and long-term effects. Alternative 2 harvests 660 acres more than Alternative 3, most of which lies within sensitive plant habitat. This creates greater short-term impacts from soil compaction and sediment, but also greater long-term benefits from reducing competition, increasing light to the forest floor, and helps keep vegetation in an early successional state. The same is true for noncommercial thinning; more acres are proposed for treatment in Alternative 2. Alternative 1 promotes short-term stability of habitat because there would be no operational impacts. It would not promote long-term benefits for meeting the desired future condition. Habitat

in the project area would remain over-stocked with trees, and continue to have risk of detrimental effects from increased wildfire intensity.

Table 48. Alternative Effects Summary to Sensitive Plant Populations and Habitat for the Willow Pine Area

SPECIES	Alt. 1	Alt. 2	Alt. 3
1. <i>Achnatherum hendersonii</i>	NI	MIH	MIH
2. <i>Achnatherum wallowensis</i>	NI	MIH	MIH
3. <i>Artemesia ludoviciana ssp. estesii</i>	N/A	N/A	N/A
4. <i>Astragalus diaphanus var. diurnus</i>	N/A	N/A	N/A
5. <i>Astragalus peckii</i>	N/A	N/A	N/A
6. <i>Astragalus tegetarioides</i>	NI	MIH	MIH
7. <i>Botrychium ascendens</i>	NI	MIH	MIH
8. <i>Botrychium crenulatum</i>	NI	MIH	MIH
9. <i>Botrychium minganense</i>	NI	MIH	MIH
10. <i>Botrychium montanum</i>	NI	MIH	MIH
11. <i>Botrychium paradoxum</i>	NI	MIH	MIH
12. <i>Botrychium pinnatum</i>	NI	MIH	MIH
13. <i>Camissonia pygmaea</i>	N/A	N/A	N/A
14. <i>Carex backii</i>	N/A	N/A	N/A
15. <i>Carex hystericina</i>	NI	MIH	MIH
16. <i>Carex interior</i>	NI	MIH	MIH
17. <i>Carex stenophylla</i>	N/A	N/A	N/A
18. <i>Calochortus longebarbatus var. longebarbatus</i>	N/A	N/A	N/A
19. <i>Calochortus longebarbatus var. peckii</i>	NI	MIH	MIH
20. <i>Cypripedium calceolus var. parviflorum</i>	NA	NA	NA
21. <i>Dermatocarpon luridum (meiophyllizum)</i>	NI	NI	NI
22. <i>Lomatium ochocense</i>	N/A	N/A	N/A
23. <i>Mimulus evanescens</i>	N/A	N/A	N/A
24. <i>Penstemon peckii</i>	N/A	N/A	N/A
25. <i>Rorippa columbiae</i>	N/A	N/A	N/A
26. <i>Scouleria marginata</i>	NI	NI	NI
27. <i>Thelypodium euosmum</i>	NI	MIH	MIH
28. <i>Thelypodium howellii ssp. howellii</i>	N/A	N/A	N/A

NI: No Impact.

MIH: 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.

WIFV*: Will Impact Individuals or Habitat With A Consequence That The Action May Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population or Species.

BI: Beneficial Impact

N/A: No Habitat or Species Present

***Trigger For A Significant Action As Defined in NEPA**

****Note: Rationale For Conclusion of Effect Is Contained In The NEPA Document.**

Form 2 (R-1/4/6-2670-95)

Noxious Weeds

Affected Environment

Introduction

Most noxious weed infestations on the Paulina Ranger District are being treated using an integrated approach of control methods including hand pulling and grubbing, herbicides, and biological agents. Some infestations are treated using herbicides in accordance with the 1998 Ochoco NF Integrated Weed Management Environmental Assessment (Weed EA). Prevention is a key part of the integrated approach to weed control. Measures commonly taken on the district include washing of off-road equipment and using weed-free hay and seed. The Region 6 “Preventing and Managing Invasive Plants” EIS recently amended the Ochoco NF Land Management Plan (USDA 2005), which adds new management direction relative to invasive plants, increasing emphasis on prevention, and expands the herbicides available for use on National Forest land. Site-specific analysis on the Ochoco NF is underway to assess new treatment methods and sites introduced after 1998.

Measure #1

Potential for Noxious Weed Spread

For the purposes of this analysis, a qualitative discussion of noxious weed spread will be provided. The existence, introduction, and spread of weeds are difficult to quantify and attribute specifically to any one vector on a landscape. As a result, this effects analysis will provide a qualitative assessment of the alternatives on the potential for weed spread as a function of: 1) Current location and treatment status of weeds within the project area; 2) Risk of proposed activities in spreading existing infestations, and the potential for starting new infestations.

Most infestations begin on disturbed areas, such as roads, harvest landings, and recreation sites. The primary introduction of noxious weeds is by vehicles. Other sources of overall introduction and spread include water, wind, livestock, road maintenance and projects such as culvert replacement.

The quantity of noxious weed populations within the Willow Pine Project Area is considered moderate compared to the rest of the District. Currently there are 51 sites of weeds encompassing 28 acres. Table 49 lists the weed status within the project area. Population, as used here, describes a noxious weed occurrence that can be as small as one plant, to as large as thousands of plants but spatially separated from other occurrences. See Figure 10 for a map showing the locations of weed populations.

The Weed EA has treatment sites that follow a few major roads on the District. These treatment sites allow the use of herbicide to control certain species of noxious weeds. Within the project area, 15.8 miles can be treated. The roads included in treatment sites are: 58, 5870, and parts of the 5870-100 and 5870-800. Species available for treatment along these roads is limited to the knapweeds.

Most weed populations are located on roads, along the shoulder and in the ditches; the highest concentration is along the 5870 Road. A large population of spotted knapweed that occurs on the road leading to the Sunflower Material Source on the 5870-100 is treated yearly and plant numbers

have reduced significantly. Plant morphology plays an important role in the effectiveness of treatment. Whitetop, Russian knapweed, and Canada thistle are rhizomatous perennial species that increase using manual control because new plants form from any root segments left in the soil after pulling the mature plant. Table 49 shows manual treatment of whitetop, this has been successful to reduce spread only because it is currently confined to the road shoulder; pulling has reduced numbers and plant vigor. Sulfur cinquefoil and Canada thistle are of particular concern because they readily grow in riparian zones, and have the ability to form large patches of rhizomatous growth. There is no effective manual control.

Table 49. Noxious Weeds within the Willow Pine Project Area

Scientific Name	Common Name	Number of Populations	Gross Infested Acres	Treatment
<i>Centaurea repens</i>	Russian knapweed	1	0.2	Herbicide
<i>Cardaria draba</i>	Whitetop	17	4.9	Manual
<i>Centaurea biebersteinii</i>	Spotted knapweed	4	3.2	Herbicide/Manual
<i>Centaurea diffusa</i>	Diffuse knapweed	3	1.35	Herbicide/Manual
<i>Cirsium arvense</i>	Canada thistle	16	9.4	None
<i>Euphorbia escula</i>	Leafy spurge	1	0.01	Manual
<i>Hypericum perforatum</i>	St. John's-wort	1	1.0	Manual
<i>Potentilla recta</i>	Sulfur cinquefoil	8	8.0	None
<i>Cirsium vulgare</i> / <i>Verbascum thapsis</i>	Bull thistle Common mullein	1	13.0 (est.)	None (Murray Fire)
Total		52	41.1 acres	10.5 acres treated

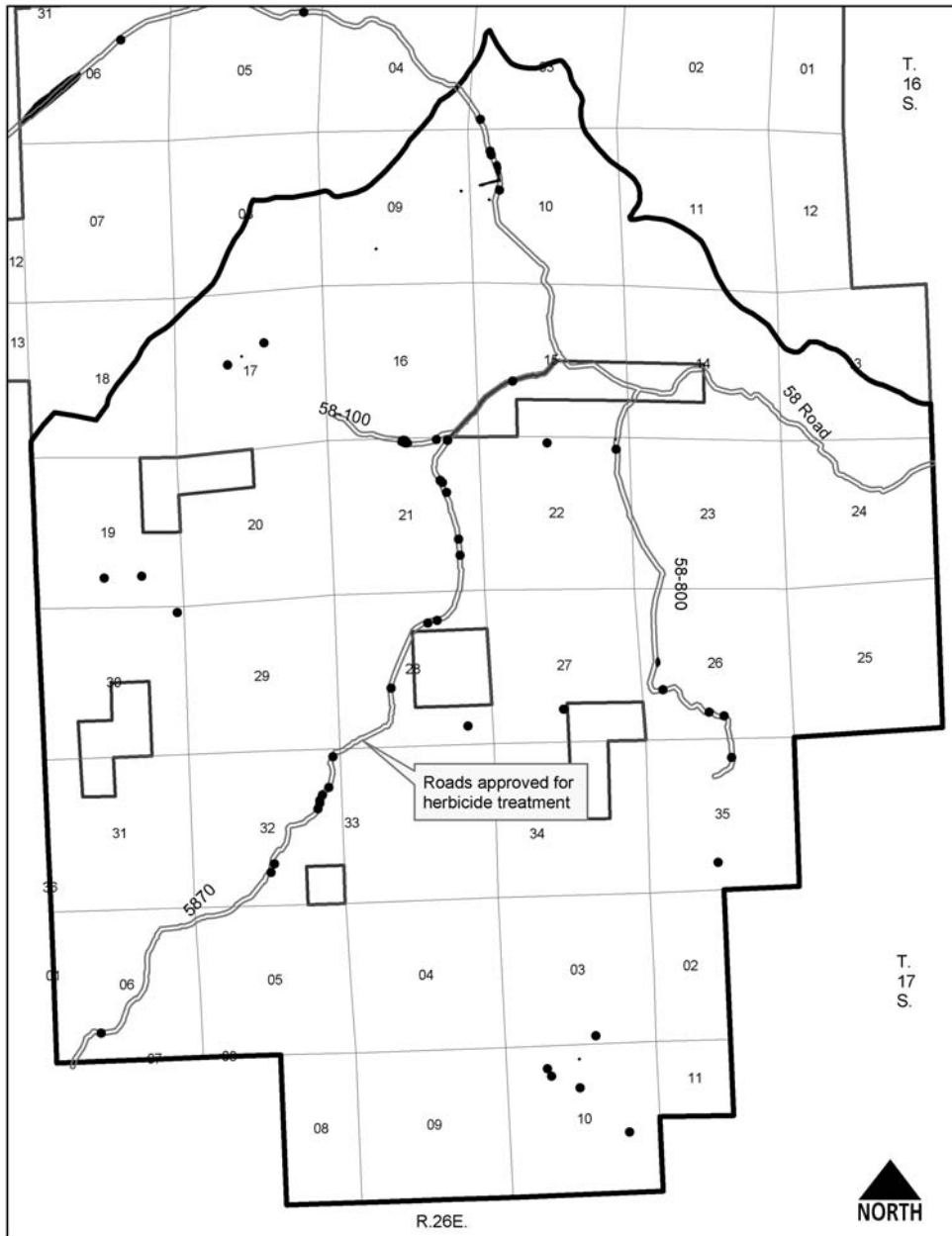
The populations treated with herbicides are decreasing in number of plants. The Sunflower Pit knapweed site has a very persistent seed bank, it is sprayed each year, whereas the other populations have few plants and are often hand pulled. A population of spotted knapweed at the 58 and 58-500 junction was spread during fire suppression activities during the Murray Fire. Untreated infestations of Canada thistle and sulfur cinquefoil are slowly increasing in size. The whitetop and St. John's-wort populations are not increasing at present, they are considered stable. The leafy spurge population has not been seen since 2000, this site may have been controlled before it could reproduce and create a seedbed.

Environmental Consequences

Introduction

Effects analysis of the alternatives assumes that weed populations covered under the 1998 Weed EA would continue to be treated with herbicide as needed each year. Treatment of infestations not covered under the Weed EA and new populations would be treated by manual methods, depending on plant morphology. In the analysis, short-term is defined as a period less than 3 years, and long-term is a period greater than 10 years. The cumulative effects analysis area for noxious weeds is larger than the project area. Vectors not confined to an area, such as animals, wind, and human activity, all transport weeds. The analysis will be based on the project area, adjacent federal and private land, and a linked transportation system.

Figure 10. Noxious Weed Locations within the Willow Pine Project Area



Direct and Indirect Effects – Alternative 1

This alternative has the least potential to spread or introduce noxious weeds. No tree harvest, road building, slash piling, or burning would occur. There would be no associated vegetation disturbance, vehicle traffic increase, or bare ground created. Introduction of new noxious weeds and spread of existing sites would continue from other vectors such as forest visitors, animals, wind, and water.

The risk rating for this Alternative is low risk (see Noxious Weed Report, Appendix F). A level of risk is associated with no action because of on-going use of the area. Noxious weed establishment and spread depends on a vector of introduction and a receptive seedbed, usually disturbed ground, or bare ground within a non-vigorous native plant community. This is a primary reason why weeds become established along roadsides, vehicles being the vector and the road shoulder devoid of vegetation, the seedbed. Over the last 10 years, the Paulina Ranger District has been averaging 25 new weed sites per year, and 2 new weed species per year, based on data since 1995. The Willow Pine area is below that average with an average of five new sites per year and new species occurring about one every three years.

Treatment of the 10.5 acres identified in Table 49 would continue each year. The knapweed and whitetop populations would continue to decrease in plant numbers and net acreage. The St. John’s-wort, sulfur cinquefoil, and Canada thistle populations would remain stable to slightly increasing in the short term without major disturbance. Long term these infestations would increase, and continue to spread through reproduction and common disturbances such as vehicle travel, competing with native plants and reducing biodiversity.

None of the proposed activities would occur in this alternative; therefore, there is no risk of introducing noxious weeds from heavy equipment, log trucks, or Contractor vehicles. There would be no creation of a potential seedbed through disturbance. There is also no potential for the activities to spread existing weed populations, making this alternative compatible with reaching desired future conditions.

Cumulative Effects – Alternative 1

Past activities in the Willow Pine area have been extensive. There has been over a century of sheep and cattle grazing, along with improvements such as fences, trough placement and reservoir construction. Large populations of deer and elk use the area, and there is intermittent wild horse grazing. Since 1950, over 52% of the project area has had timber management. Table 50 shows a summary of projects occurring after 1950. Before 1950, there was a road system in place and a mill located in section 32 was shipping logs to Prineville. Harvest records are vague before 1950.

Table 50. Past Harvest Activity in the Willow Pine Project Area

Type of Activity	Acres	Years	Timber Sale/Project Names
Regeneration harvest	4,189	1973 through 1991	Cougar, Coyote, Frazier, Roadrunner, Sedge Spring, Spur, Telephone, Willow
Intermediate harvest	6,350	1953 through 2006	Columbus, Coyote, Frazier, Hardscrabble, Porcupine, Sunflower, Sunny, South Aspen, Wildhorse, Willow, Windy John
Machine piling	2,331	1976 to 1990 (est.)	Cougar, Coyote, Spur Butte, Wildcat
Grapple piling/slash grinding	1,500	1975 through 2000	Bird, Columbus, Sunflower, Tomahawk 1975

Many introduced plants became naturalized due to European settlement. Plants such as cheatgrass, Kentucky bluegrass, and Japanese brome are now commonplace. The earliest record of noxious weeds in the project area is an unconfirmed sighting of tansy ragwort in the Columbus Creek drainage in 1983. There is no specific data regarding this weed population, nor has any plants been

found. Records exist starting in 1995 with two whitetop populations on the 58-800 road, and one diffuse knapweed population at the Sunflower Pit. The direct cause of these infestations is unknown. Most of the noxious weed sites in the project area to date are located on road shoulders, again with no clear link to cause, other than a presumption they are tied to vehicle traffic.

An exception to this is the spread and introduction of weeds coming from the Murray Fire. The Murray Fire burned approximately 320 acres the summer of 2002. The fire occurred in the northwest part of the planning area. This was a high intensity fire; herbaceous vegetation and plant litter were consumed down to bare soil, and resulted in tree death over the majority of the area. Hydrophobic soil was rated as low over 77% of the area however (USDA 2003), and vegetation has responded well over the last three years. Dense patches of bull thistle and mullein were established from the creation of bare ground acting as a seedbed. Seed of these species are wind borne. These species are not particularly aggressive but do take resources away from native plants, and are so commonplace tracking them is not practical. The diffuse knapweed population at the junction of the 58 and 58-500 roads also spread down both roads from vehicle disturbance during the fire.

The Ochoco NF is currently working on an analysis for the treatment of noxious weeds. This effort is tiered to the programmatic Region 6 Preventing and Managing Invasive Plants EIS. This Regional EIS gives Forests the ability to use newer herbicides; the Ochoco NF analysis would be site specific for treatment of all weed sites on the District. Having the ability to choose the most effective herbicide based on noxious weed species and the ability to treat all known infestations, if necessary, would reduce the spread potential of weeds. Funding and litigation issues may delay these control efforts by several years.

Other present-day activities include timber harvest on private land. Private land in sections 27 and 34 (approximately 160 acres) are currently being harvested using ground based equipment. Weed seed transported in the soil attached to heavy equipment is often a vector of weed introduction. This vector along with soil disturbance may lead to new weed infestations. These could then spread to adjacent Forest Service land.

Grazing of the Sunflower Cattle Allotment occurs every year under rest-rotation management. Cattle contribute to noxious weed spread in several ways; they act as a physical vector and affect native plant communities. All animals (domestic and wildlife) can transport viable weed seeds attached to their hair and hooves, or can carry them in the digestive tract (Parks et al 2004). Overgrazing can lead to less vigorous and early seral plant communities that are susceptible to noxious weed invasion. Areas of soil disturbance or overgrazed areas are more susceptible to weed establishment than areas occupied by healthy native vegetation (Hann et al 1997). Noxious weed presence can be a symptom of deteriorating rangeland health. Presently no weed infestations in the project area are thought to be directly caused by livestock. Observations indicate trailing along the 5870 road shoulder may be affecting whitetop populations.

Future cumulative impacts of travel on forest roads by visitors and forest workers would be detrimental to native vegetation through the spread of noxious weeds in the long-term. The Willow Pine area is well traveled, as its northern boundary is the 58 Road, which is the only access route to the District from the east. This road connects to the South Fork Road, going to Izee and Dayville. Noxious weeds are prevalent in the South Fork John Day area, with aggressive species such as medusahead, dalmatian toadflax, scotch thistle, and musk thistle. The risk of spreading these weeds by forest visitors is high. The 5870 Road runs through the project area to the south, providing access to private land, and the Post-Paulina Highway. Permittees, adjacent landowners

and hunters use this route most of the year. There are noxious weeds on private land to the south and west of the project area, including scotch thistle and medusahead, the extent of these populations is unknown. Risk of spread to Forest Service land is possible.

Future activities in the Willow Pine Project Area include timber harvest and natural fuels burning. The South Aspen Stewardship Timber Sale (<10 acres) would remove conifers from two aspen stands to promote aspen regeneration. No weed populations are present in the area, and prevention measures are in place for cleaning of equipment before entering Forest Service land. The acreage involved is minor and this action is not expected to add new noxious weed sites. The Sunflower Natural Fuels project would burn 4,500 acres over the next several years. This activity is expected to have short-term effects from consumption of vegetative material and duff to the point where some amount of mineral soil is exposed. Bare soil increases the risk of weed introduction, especially when it is adjacent to main travel routes.

Another foreseeable future event in the project area is wildfires. Dense multi-storied stands act as “ladder fuels”, bringing ground fire into the crowns of trees, greatly increasing the burn severity, as seen in the Murray Fire. Alternative 1 does nothing to reduced stand densities and ladder fuels. Wildfires are a high risk for the introduction and spread of noxious weeds due to several factors. A high severity fire creates a bare ground seedbed with no native plants to provide competition against aggressive weed species that can quickly occupy a site. The second high risk factor is the act of fire suppression. Equipment brought in from different areas may be harboring weed seed. Due to the emergency nature of wildfire, prevention measures such as equipment cleaning are not used. Dozer lines, hand lines, drop points, safe areas, staging areas, etc all create bare ground with heavy travel and disturbance. Vehicle traffic increases substantially.

Direct and Indirect Effects – Alternative 2

The potential exists for proposed activities in Alternative 2 to increase noxious weed populations within the Willow Pine Project Area. Vehicles, soil disturbance, and pile burning have the largest potential to introduce new weed infestations and spread existing ones. The risk rating for Alternative 2 is high, see Appendix F.

Table 51 (see below) lists high-risk activities from the risk analysis in the Noxious Weed Report, Appendix F. These activities have potential for introduction and spread of noxious weeds through the creation of bare ground (grapple-pile burning, landings, and road construction) which can be quickly colonized by noxious weeds and introduced plants. Grapple piles are usually large, since they are machine-constructed. Intense heat is a result, which burns all vegetative material down to mineral soil. Harvest landings are highly disturbed areas where the potential for weed infestations coming from outside the project area is the greatest. Log trucks travel great distances and go to mill yards that may have noxious weed infestations, and then return to the landing. There is some probability of starting new infestations from seed and other vegetative material transported back to the landing, a receptive seedbed. There is a risk of weed spread from vehicle traffic, namely log haul, on roads that have concentrated uncontrolled weed infestations of species susceptible to spreading. This includes bull thistle, spotted and diffuse knapweed on the 5870-100, 5870-500, and 58-806 roads. Although the knapweed sites are treated every year, there is a persistent seedbed, and a handful of plants may flower any given year. The bull thistle infestations are not being treated. From the Table, it is apparent that the number of roundtrips through these sites is similar for each alternative, with Alternative 2 having the most direct effect on the populations.

Although the project contains high-risk activities, the probability of spreading existing infestations or bringing new weeds in from outside the planning area is moderate to low when all prevention measures are followed. Prevention measures are listed in detail in Appendix F of this report. The measures are listed as design elements common to the action alternatives and are outlined in Chapter 2 of the Willow Pine Vegetation Management EA. The risk of bringing in weeds from outside the project area is proportional to exposure to noxious weeds prior to coming on the District, or exposure during project activities, such as log haul to and from mill yards. The increased risk of new weed establishment is also proportional to the increase in disturbed soil. This is especially true along travel corridors.

Most of the risk of weed introduction from heavy equipment is lessened through design elements that require cleaning before entering Forest Service land. Heavy equipment such as skidders and harvesters would be free of weed seed, dirt and debris. This substantially reduces the risk of introducing new infestations. Vehicles, however, including log trucks used for hauling are exempt from this requirement, and therefore still pose a risk. Forest Service vehicles are another possible source of weed spread, especially when coming from other Districts and Forests where weeds may be prevalent.

Table 51. High Risk Actions for the Introduction and Spread of Noxious Weeds

	Alternative 1	Alternative 2	Alternative 3
Grapple pile burning adjacent to weed sites	0 Acres	48 Acres	42 Acres
Temporary road construction	0 Miles	4.5 miles	3.9 miles
Number of harvest landings ¹ (new landings in parenthesis)	0 (0)	375 (44)	294 (34)
Log haul along major weed infestations	0 Roundtrips	345 Roundtrips	315 Roundtrips

¹ The basis for this estimate assumes ¼-acre landings every 600 feet of skidding distance for conventional logging. Actual figures depend on terrain and volume in each unit.

Cumulative Effects – Alternative 2

Cumulative effects of past and present forest activities on noxious weed populations are the same as those analyzed under Alternative 1. Additional future activities to those listed under Alternative 1 include the timber harvest, noncommercial thinning, temporary road building, grapple piling, and prescribed burning proposed in Alternative 2. These activities, in conjunction with past and future actions in the cumulative effects analysis area would increase the potential for noxious weed introduction and spread. The risk would be short-term, while native vegetation recovers the disturbed ground. If weeds do become established through the proposed activities, the potential for effects are long-term.

Prevention techniques through design elements and the current weed treatment program would help reduce increased cumulative effects of Alternative 2. The Ochoco LRMP was amended in 1998 to add extensive prevention measures that guide all activities on the Forest, see Appendix F of this report. Prevention helps meet the desired future condition regarding noxious weeds, but does not eliminate risk.

The use of herbicide and biological control on new sites and species is not expected within the near future due to the length of time it takes to complete site-specific analysis and the potential for litigation over the controversy of herbicide use on public land. This leaves manual control

techniques or no control on new sites. Manual treatment is not effective on all species, thus the effects of noxious weed invasion may be long-term.

The proposed activities in the Willow Pine project would reduce stand densities, which is critical to reduce the risk of wildfire. Alternative 2 does the most to reduce this risk by treating the most acres through commercial harvest, noncommercial thinning, and prescribed burning.

Direct and Indirect Effects – Alternative 3

The potential exists for activities proposed in Alternative 3 to increase noxious weed populations within the Willow Pine Project Area. Vehicles, equipment and pile burning have the largest potential to introduce new weed infestations and spread existing ones. The risk rating for Alternative 3 is high, see Appendix F.

Table 51 shows the highest risk activities from the risk rating. Alternative 3 proposes fewer activities that could potentially result in new noxious weed populations compared to Alternative 2. There are three less harvest units going out the 58-500 road haul route, which would result in fewer roundtrips by log trucks. There are 660 fewer acres of harvest proposed overall in this alternative, which means fewer log landings and less temporary road construction. The alternative has one less grapple piling unit (6 acres) adjacent to a noxious weed population that could spread onto bare soil.

Alternative 3, in addition to having somewhat less potential associated with high-risk actions, also proposes dropping units 16, 38, 140, 141 and 142, which is spatially advantageous compared to Alternative 2. These units are adjacent to spotted knapweed and whitetop populations that may be susceptible to spread. Although the weed populations are currently contained, they have not been eradicated. These species have a persistent seed bank, there is always a level of uncertainty from one year to the next, what weather, and other environmental factors may have on plant germination. Not having tree harvest in the vicinity reduces the risk of spread regardless of weather factors.

Prevention measures would be in place to help reduce the potential for noxious weed spread, see description under Alternative 2.

Cumulative Effects – Alternative 3

Cumulative effects of past and present forest activities on noxious weed populations are the same as those analyzed under Alternative 1. Future activities, in addition to those listed under Alternative 1, include the timber harvest, noncommercial thinning, temporary road building, grapple piling, and prescribed burning proposed in Alternative 3. The analysis described under Alternative 2 cumulative effects also applies here. The difference between the two action alternatives is minor. The risk of noxious weed spread would cumulatively be less under Alternative 3 due to fewer proposed management activities, and their spatial distribution.

Summary

The probability of either spreading or introducing noxious weeds depends upon the amount of ground disturbed, the level of risk associated with each project activity, the extent of present populations and vectors involved. The high-risk actions listed in Table 51 are somewhat high in magnitude, considering a 20,000-acre project area. This is due to several iterations of projects occurring on the same acreage; for example, tree harvest and then grapple piling the same area to reduce slash loads, increasing the risk exposure.

Prevention is a good defense against noxious weeds. There are prevention measures in place for the Willow Pine Vegetation Management Project, implementing these would meet standards and guidelines set forth in the Ochoco Forest Plan and its amendments. These measures, in conjunction with current infestation treatment would reduce the probability of weed introduction. However, all management activities involve a level of risk that cannot be completely mitigated. The No Action Alternative also has a level of risk, merely through Forest visitors traveling on roads, however this alternative would move towards the desired future condition faster than the other alternatives. Of the action alternatives, Alternative 3 has the least probability and risk of noxious weed spread, and Alternative 2 has the highest probability.

While Alternative 2 has the most risk associated with it, it does the most to meet the purpose and need of the project to reduce the potential and the affects of a large wildfire. A certain result of wildfire is noxious weed invasion. Alternative 1 does nothing to reduce the affects of an intense wildfire.

Fuels Reduction Activities

A hazard is something in an environment that could cause the loss of something else in that environment. Forest fuels are considered hazardous if, when they burn in a wildfire, they cause the unwanted loss of trees, soils, habitat, property, or other forest resources. Fuels are also considered hazardous if their volume and continuity forces firefighters to employ suppression tactics that are less safe than other tactics. So, the primary purpose of fuels reduction is to reduce the intensity of future wildfires; to reduce fuels to levels where they are not a hazard to forest resources when they burn.

Fuels are arranged horizontally and vertically. Vertical fuels are called “ladder” fuels; these are trees in the forest understory which provide a ladder for fire to move from the forest floor to the forest overstory. In the semi-arid, low-elevation, historically pine-dominated forests of the Willow Pine planning area, frequent low-intensity fires kept forest stands open, and ladder fuels to a minimum. When fire is kept out of forest stands, ladder fuels increase and stands become more dense, which increases the likelihood of high-intensity wildfire, which can kill the entire stand.

Horizontally arranged fuels are called “surface” fuels. The amount of surface fuels 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. Fuel size also relates to fire intensity; small diameter fuels (less than 3 inches in diameter) are the primary influence on surface fire rate-of-spread and flame lengths. The guideline on the Ochoco National Forest for surface fuels is to manage for an average fuel load of less than 5 tons per acre for fuels less than 3 inches in diameter (Ochoco National Forest Plan 1989 p. 4-156, Table 4-34). Large diameter fuels (greater than 3 inches in diameter) are the primary influence on fire duration; the guideline for large fuels is to manage for less than 10 tons per acre.

By reducing ladder fuels and surface fuels, the proposed activities would: 1) Reduce damage to forest resources by reducing the potential for crown fire, reducing the potential for crown scorch (which kills trees by scorching a large percentage of their needles with convective heat), reducing the potential for radiant heat damage to cambium (the inner bark of trees, where diameter growth occurs), and reducing the potential for radiant heat damage to soils and tree roots (Saveland and Nuenschwander 1989). 2) Reduce suppression costs. 3) Increase firefighter safety by reducing potential fire intensity (rate of spread and flame length) which reduces a wildfire’s resistance to control. Low fire intensities allow for direct fireline construction (close to the edge of a fire), which is a safer suppression tactic than indirect fireline construction.

Ladder fuels and surface fuels are factors of fire regimes, which describe the role fire plays in an ecosystem in terms of frequency and intensity. Reducing ladder fuels and surface fuels increases the opportunity for frequent, low-intensity fires, and decreases the potential for high-intensity (stand replacement) fires, moving forest stands from one fire regime to another. Note: It is not the purpose of this project to reduce the possibility of wildfire occurring in the planning area (this is not possible). It is the purpose of this project to decrease the possibility of high-intensity wildfire occurring across the Willow Pine landscape.

Surface fuels consist of “natural fuels”, which accumulate naturally, and “activity” fuels, which are a product of mechanical thinning. Natural fuels and activity fuels in the Willow Pine planning area would be reduced with prescribed fire, either by underburning, or by piling the fuel and burning the piles. Ladder fuels would be reduced by thinning trees mechanically (with chainsaws) and then underburning to treat the slash (branches and small trees), or by underburning alone (thinning with fire). Underburning also prunes 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. However, with the exception of junipers, underburning alone is not an appropriate tool for reducing trees more than 3 inches in diameter, because the amount of heat required to kill larger trees could cause unacceptable damage to the overstory.

Mechanical thinning creates a potential short-term increase in hazard in exchange for a long-term reduction in hazard. Although the threat of high intensity fire is greatly reduced by thinning, the slash created by thinning is a potential hazard until it is treated by burning. For the first year after thinning, the fuel moisture in green slash makes it unavailable to burn, unless a wildfire occurs under extreme conditions (Rothermel et al. 1986). After approximately 1 year, the slash has dried out and turned red, and 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 under a certain height, usually 18 inches, or by piling the slash; the former addresses fire intensity, while the latter reduces fire spread. In units that have been lopped, after 3 or 4 years the slash gets further compacted by winter snows and can be burned with a lower intensity underburn without causing undesired fire effects. This delay also allows for the redistribution of nutrients from the slash back into the soil (Graham et al 1999).

Prescribed underburning is the application of fire in pre-determined patterns under pre-determined conditions in order to produce a desired average flame length and rate of spread. (This combination of environmental conditions is called a “fire prescription”). The most common ignition techniques are the strip-head fire and the backing fire. A strip head fire involves igniting strips of fire across a slope, or with the wind, until one strip reaches the area burned by the strip ahead of it. Fire intensity and rate of spread is controlled by adjusting the distance between the strips, and the number of strips ignited at one time. A backing fire involves igniting a strip of fire and allowing that strip to “back” into the wind or downhill. Fire intensity and rate of spread is controlled by adjusting how often and where fire is ignited to keep it moving (Kilgore and Curtis 1987). Based on past experience*, 40 - 70% of the surface area of prescribed fire units is burned; mineral soil exposure usually occurs on less than 5% of a unit.

* Ref. FASTER, State of Oregon Smoke Management Program database for Ochoco National Forest prescribed fire projects 1990-2000, e.g. Trout, Mill, YoBear, Dippy Beaver project areas

Usually, prescribed fire units that face South and West are in prescription to burn in the spring. Units that face North and East do not usually dry out enough to burn in the spring, and are generally burned in the fall. Units that sit at lower elevations are generally burned in the spring, while units at higher elevations are generally not in prescription to burn until the fall.

7,071 acres of fuels treatments are proposed in the Willow Pine project. Based on a likely implementation period of 7 years, the average number of acres of fuels likely to be treated annually in the planning area is 1010, with a high of 2009 acres and low of 524 acres.

Where prescribed underburning occurs, a fireline (fuel break) is needed around burn units to control fire spread. Fireline construction would be minimized by using roads, major streams, rocky areas or other existing fuel breaks. Where fuel breaks are not available and a fireline is deemed necessary a fireline would be built.

Handline is fireline constructed using handtools, and consists of clearing a 5-10 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 1-3 feet. The width of the line depends on the fuel type the line is constructed through, with narrower line in light fuels such as grass or duff, and wider line in heavier fuels such as high loadings of downed woody material and brush. Position on the slope and topography are other factors dictating the size of the handline.

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 – 30%, waterbars would be placed approximately every 60 feet. On slopes over 30%, waterbars would be placed approximately every 30 feet. On slopes over 45%, waterbars would be placed every 25 feet.

Fireline built with handtools (handline) would be avoided through seeps, bogs, springs, meadows, and any other wet areas. Handline in Riparian Habitat Conservation Areas (RHCAs) would not occur within 50 feet of riparian vegetation (see design criteria, #6, Fisheries).

Piling slash and burning the piles is proposed where fuel loadings are expected to be too high to underburn without causing undesired effects, or to facilitate fuels reduction adjacent to the Forest boundary. Piling increases the amount of fuels that can be treated within the project area within the lifetime (time span) of the project. Piling can occur immediately after thinning, before the fuels dry out, reducing the duration of the short-term hazard that exists after thinning. Piling usually removes a large percentage of the fuel in any given area, leaving the rest to maintain effective ground cover and to provide nutrients for cycling. Approximately 5% of the surface area of piled units is covered by piles.

Handpiles may be necessary along main forest visitor routes. Handpiling affords some protection while red thinning slash represents a high risk prior to underburning. Handpiling along roads represents a clean sweep for 50' to 100' from the road. Handpiles consist of forest fuels that are stacked by hand, are 4-6 feet high and 5-10 feet in diameter.

539 acres of grapple piling are proposed in the planning area. Grapple piles consist of forest fuels that are stacked by a grapple piler (a machine such as an excavator, with an opposable thumb on an articulating arm), are 5-10 feet high and 10-15 feet in diameter. Grapple machines would ideally operate on existing skid trails, on slopes less than 35%, and typically would “walk” Fuels would be piled on 40-70% of grapple units (the area within a grapple unit that can be reached by a machine operating on existing skid trails).

Piles would be centered in the spaces between trees in order to reduce damage to the trees when the piles are burned. Material which is rotten would not be piled. Where a sufficient amount of thinning slash of a diameter and species desirable for firewood exists, thinning units would be made available to firewood cutters before piling, to reduce the amount of slash needing treatment and to provide a low-cost heat source for the community.

Piles would be burned in the late fall or early winter of the second or third season after they are piled. Fire from burning piles could spread in a low-intensity underburn and creep around the forest floor between the piles. 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.

Affected Environment and the Effects of the Alternatives on Fire Regimes and Stands

Fire regimes describe the role fire plays in an ecosystem in terms of fire frequency and fire intensity (Agee 1993). 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 regime, 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 52 displays fire regimes and the effects of fire in those regimes on vegetation:

Table 52. Fire Regimes

Fire Regime	Average Frequency	Effects on Vegetation
Low Intensity	15 years	More than 70% of the basal area or more than 90% of the canopy cover that existed prior to the fire still remains after the fire.
Mixed Intensity	50 years	Fires of intermediate effects, often resulting from a mosaic of varying conditions.
Stand Replacement (High intensity)	115 years	Less than 20% of the basal area or less than 10% of the canopy cover of the overstory remains after the fire.

Each fire regime has a historic range of variability (HRV) (Powell 2000). The historic range of fire regimes is linked to the seral/structural stages of plant association groups (Hall 1989 and Johnson and Clausnitzer 1992) as described in the Viable Ecosystems Management Guide (Simpson et al. 1994) for the Ochoco National Forest. The HRVs described in Viable Ecosystems are based on USGS land survey notes from the 1870s, fire histories, the 1915 Forest Establishment Report for the Ochoco National Forest, stand exams, scientific publications and journals, and the professional judgment of forest botanists, silviculturalists and fire ecologists.

Fire suppression has removed broad-scale, low-intensity fires from the Ochocos. As a result, the amount of surface fuels and ladder fuels, and the density of forest stands, has increased and the distribution of fire regimes is substantially changed from historic condition. The following Table displays fire regime HRVs for forested stands and their current distribution in the Willow Pine project area (Owens 2002). Note: The importance of HRV is not in any specific number but in how much of one regime exists relative to other regimes.

Table 53. Historic and Current Condition of Fire Regimes in Willow Pine, and the Effects by Alternative on Fire Regimes

FIRE REGIMES	HRV Low	HRV High	No Action Alternative	Proposed Action: Alt 2	Alt 3
Low Intensity	10,688	17,010	5,705	9,718	9,335
Mixed Intensity	1,939	8,176	7,242	6,671	6,597
High Intensity	784	7,407	4,334	892	1,349

Direct and Indirect Effects - Alternative 1, No-Action

Currently, the percent of forested area within the low-intensity fire regime is well below HRV, and the amount within the mixed intensity fire regime is approaching the upper limits of its historic range. Under the no-action alternative, the amount of forested acres within the mixed and high intensity fire regimes would increase and low intensity acres would decrease as fuel accumulates faster than it decomposes and the number of trees per acre in the understory increases. The increase in surface fuels would increase flame lengths. As ladder fuels increase, the distance from the ground to the base of the forest canopy would decrease, and crown density (canopy closure) would increase. This would increase the potential for individual tree torching, and increase the probability of landscape-scale, high-intensity crown fire, and its severe effects on fish and wildlife habitat, soil productivity, old growth timber, and air quality.

Direct and Indirect Effects - Alternative 2 and 3

Alternatives 2 and 3 would use commercial thinning of trees from 7-9 inches dbh up to 21 inches dbh, noncommercial thinning of trees under 7-9 inches dbh, and prescribed fire. This combination of treatments would reduce the potential for high intensity fire by decreasing crown density (making crown fire less probable), would increase canopy base height (requiring longer flame lengths to initiate tree torching), and would reduce surface fuels (reducing flame lengths of surface fires).

Alternatives 2 and 3 would increase the proportion of forested area within the low intensity fire regime, reduce the proportion of forested area within the high intensity fire regime, and maintain low-intensity fire conditions in those areas where they already exist. These changes are a result of reductions in surface fuels, ladder fuels and stand density, and an increase in the proportion of fire-resistant Ponderosa pines.

Treating the fuels generated by noncommercial thinning in closed canopy stands would be more expensive, and potentially more damaging to the stand.

Alternative 2 would move more acres with mixed and high intensity fire conditions into a low intensity fire condition than Alternative 3; fewer acres after treatment would support a crown fire. Alternative 2 would move the distribution of fire regimes across the landscape closer to the historic range found in the planning area than Alternative 3.

Cumulative Effects

Grazing

Livestock grazing in the project area could impede the meeting of prescribed fire objectives in open stands with light surface fuels by reducing the surface fuel layer needed to carry fire through the stand. Livestock grazing does not affect potential fire intensity in closed canopy, multi-storied stands with heavy surface fuel loading. Livestock grazing does not effect the distribution of fire regimes because grazing does not alter stand structure and density.

Recreation

Most accidental human-caused fires in the planning area are caused by hunters, and because they occur in the spring and fall are insignificant in size (usually less than 1/10 acre) and effect. Smoke from prescribed fires can impact hunter camps, especially in the late evening/early morning hours as smoke pools in drainages and other low spots.

There are no other planned activities that would affect the distribution of fire regimes in the project area.

Air Quality

Affected Environment

Winds in the Willow Pine project area are typically from the southwest-to-northwest during the spring and fall prescribed fire seasons. Inversions are common at night in the fall in the Paulina Valley, but tend to dissipate by mid-morning.

Direct and Indirect Effects: Alternative 1 – No Action

There would be no emissions produced from prescribed burning related to the Willow Pine project.

Direct and Indirect Effects: Alternatives 2 and 3

The Oregon Department of Environmental Quality is responsible for assuring compliance with the Clean Air Act. In 1994, the Forest Service, in cooperation with the Oregon Department of Environmental Quality, the Oregon Department of Forestry and the Bureau of Land Management, signed a Memorandum of Understanding (MOU) to establish a framework for implementing an air quality program in Northeast Oregon. The MOU includes a prescribed fire emission limit of 15,000 tons of PM 10 per year for the national forests of the Blue Mountains (Malheur, Ochoco, Umatilla, and Wallowa-Whitman). (PM 10 are particulate matter that measure 10 microns in diameter or less, and are small enough to enter the human respiratory system.) All prescribed burning on these forests is coordinated with the Oregon Department of Environmental Quality and the Oregon Department of Forestry through the State of Oregon smoke management program.

Site specific information about prescribed fire units is entered into a regional database along with observations of environmental conditions taken during the implementation of prescribed fires. This data is used to determine the amount of emissions produced by prescribed fires and compliance with established regional limits.

Due to the location of the project area and local weather patterns, smoke from prescribed fire would not affect Class I wilderness areas or urban Special Protection Zones. The nearest Class I wilderness is the Strawberry Mountain Wilderness, 36 miles to the east. The nearest Special

Protection Zone is Bend, 86 miles to the west, into the prevailing winds. Prescribed fire operations are not expected to contribute significantly to smoke pooling in the Paulina Valley. Impact from smoke could affect widely scattered individual dwellings in the Paulina Valley, and would be short-term.

Vegetation and Forest Health (Insects and Disease)

Affected Environment

Introduction

The following report documents forest vegetation and insect and disease conditions for the Willow Pine Project Area. The area within the Project Area boundary was used as the basis for the analysis. The area is of sufficient size and diversity to be representative of insects and diseases concerns and vegetation within the larger landscape beyond the Project Area that might otherwise have influences within the Area.

Data used to describe the vegetation condition and to analyze the effects of alternatives was initially generated from satellite imagery at the pixel scale (1/6 acre) and from an existing plant association GIS data layer. This imagery was then summarized and applied to the Forest's GIS CCLPOLY layer (surrogate for a stand layer). This layer provides canopy closure, size class, and species information. Stands were then delineated on aerial photos and the delineation transferred onto orthophotos where the information was used to create a stand layer. The CCPLY layer data was applied to the stand layer and this information was used as the initial basis for existing conditions for structure and seral (successional) stages of tree vegetation.

Additional site specific data was gathered from field reconnaissance and stand exams and was used to correct stand structure, seral stage, and plant association assignments for the existing condition. A total of 12,690 acres were field reviewed by the project silviculturist including all stands where silvicultural treatments are recommended. Sample trees were increment cored to assess their diameter growth rates, and the presence and extent of insects and diseases were noted.

Data collected during formal stand exams in 2001, 2002, and 2003 of representative stands was used in the Forest Vegetation Simulator (FVS) (Wykoff et al. 1982), a stand growth and yield model, to simulate changes in stand structure and species composition resulting from proposed silvicultural treatments. Vegetation analysis relied on four stand characteristics: stand structure, seral stage (species composition), stand density, and plant associations. Future diameter growth rates for treated stands were estimated using FVS and methods described by Hall (1987) to support an out-year projection of 30 years after treatments for the effects analysis.

The Interim ecosystem standard included in the Regional Forester's Forest Plan Amendment #2 (1995) (Eastside Screens) 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" (HRV) and to identify structural conditions and biophysical environment combinations that are outside HRV conditions to determine potential treatment areas.

The Viable Ecosystems model (VEM) is the method used on the Ochoco N.F to apply ecosystem concepts to project-level planning. This system compares existing vegetation with site potential (or biophysical environment) and historic conditions. 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 model focuses on relationships between combinations of vegetation structure and species composition, and habitat requirements for animals, insects, and plants. The VEM stratifies the environmental gradient using plant associations. The Viable Ecosystems Management Guide (Draft) (Simpson et al. 1994) was used to characterize and compare seral structural conditions to HRV. Full spreadsheet displays of existing conditions and projections of change based on proposed treatment alternatives can be found in Appendix G.

Plant associations are a land classification based on the probable plant community that would develop in the absence of disturbance influences (Johnson 1992). Between 1992 and 1994 plant associations were mapped for the entire Ochoco National Forest. These were verified during field visits to the stands for this project, and any necessary corrections were made. For the Viable Ecosystem model, the plant associations are then grouped into what are called plant association groups (PAGs) according to similar disturbance regimes. Examples of these in decreasing order of moisture regime and site productivity are the dry grand fir, Douglas-fir, mesic (moist) ponderosa pine, and dry ponderosa pine PAGs.

Each PAG is further characterized by seral structural stages, successional processes and disturbance regimes. Seral/structural stages are defined by species composition, size/structure, and canopy closures. Seral stages are determined by percent species composition of shade intolerant species and organized into three stages: E (early), M (mid), and L (late). The structural stage classification is based on the largest structural class that forms 30% or more of the canopy closure. There are five structural stages: 1 (grass/forb/shrub), 2 (seedling and sapling, trees less than 4.9 inches dbh), 3 (pole, trees between 5 and 8.9 inches dbh), 4 (small, trees between 9 - 20.9 inches dbh), and 5 (medium and large, trees greater than 21 inches dbh) (Table 54).

Table 54. Viable Ecosystems Seral/Structural Matrix

Structure Class	Species Composition		
	Early	Mid	Late
Grass, forbs, shrub	E1	N/A	N/A
Seedling , sapling (<4.9" dbh)	E2	M2	L2
Pole (5-8.9"dbh), high density	E3a	M3a	L3a
Pole (5-8.9"dbh), low density	E3b	M3b	L3b
Small (9-20.9" dbh), high density	E4a	M4a	L4a
Small (9-20.9" dbh), low density	E4b	M4b	L4b
Medium/large (21"+ dbh), high density	E5a	M5a	L5a
Medium/large (21"+ dbh), low density	E5b	M5b	L5b

The seral/structural stage coding is further subdivided to reflect relative differences in tree density and multi or single canopy (strata) structure. Subscripts "a" and "b" are used to denote high density and multi-canopy or low density and single or two-canopy stands. These "a" and "b" subscripts are based on crown closure values derived from satellite imagery. For example, a ponderosa pine stand within the dry ponderosa pine PAG would result in an "a" for high density attached to the stage when crown closure values exceed 25%. Crown closure values of greater than 40% are used to define high density for Douglas-fir and grand fir stands. Multi-stratum (more than one layer of forest canopy) canopies are assumed when crown closure values are 41% and greater.

“The general term stand density is a measure of the amount of tree vegetation on a unit of land area” (Powell 1999) and can be the number of trees per acre, the basal area per acre, or other parameters such as average stand density index (SDI) per area. SDI is based on the relationship between tree size and the number of trees per acre and is indexed to a stand having a 10 inch diameter at breast height (dbh) average tree size. Thus, a stand with an SDI of 218 would represent 218 ponderosa pine trees per acre (TPA) with an average tree size of 10” dbh. One stand might achieve this SDI of 218 by actually having 739 TPA averaging 5”dbh while another stand has an SDI of 218 but averages 40 TPA and an average diameter of 26”dbh.

Upon being visited in the field, stands were hazard rated as to their susceptibility to catastrophic mortality from insects, diseases, and fire. The hazard ratings in turn were used to prioritize stands for treatment. Stands with “a” densities were considered moderate, high, or very high risks, depending on whether densities were 90-150%, 150-200%, or >200%, respectively, of upper management zones (UMZ). Stands within these categories were considered to be imminently susceptible to insect attack. Determination of UMZs and lower limit management zones (LMZ) is described by Cochran et al. (1994) and Powell (1999). Adjustments were made to a stand’s priority rating for treatment based on factors such as presence of large old trees at risk because of dense understories or presence of active populations of bark beetles within or adjacent to the stand.

Assumptions Used in Projecting Changes to Seral/Structural Stages

- (1) The structural stages of stands not treated by harvest or non-commercial thinning remain the same over thirty years because of poor growth rates and likelihood that mortality would occur disproportionately in the larger trees (Barret 1979).
- (2) Stands proposed for non-commercial thinning change stages and density classification only if a stand is currently classified as sapling or pole sized. Because non-commercial thinning would not cut any trees greater than 9”dbh, small and medium/large classified stands would remain overly dense and the species mix of the dominant canopy layer (>9”dbh) would not change.
- (3) Stands prescribed burned do not change seral/structure stage. Burning would kill only the smallest trees, therefore, not affecting the overall species mix, dominant tree size, or density to the extent needed to change stages.
- (4) The following was assumed in making 30 year projections (based on FVS and Hall (1984) for seral/structural stages: (a) Thin <21”dbh trees from below to SDI 55. (b) Following commercial thinning (HTH or HIM), stand dbh would average 15-16”dbh, meaning at least 10-15 TPA are already 16-18”dbh. (c) Following commercial thinning to densities near the LMZ, residual trees would grow an average of 2”/decade; thus, resulting trees in 30 years would be ≥ 21 ”dbh. (d) The stands remain below the UMZ over the 30 year period.
- (5) The breakpoint between commercial harvest and non-commercial harvest is 7-9” dbh, the exact diameter depending on market conditions, stand structure, and management objectives.

Affected Environment

Stand Composition

Coniferous forest land comprises 89% of the Project Area and consists of six forested plant association groups (PAGs). PAGs represent the different productivity levels across the landscape. Figure 12 shows the distribution of PAGs across the Project Area, and Table 55 displays PAG acreage. Areas of rock and plant associations characterized by upland grass, scabland grass, meadow grass, and shrubs are grouped under non-forest.

The two western juniper PAGs have low site productivity and are not considered suitable for timber management. Of the four remaining PAGs, the dry grand fir has the most productive plant associations and the dry ponderosa pine the least productive associations. All four of these PAGs contain ponderosa pine as an important component, either as a seral component or as a late species (Table 56). A listing of the plant associations found in the Project Area and their corresponding PAGs can be found in Appendix H. Johnson and Clausnitzer (1991) provide detailed descriptions of each of the plant associations.

Figure 11. Distribution of Plant Association Groups (PAGs) Across the Willow Pine Project Area

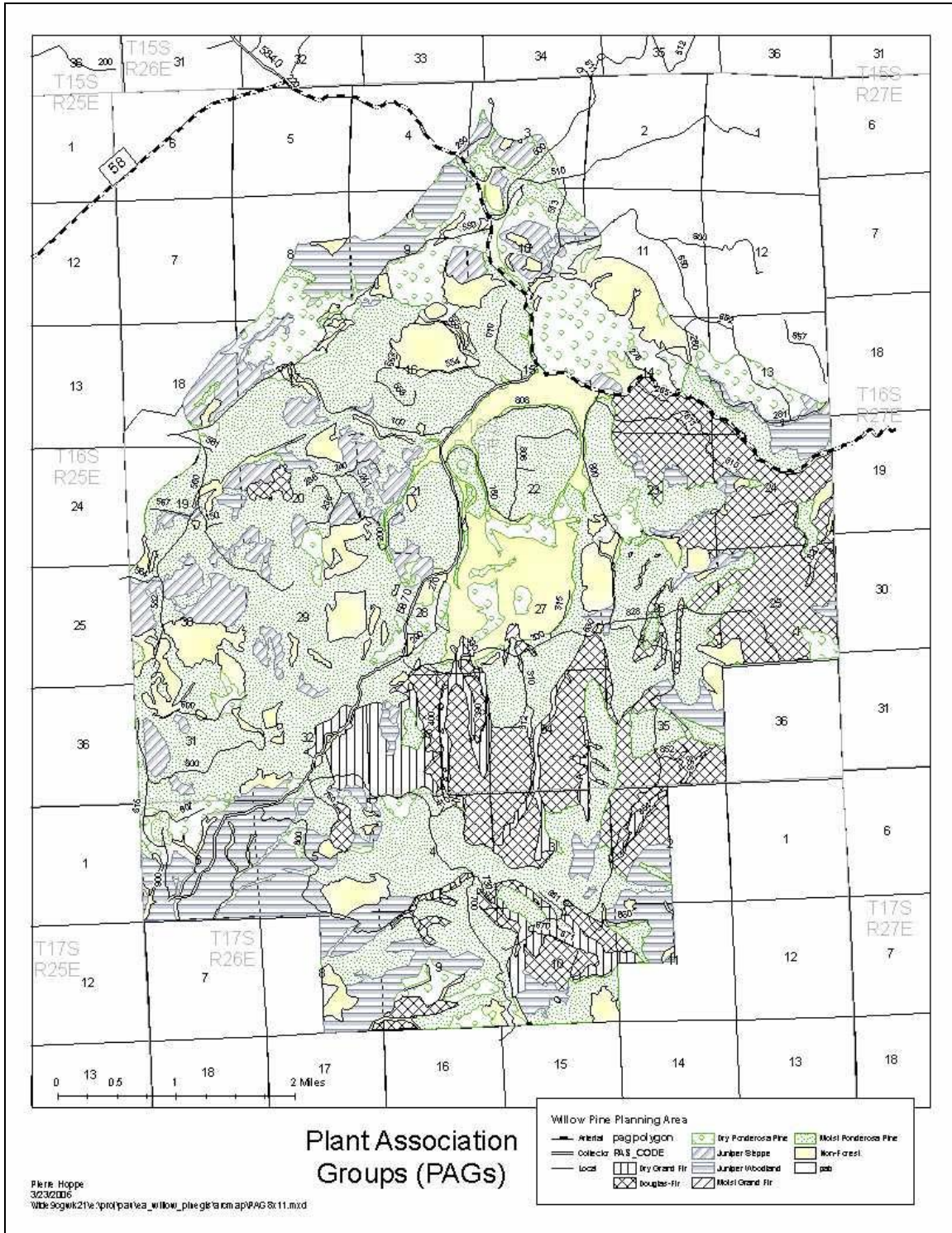


Table 55. Plant Association Groups within the Willow Pine Project Area

Plant Association Group (PAG)	Acres	% of Project Area	% of Forest Area
Dry Grand Fir	970	5%	6%
Douglas-fir	2,708	14%	15%
Mesic Ponderosa Pine	7,373	38%	42%
Dry Ponderosa Pine	3,113	16%	18%
Western Juniper Woodland	2,113	11%	12%
Western Juniper Steppe	1,211	6%	7%
Non-forest	2,140	11%	---
Total	19,628	100%	100%

Note: Data does not include 931 acres of private land.

The mesic and dry ponderosa pine PAGs are the most common and most widespread PAGs in the Project Area. They are dominated by ponderosa pines. The presence of western junipers indicates that a dry ponderosa PAG stand is in an early or mid seral condition. The large surplus (1,157 ac.) of dry ponderosa mid seral and deficit of late (564 ac.) indicates an overabundance of dense pole acreage and a lack of open, park-like stands of large trees compared to historical conditions (Table 56).

Table 56. Seral Stage, Abundance, Dominant Tree Species, and Departure from HRV for each PAG

PAG	Seral Stage	Dominant Species Composition	Area of PAG	Proportion of PAG	Departure from HRV
Dry Grand Fir	Early	PP	78 ac.	8%	404 ac. below
	Mid	PP, DF, GF	424 ac.	44%	144 ac. above
	Late	GF, DF	468 ac.	48%	273 ac. above
Douglas-fir	Early	PP, WJ	758 ac.	28%	722 ac. below
	Mid	PP, DF, WJ	1,511 ac.	56%	1,333 ac. above
	Late	DF, PP	439 ac.	16%	48 ac. above
Mesic Ponderosa	Early	PP, WJ	716 ac.	10%	206 ac. above
	Mid	PP, WJ, DF	3,547 ac.	48%	3,325 ac. above
	Late	PP, DF	3,111 ac.	42%	2,862 ac. below
Dry Ponderosa	Early	WJ	704 ac.	23%	118 ac. above
	Mid	PP, WJ	1,312 ac.	42%	1,157 ac. above
	Late	PP	1,098 ac.	35%	564 ac. below
Western Juniper	Early	WJ	1,360 ac.	41%	1,500 ac. below
	Mid	WJ	1,549 ac.	47%	1,383 ac. above
	Late	WJ	416 ac.	12%	231 ac. above

Source: Willow Pine Viable Ecosystem HRV spreadsheet, Silviculture Report, Appendix G.

Notes: The western juniper woodland and steppe PAGs have been combined.

PP = ponderosa pine, DF = Douglas-fir, GF = grand fir, WJ = western juniper

The presence of Douglas-firs in a mesic ponderosa pine stand indicates the stand is moving towards a late seral condition. The large surplus of acreage for mesic ponderosa in the mid seral stage is mainly the result of the very large expanse of overly dense pole and small sized ponderosa throughout the Project Area.

The dry grand fir and Douglas-fir PAGs are found on more northerly aspects, on the lower 1/3 of slopes, in draws, or along stream channels. Some of the grand fir stands along stream channels have always been dominated by grand fir and Douglas-fir. This conclusion is supported by the number of very large, old trees of these species and the lack of ponderosa pine stumps or trees. However, most of the acreage of this PAG was at one time dominated by ponderosa pine (conclusion based on existing large ponderosa pine stumps). The Viable Ecosystem Model historic range of variability (HRV) analysis (Table 56) shows only 8% of the dry grand fir currently in an early seral condition, a condition that would have a large component of ponderosa pines and Douglas-firs. This represents a deficit compared to HRV of 404 acres. In contrast, 48% of the acreage is found in late seral - meaning dominated by grand fir. The excess of late seral was calculated at 273 acres.

Similarly, the HRV analysis for the Douglas-fir PAG indicates only 28% of the PAG in an early seral condition for a deficit of 722 acres, indicating a large departure from the ponderosa pine dominated stands that existed in much of this PAG historically (Table 56).

Table 56 also shows an overabundance of sapling and pole sized western juniper (mid seral stage) that have become established in the past 100 years with fire exclusion. In contrast, earlier seral conditions dominated by grass and shrubs are 1,500 acres below historic levels.

In summary, decades of fire exclusion has shifted species dominance from those associated with early seral stages to species found in mid and late stages. In the absence of fire, ponderosa pine, being much more tolerant of fire than grand fir and Douglas-fir, has been replaced as the dominant species in many stands. The disproportionate cutting of large ponderosa from the 1930's through the 1980's has also contributed to the species shift. A change in relative abundance of the different seral stage to proportions similar to historical conditions is needed to have sustainable, healthy stands. The acreage departure from HRV by PAG is the measure that will be used to assess effects to seral conditions for each alternative.

Stand Structure and Density

Most ponderosa pine PAG stands can be considered even-aged with most trees 90-110 years. Precommercial thinning was done partially or fully in stands totaling 6,000 acres. Where precommercial thinning was done, these stands typically have 200-300 trees per acre (TPA) ranging from 7 to 16" dbh (Photograph 1). Ponderosa pine and western juniper seedlings and saplings are present in many of the stands. Older ponderosa pines, 200 years and more, are widely scattered and found individually or in small groups of 2-5 trees. Typically they have dense understories of sapling and small sized (9-20.9" dbh), younger trees under them, unless the stand was recently non-commercially thinned and prescribed underburned.

Most upland stands within the Douglas-fir and dry grand fir PAGS could also be considered mostly even-aged, but tree stocking is clumpier and there are more groups of older trees (>110 yrs.). Species presence is quite variable as the proportion of grand fir, Douglas-fir, and ponderosa pine changes from acre to acre. Near stream channels, these PAGs predominately support uneven-aged stands dominated by grand fir and Douglas-fir with only an occasional ponderosa pine.



Photograph 1. Overly dense small (9-20.9" dbh) sized ponderosa pine stand that was previously non-commercially thinned to a narrow spacing and is typical of many stands within the Project Area.

Of the 72 seral/structural stages possible within the Project Area, 26 are within HRV, 25 are above HRV, and 21 are below HRV. A disproportionate amount of overly dense stands are found in all size classes and all PAGs except for the seedling/sapling and the medium/large size classes (Table 57). The small acreage of overly dense acreage in the medium/large size class is a function of the fact there are so few stands classified as medium/large (Table 57).

Scattered, large trees also have overly dense conditions surrounding them, but these mostly are within stands designated as pole or small sized as there are insufficient numbers of >21" dbh trees to classify the stand as medium/large. These large trees in overly dense stands and the area they represent are better characterized in Table 58 in which satellite pixel data was able to capture them on a scale smaller than what would be mapped as a medium/large stand.

Almost half (48%) of all the suitable acreage within the Project Area is made up of overly dense stands dominated by small sized (9-20.9" dbh) trees (Table 57). A large percentage also consists of overly dense pole stands (26%). Dense stands increase the rate of loss of large trees due to competition-related stress. Dense stands also lead to increased risk of catastrophic tree loss resulting from fires, insects, and diseases. Tree growth rates of dense stands are much slower than less dense stands, resulting in much longer time frames for pole and small sized trees to achieve medium/large tree sizes that are more resistant to fire and desirable for old-growth dependent wildlife species.

Table 57. Tree Size and Abundance by PAG for Stands Classified as Overly Dense (“a”) (suitable lands only) Compared to HRV

PAG (total acres)	Tree Size Class	Proportion of total PAG	Overly dense area of PAG	HRV Range	HRV Departure
Dry Grand Fir (970 ac.)		94%	910 ac.		
	Seedling , sapling (<4.9" dbh)	0%	0 ac.	N/A	N/A
	Pole (5-8.9"dbh)	6%	54 ac.	0-10 ac.	44 ac. above
	Small (9-20.9" dbh)	64%	618 ac.	10-98 ac.	520 ac. above
	Medium/large (21"+ dbh)	24%	238 ac.	38-98 ac.	140 ac. above
Douglas-fir (2,708 ac.)		82%	2,225 ac.		
	Seedling , sapling (<4.9" dbh)	0%	0 ac.	N/A	N/A
	Pole (5-8.9"dbh)	27%	738 ac.	0-27 ac.	711 ac. above
	Small (9-20.9" dbh)	42%	1,139 ac.	54-298 ac.	841 ac. above
	Medium/large (21"+ dbh)	13%	348 ac.	108-406 ac.	within
Mesic Ponderosa (7,373 ac.)		81%	5,973 ac.		
	Seedling , sapling (<4.9" dbh)	2%	142 ac.	N/A	N/A
	Pole (5-8.9"dbh)	25%	1,878 ac.	0-74 ac.	1,804 ac. above
	Small (9-20.9" dbh)	51%	3,787 ac.	0-222 ac.	3,565 ac. above
	Medium/large (21"+ dbh)	2%	166 ac.	74-517 ac.	within
Dry Ponderosa (3,113 ac.)		73%	2,283 ac.		
	Seedling , sapling (<4.9" dbh)	1%	40 ac.	N/A	N/A
	Pole (5-8.9"dbh)	33%	1,020 ac.	0-31	989 ac. above
	Small (9-20.9" dbh)	39%	1,223 ac.	0-93	1,130 above
	Medium/large (21"+ dbh)	0%	0 ac.	31-155	31 ac. below
Total (14,164 ac.)		80%	11,391 ac.		
	Seedling , sapling (<4.9" dbh)	1%	182 ac.	N/A	N/A
	Pole (5-8.9"dbh)	26%	3,690 ac.	0-142 ac.	3,548 ac. above
	Small (9-20.9" dbh)	48%	6,767 ac.	64-711 ac.	6,056 ac. above
	Medium/large (21"+ dbh)	5%	752 ac.	251-1,176 ac.	within

Table 58. Acres That Contain Various Levels of Large-Diameter Ponderosa Pine Growing Under Dense Conditions within the Sunflower Project Area

Plant Association Group (PAG)	Acres of PAG on Sunflower PA	Number of acres with high stand densities and some level of large-diameter ponderosa pine	% of total PAG acres at high density
Dry Grand Fir	780	362	46.4
Douglas-fir	2,939	1,269	43.2
Mesic ponderosa pine	8,663	2,483	28.7
Dry ponderosa pine	2,119	1,159	54.7
Total	14,501	5,276	36.4

Source: A. Eglitis (2004) from Viable Ecosystem pixel data.

In summary, decades of fire exclusion has allowed many more trees to become established across most acreage than occurred historically. A reduction in the amount of acreage of overly dense stands is needed to move the Project Area towards HRV and the desired condition so that a more sustainable, healthy landscape can be achieved. This can be achieved by reducing stand densities to recommended levels by mechanical thinning.

The number of seral/structural stages within HRV and the acreage of overly dense stands are the measures that will be used to assess effects to stand density and structure.

Late or Old Structure

Late or old structure (LOS) stands are defined as those stands averaging a minimum of 13 TPA greater than 21”dbh (USDA 1993). The overall acreage (752 ac.) of multi-strata (more than one canopy layer) LOS is within HRV. Only the dry ponderosa PAG is below the multi-strata HRV since there no acres classified as multi-strata LOS, though the departure is small (31 ac.) because historically there was very little. On the other hand, the acreage of single-story LOS stage stands (5 ac.) is almost non-existent and well below what was historically present (Table 59). The deficit occurs and is large in all four of the PAGs considered suitable for timber management.

Table 59. Historic Ranges and Existing Condition for Both Multi and Single-Stratum LOS Conditions

PAG	Structure	HRV Range	Existing Condition	Departure from HRV
Dry Grand Fir				
	Multi Strata	87-243 ac.	238 ac.	within
	Single Strata	446-834 ac.	0 ac.	446 ac. below
Douglas-fir				
	Multi Strata	108-406 ac.	348 ac.	within
	Single Strata	1,300-2,031 ac.	0 ac.	1,300 ac. below
Mesic Ponderosa				
	Multi Strata	74-516 ac.	166 ac.	within
	Single Strata	4,351-6,268 ac.	0 ac.	4,351 ac. below
Dry Ponderosa				
	Multi Strata	31-156 ac.	0 ac.	31 ac. below
	Single Strata	779-1,682 ac.	5 ac.	774 ac. below
Total				
	Multi Strata	300-1,321 ac.	752 ac.	within
	Single Strata	6,876-10,815 ac.	5 ac.	6,871 ac. below

Source: Willow Pine Viable Ecosystem HRV spreadsheet, Silviculture Report, Appendix G.

As such, the large-tree ponderosa pine-based forest structure is important to protect where it exists and important to recruit where the potential to do so exists. Because many of these small blocks designated as LOS or old growth have a minimum number of large trees at the present time, even the loss of two or three of them per acre may take the LOS stand below the threshold that constitutes ‘large trees common’, the first element of any LOS classification.

The trees that were established before European settlement (trees greater than 150 years old) are the most vulnerable in multi-storied stands. In ponderosa pine forests of the Southwest, Mast and others (1999) reported more than a ten-fold increase in the rate of pre-settlement tree mortality

between the 1970s and the 1920s. Similarly, Dolph and others (1995) noted a significant degree loss of the larger-diameter trees (> 27" dbh) in untreated and lightly treated ponderosa pine stands in northeastern California over a 50-year period of monitoring" (Eglitis 2004).

Timber harvest of large ponderosa pine and Douglas-fir in the past in combination with high mortality rates because of overly dense stands and the resulting competition for scarce resource has led to a very large departure from HRV of single storied LOS structure. The acreage departure from HRV and the acreage change in LOS in 30 years are the measures that will be used to characterize LOS.

Forest Health (Insects and Disease)

Tree vigor is a major factor in assessing the overall health of a forest. 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 co-dominant trees (Cochran 1993). This is important given the existing low amount of large trees and the time and growth needed to develop large tree structure. A variety of disturbance agents exist within the Project Area. The most readily apparent are bark beetles, dwarf mistletoes, root disease, and defoliators. Table 60 displays by hazard class the acreage within the Project Area thought to be at risk to insects and disease because of high stand densities (see Methodology section for a more detailed explanation).

Table 60. Acreage Susceptible to Insects and Diseases Because of High Stand Densities by Hazard Rating and PAG

PAG	Very High Hazard	High Hazard	Moderate Hazard	Low Hazard or not rated
Dry Grand Fir	478 ac.	317 ac.	69 ac.	106 ac.
Douglas-fir	802 ac.	894 ac.	273 ac.	739 ac.
Mesic Ponderosa	2,491 ac.	2,586 ac.	910 ac.	1,386 ac.
Dry Ponderosa	815 ac.	998 ac.	541 ac.	759 ac.
Western Juniper	0 ac.	15 ac.	463 ac.	2,846 ac.
Total	4,586 ac.	4,810 ac.	2,256 ac.	5,833 ac.

Total

Note: Stands not visited in the field were assigned to the Low Hazard category.

Insects

Western pine (*Dendroctonus brevicomis* Leconte) and **mountain pine** (*Dendroctonus ponderosae*) **beetles** are found throughout the Project Area in high numbers, especially within the pure ponderosa stands of the mesic and dry ponderosa pine PAGS. Bark beetles are most typically associated with dense, overcrowded stand conditions (Eglitis 2004).

Aerial insect and disease surveys for the years 2004 and 2005 show numerous tree mortality centers resulting from bark beetle attack. Stand exams and field reconnaissance also identified bark beetle activity and susceptible stand conditions. Tree density levels for the acreage displayed earlier in Table 57 exceed thresholds above which stands are considered imminently susceptible to attack by bark beetles. The trees exhibit poor growth rates and low vigor, indicators that they would have difficulty fending off attacks by bark beetles.

Western and mountain pine beetles are killing ponderosa pines, both individually and in pockets of up to 20 trees in a group. The populations of these beetles increased substantially between 2003 and 2004 and reached near outbreak proportions in 2004 (Eglitis 2004). Table 61 shows the number of acres impacted by these beetle over the past few years. Though data is not available for 2005, the level of beetle caused mortality to ponderosa pines observed during on-the-ground reconnaissance during the 2005 field season appeared similar to that experienced in 2004. Aerial detection surveys showed a decrease for 2005 but this might have been the result of killed trees changing color very quickly in 2005 and being dismissed during the detection survey as 2004 mortality.

Table 61. Acres Affected by Two Pine Bark Beetle Species Between 2002 and 2004 in the Sunflower Project Area as Determined from Aerial Insect Detection Surveys

Agent	Area affected 2002	Area affected 2003	Area affected 2004
Mountain pine beetle - PP	*	198 ac.	170 ac.
Western pine beetle – large PP	*	1 ac.	69 ac.
Western pine beetle – small PP	*	-	499 ac.
Total	*	199 ac.	738 ac.

Note: *Data is unavailable, but numbers are presumed to be low.

PP = ponderosa pine

Source: A. Eglitis, 2004.

On-the-ground observations indicate that ponderosa pine mortality resulting from bark beetle attack is generally greatest in the highest density stands and also appears in some areas to be associated with prescribed burns carried out in recent years. Diameters of recently attacked trees range from 7-24” dbh. In the past three years in a stand on Spur Butte, where a goshawk nest is located, many of the largest trees (16-24” dbh) have been attacked and killed, jeopardizing the stand’s ability to provide nesting habitat. Two other goshawk nest stands also have density levels three times higher than the threshold level above which tree mortality from bark beetles can become serious (Cochran et al. 1994).

It has long been recognized that stand density is one of the most important of many factors that influence the populations of bark beetles. Reduced tree vigor that arises from competition between trees for site resources is responsible for increases in beetle populations. Bark beetle populations can most successfully be regulated by reducing their habitat; that is, by thinning the stands that are vulnerable. Numerous researchers studying ponderosa pine and its associated bark beetles have reported significant tree mortality in dense stands that [the mortality] was reduced by thinning (Cochran 1992; Cochran and Barrett 1999; Cochran and others 1994; Dolph 1982; Fiddler and others 1989; Hall and Davis 1968; Sartwell and Dolph 1976; Sartwell and Stevens 1975; Schmid and Mata 1992). Although the previously mentioned references deal primarily with stands of young ponderosa pines, the same principle applies to older trees. The benefits from thinning to pre-settlement trees in old-growth ponderosa pine stands have been demonstrated by Stone and others (1999) and Kolb and others (2001)” (Eglitis 2004).

Conclusions seemingly contrary to the well documented strategy of thinning in western coniferous to prevent catastrophic bark beetle attack are made by Black (2005). In discussing Black’s

publication, Forest Service forest entomologists responded that “There are [in Black’s report] many statements . . . within the report that are taken out of context, misleading, or simply not true. . . . literature is selectively cited, and opinions are extrapolated from research that often is inappropriately used to support the points being made” (USDA 2005). The entomologists reiterated that “Thinning is a well-established and universally accepted prevention strategy by professional foresters and scientists to significantly reduce susceptibility to endemic [native] bark beetle activity.”

Cochran (1992) and Cochran and others (1994) have developed stocking density guidelines from which we can generally predict the risk of bark beetle attack for a number of tree species in Central Oregon. The guidelines are adjusted for each plant association so that site potential (carrying capacity) can be factored into the equation, and higher stand densities can be accommodated on the better sites. Cochran describes an “Upper Management Zone” [UMZ] which is equal to a stocking density that allows for radial growth of 13 annual rings [per inch] [or 1.5 inches of diameter growth per decade] and represents the threshold beyond which tree mortality begins to occur. The comparison of existing stocking levels and growth rates with the levels recommended by Cochran and others (1994) provides a useful index to describe the relative stability of a stand of trees with regard to infestation by bark beetles” (Eglitis 2004).

If managed below these upper management zones, a suppressed class of trees never develops that would make the stand susceptible to serious bark beetle attack. Without treatment, it is feared the stands would face increasing levels of bark beetle attack, resulting in many of the largest trees being killed. UMZs for the dominant plant associations found in the Project Area can be found in Appendix H.

Treatment acreage of very high, high and moderate hazard stands dominated by ponderosa pine will be the measure used to assess how well each alternative addresses the threat of serious mountain pine and western pine beetle attack.

Similarly, **fir engraver beetles** (*Scolytus ventralis*) are attacking and killing grand fir in large numbers in the dry grand fir PAG stands. The mortality is found mostly in densely stocked areas and is also likely associated with droughty conditions and additional stresses from annosus root disease infections. The tree mortality is generally found in trees 10-20”dbh. Treatment acreage of very high, high, and moderate hazard stands with large components of grand fir will be used to assess how well each alternative addresses the threat from fir engraver beetles.

Also occurring in the Project Area are **Douglas-fir beetles** (*Dentroctonus pseudotsugae*). Like fir engraver beetles, these insects are secondary pests because they attack Douglas-fir trees that are weakened and stressed. Factors such as drought, defoliation, overstocking, and disease can result in outbreaks of these insects and subsequent severe tree mortality. Treatment acreage of very high, high, and moderate hazard stands with large components of Douglas-fir will be used to assess how well each alternative addresses the threat from Douglas-fir beetles.

Old top kill of grand fir and Douglas-fir thought to be associated the **western spruce budworm** (*Choristoneura occidentalis* Freeman) is present. The western spruce budworm is a defoliating insect which predominately feeds on Douglas-fir and grand fir. 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 of mortality as a result of budworm epidemics contribute to high fuel loadings and fire hazard, increasing the risk of severe wildfire. Habitat conditions that promoted the previous epidemic population of budworm remain.

Basic management strategies focus on damage prevention by reducing stand densities to maintain vigor, and favoring early seral species such as ponderosa pine. The risk of future western spruce budworm damage is decreased in stands with an early seral species composition and stocking control (Brookes 1987). Treatment acreage of very high, high, and moderate hazard stands dominated by grand fir and Douglas-fir will be used to assess how well each alternative addresses the threat from western spruce budworm.

Diseases

The “S-group” of **annosus root disease** fungus (*Heterobasidion annosum* (Fr.) Bref.) is common in the Project Area wherever grand firs are found. Grand fir appears to be the only species in the Project Area to be infected. The fungus causes growth loss, tree mortality, wood decay and stain, and stem breakage. Snags created by *H. annosum* are very short lived. Pockets of as many as 20 dead and fallen grand fir thought to have been killed by the root disease are found in some areas of the grand fir type. Samples of laminated type decay from the exposed roots of fallen grand fir and conks (fruiting bodies) located inside decayed stumps were verified by the Area Forest Pathologist as being from *H. annosum* (Helen Maffei, personal communication). Effects of *H. annosum* can be minimized by favoring ponderosa pine and Douglas-fir, in which case applying borax to freshly cut stumps, a method used to sometimes prevent its spread by preventing spore germination and infection, would not be necessary. Treatment acreage of infected stands will be used to assess how well each alternative addresses the threat from annosus root disease.

Indian paint fungus (*Echinodontium tinctorium* Ell. & Ev.) was observed in almost all of the dry fir PAG stands. This stem decay fungus affects grand fir and causes rot within the tree bole. Treatment acreage of very high, high, and moderate hazard stands containing a large component of grand fir will be used to assess how well each alternative addresses the threat from Indian paint fungus.

Western dwarf mistletoe (*Arceuthobium campylopodum*) infects ponderosa pines and is found on about half the acreage dominated by this tree species. Infection levels of affected stands range from light to severe. The parasitic plant decreases tree vigor, reduces growth, and increases susceptibility to other pathogens and to bark beetles. Infections in trees of the upper canopies spread readily to trees in the lower canopies. **Douglas-fir dwarf mistletoe** (*Arceuthobium douglasii*) is found in almost all the stands with a large component of Douglas-fir and causes growth loss, reduced wood quality, top-kill, and mortality.

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

Dwarf mistletoe management can be directed at either prevention or reduction. The most effective treatment for dwarf mistletoe control is to remove infected overstory trees where they exist to prevent its spread to adjacent trees. Where infections levels are confined to the lower one-half of the tree crown and trees are not at risk of infection from above, stocking control can effectively reduce some growth loss, improve vigor, and reduce re-infection (Barrett and Roth 1985); especially if the worst infected trees are targeted for removal. Treated stands would have a better chance of developing large tree structure than if they were not treated.

Treatment acreage of dwarf mistletoe infected stands will be the measure used to assess how well each alternative addresses the threat from this parasite.

Management Direction

The Ochoco National Forest Land and Resource Management Plan (Forest Plan) (USDA 1989) provides direction for the management of vegetation and forest health in the Ochoco National Forest. Additional direction comes from the Eastside Screens. Forest wide standards and guidelines applicable to the Project Area are shown in Table 62.

Table 62. Vegetation and Forest Health Standards and Guidelines Applicable to the Project Area

Management Activity	Management Direction/ Standards and Guidelines
Vegetation Management	<p>Precommercial and commercial thinnings would receive high priority in development of stand management activities, in order to meet objective for stand health (especially resistance to bark beetles), economic efficiency, and production of high quality wood (Forest Plan, p. 4-223).</p> <p>The minimum stocking standards based on 4.5 ft. tall trees are 50 TPA for low site pine and 75 TPA for mesic ponderosa pine and mixed conifer sites (Forest Plan, p. 4-205).</p> <p>In General Forest, emphasis will be on the prevention of stand and fuels conditions that will provide favorable habitat for pests to increase above endemic levels (Forest Plan, p. 4-153).</p> <p>In Visuals, all treatment strategies may be utilized to manage insects and diseases, to meet the management area objectives. Emphasize strategies that improve aesthetics and safety. Treatment of bark beetles and root disease are emphasized (Forest Plan, p. 4-152).</p>
Insect and Disease Management	<p>In General Forest Winter Range, utilize all methods to prevent or suppress insect and disease outbreaks. Consider thermal cover objectives when prescribing stocking levels for ponderosa pine stands (Forest Plan, p. 4-153).</p> <p>For mountain pine beetle, control stocking levels by thinning, cleaning, or prescribed burning. Keep stands in vigorous condition (Forest Plan, p. 4-149).</p> <p>For western pine beetle, remove high risk trees that exhibit declining crown vigor preferentially during normal entries and decrease intertree competition by thinning, cleaning, or underburning (Forest Plan, p. 4-149 and 4-150).</p> <p>For western spruce budworm, develop stands composed of larch and pines.</p> <p>For western dwarf mistletoe, eliminate inoculum by regeneration harvest of infected stands (Forest Plan, p. 4-149).</p> <p>For annosus root disease, regenerate those areas with tolerant or resistant tree species. Discriminate against grand fir; favor any other species (Forest Plan, p. 4-150).</p> <p>For Indian paint fungus, do not manage high risk understories. Keep rotations under 120 years and promote tree vigor throughout the life of the stand (Forest Plan, p. 4-150).</p>

Desired Condition

The desired condition is derived from the Forest Plan and the Purpose and Need for the project. Forest Plan direction for desired condition is to achieve tree density and species composition that will reduce the adverse effects of insects, disease, and drought and will enhance habitat for sensitive wildlife species. The desired condition represents an ecosystem that is dynamic and resilient to disturbances to structure, composition and process, and their biological or physical components. The overall goal is to manage species composition, structure, and spatial patterns consistent with those resulting from historical fire regimes and populations of insect and disease agents within historic levels. The VEM is used as a guide for moving seral/structural stages from outside the HRV to within (or closer to) the HRV.

The desired condition is a landscape that roughly mimics the area estimated for HRV for the different seral/structural classes for the different PAGs. Desired density levels are those that fall between the recommended UMZ and the LMZ for applicable plant associations (Powell 1999). The desired average growth rate over a growing period for individual trees is 2 inches of diameter growth per decade with a minimum during the period of 1.5 inches of diameter growth per decade. Areas of LOS would be distributed relatively evenly across the Project Area. LOS would represent between 50 and 85% of all capable and suitable acreage. Single-strata stands would make up 90% of LOS and multi-strata stands 10% of LOS. Single-strata stands would be almost exclusively ponderosa pine for all PAGs where the species is a major component. Ponderosa pine would dominate most small-size/structural stage stands. Photograph 2 shows the desired condition immediately following treatment for a stand dominated prior to treatment by overly dense, small (9-20.9" dbh) sized ponderosa pines.



Photograph 2. Desired condition immediately following treatment for a mesic ponderosa pine stand dominated by 100 year old trees. Most trees are 12-21" dbh and stand density ranges from 35 to 60 tree per acre.

Specifically, the desired condition in ponderosa pine PAGs where single-strata LOS is the goal (approximately 5,500 ac.) are stands generally consisting of a single canopy layer of large (>21" dbh), healthy, fire resistant ponderosa pines (15-30 TPA). (The same is true for the Douglas-fir and grand fir PAGs except that a component of Douglas-fir is acceptable in the Douglas-fir PAG stands and a small component of Douglas-fir and grand fir is acceptable in the dry grand fir PAG stands). Gaps in the canopy will allow regeneration to become established on a small percentage of the stand resulting in patches of smaller size classes. Stands will be resistant to bark beetle attack; trees will grow a minimum of 1.5 inches in diameter per decade but should average 2 inches per decade. Dwarf mistletoe, while still present in many stands, will be at low enough levels that stand growth can achieve 80% of the growth of an uninfected stand. Snags and down woody fuels will exist at levels that adequately provide for wildlife needs.

Where multi-strata LOS is desired, stands will have two or more layers of trees but would otherwise have the same attributes as described above.

Environmental Consequences

Direct and Indirect Effects – Alternative 1

Species Composition

No treatments would occur to change existing species composition. Dry grand fir and Douglas-fir PAG stands would continue to be dominated by grand fir and Douglas-fir. Mid and late seral conditions which are dominated by these two species in these PAGs would continue to be over HRV by a total of 1,798 ac.(derived from Table 56). Dry ponderosa pine PAG stands would continue to be above HRV by 1,275 ac. for early and mid seral stages because of the non-historical, overabundance of western juniper in these stands.

Over the next thirty years in stands not currently being prescribed burned under the Sunflower Fuels CE, the presence of Douglas-fir in the understory of mesic ponderosa pine and Douglas-fir PAG stands would increase as would grand fir in dry grand fir PAG stands. Western juniper seedlings would continue to become established in mesic and dry ponderosa PAG stands and grow into sapling/pole sized trees that would compete with ponderosa pines. Maintenance of the existing species composition as is expected in both the short term and in 30 years would not move the Project Area towards the HRV or the desired condition. The portion of the Purpose and Need related to modifying tree species composition for the purpose of improving forest health would not be achieved.

Stand Structure and Density

This alternative would not create any immediate changes to the structural stage or density classifications for any PAG. The total acreage of overly dense, pole and small sized stands would remain at 9,604 ac. above HRV (derived from Table 57). Over the next thirty years, the density of most stands would continue to increase; individual tree and stand growth rates are expected to continue to decline for all tree size classes. Decreased individual tree growth from higher density levels would increase the time for development of large trees. Although growth would occur that would slowly move trees from smaller size classes to larger size classes, competition related mortality over the same time period would likely keep the number of trees in the largest size classes near current levels. Increasing and sustained high stand densities would reduce the amount of ground vegetation that is important for soil protection and forage.

Expected increased density dependent mortality would result in increased amounts of dead and down wood in these same stands. Increased ground and ladder fuels and high crown closure would maintain a high risk of intense fire behavior. High intensity wildfires have the greatest potential to create rapid, large scale change to stand structure and density. In the event of such a fire, more early seral stand structures dominated by shrubs, herbaceous plants, and tree seedlings/saplings would be created.

The structural stages would not move toward HRV or toward the desired condition in terms of either stand structure or density in either the short term or in 30 years. The number of seral/structural stages within HRV would remain at 26; 25 would remain above HRV and 21 below.

The following needs from the Purpose and Need for this project would not be met: a) the need for structural conditions of forest stands to more closely reflect their HRV, and b) the need for reduction of stand densities.

LOS

This alternative would have no immediate effect on LOS acreage nor is there expected to be an effect in 30 years. The largest trees in most non-LOS stands average 15-18" dbh and only about one inch of diameter growth per decade. Even if that growth was maintained, which is doubtful with increasing density levels, not enough trees would reach 21" dbh to change the structure class to the medium/large (>21" dbh) size class, a requirement for stands to be classified as LOS. In fact, over the next thirty years as the density of most stands continue to increase, individual tree and stand growth rates are expected to continue to decline. Decreased individual tree growth would result in an increase in the time for development into large trees. In addition, competition related mortality from bark beetles over the same time period would likely reduce the number of older existing trees that currently exceed 21" dbh. The need for maintaining and increasing late and old structural stands would not be met under this alternative.

Bark Beetles

Under the no action alternative, there would be no change to the existing beetle hazard within the Project Area; 11,174 ac. or 79% of the suitable forest land (derived from Tables 57 and 54) would remain imminently susceptible (very high, high, or moderate risk) to bark beetle attack. The large tree component (>21" dbh), as well as smaller trees which represent future large trees, would continue to exist in overly dense stands that are experiencing slowing growth rates and loss of vigor. Continued high levels of ponderosa pine mortality caused by western and mountain pine beetles and grand fir mortality caused by fir engravers would be expected. Mortality patterns would vary from isolated trees to clumps of both large and small diameter trees. The highest tree mortality would likely occur in the densest stands and those with additional stresses induced by dwarf mistletoe or annosus root disease. Mortality from beetles would occur in periods of both normal and below normal precipitation, with accelerated rates of tree mortality possible during periods of low precipitation. In addition, there is the potential for epidemic levels of mountain pine and western pine beetles, especially considering the near outbreak population levels that already exist. If this were to occur, up to 67 percent of a stand's basal area, mostly in the largest trees, could be expected to be killed (Barret 1979).

Western Spruce Budworm

Seral and structural conditions that make stands susceptible to western spruce budworm would remain the same. 2,833 ac. of overly dense stands dominated by grand fir and/or Douglas-fir would remain in this condition.

Dwarf mistletoe

There would be no treatments to reduce the number of trees infected with dwarf mistletoe. Half the acreage of very high, high, and moderate hazard stands dominated by ponderosa pine (4,170 ac.) and all of the Douglas-fir stands in these hazard categories (1,969) would continue to have some level of infection (Table 60). Within infected single-story stands, dwarf mistletoe would continue to spread vertically in the crowns of trees. Severity of infection would increase over time and the growth of infected trees would slow. Development of LOS would be slowed. Lateral spread of the

parasitic plant to adjacent trees would occur in dense stands. Within infected multi-storied stands, the crowns of shorter trees would continually be exposed to dwarf mistletoe seeds from taller infected trees. The upper crowns of understory trees would experience increased levels of infection, and the trees would experience substantial reductions in growth. Severely infected stands would contribute to a higher risk of intense fire. Without silvicultural treatments or a high intensity wildfire, this cycle of infection would continue indefinitely, resulting in decreased stand growth and increased tree mortality. Severely infected trees would be predisposed to bark beetle attack. Mortality pattern would vary from isolated trees to clumps of trees.

Root Diseases and Stem Decays

No treatments would occur to reduce the incidences of annosus root disease and Indian paint fungus. Eight hundred and sixty-four acres of overly dense stands dominated by grand fir would remain at risk. Continued development of dry grand fir PAG stands towards late seral stages would increase the amount of host grand fir available for these diseases with an increase in their presence likely in 30 years.

Cumulative Effects – Alternative 1

Past timber harvest, the majority of which occurred 30 or more years ago, removed most of the large ponderosa pine and Douglas-fir. Past harvests and other activities that are documented in the District's data base can be found in Table 63 and in Appendix A. Specific harvest records prior to the mid 1950's were not located. However, it is known that timber harvest started in the area in the 1930's with much of the large tree removal occurring in the 1950's. Likewise, records of harvest on about 2,000 acres of private timber land that have since been acquired by the Forest Service are not available. Based on observations of existing stumps, the largest trees on this acreage were harvested; the result being that very few trees larger than 21 inches dbh now exist.

Some trees were mechanically injured during past harvest and road building activities. Mechanical damage to grand fir trees can activate dormant Indian paint fungus infections and can provide points of entry for annosus root disease spores. Spores of annosus root disease can also infect freshly cut stumps larger than 14" dbh, providing a means to then spread through root to root contact to other grand firs. Annosus root disease and Indian paint fungus are likely more prevalent than they would have been historically because of the substantially greater amount of grand fir host and the injuries to grand fir that occurred during past activities.

Table 63. Past Harvest Activity in the Willow Pine Project Area

Type of Activity	Acres	Years	Timber Sale/Project Names
Regeneration harvest	4,189	1973 through 1991	Cougar, Coyote, Frazier, Roadrunner, Sedge Spring, Spur, Telephone, Willow
Intermediate harvest	6,350	1953 through 2006	Columbus, Coyote, Frazier, Hardscrabble, Porcupine, Sunflower, Sunny, South Aspen, Wildhorse, Willow, Windy John
Machine piling	2,331	1976 to 1990 (est.)	Cougar, Coyote, Spur Butte, Wildcat
Grapple piling/slash grinding	1,500	1975 through 2000	Bird, Columbus, Sunflower, Tomahawk 1975
Noncommercial thinning	1,389	1969 through 2003	Rager Aspen, Roadrunner, Spur Butte, Sunflower, Sunflower Flats, Telephone, Telephone Juniper, TNT, Wildhorse, Willow, Windy John

Fire suppression over the past 100 years has led to a much greater presence of grand fir and Douglas-fir and higher stand densities. This shift has led to a much greater presence of insects and diseases associated with these species than would have been found in the Project Area historically. The absence of fire has also led to substantially higher levels of dwarf mistletoe in ponderosa pine and Douglas-fir.

Maintaining current stand densities, ladder fuels, and surface fuels at existing levels continues the conditions that perpetuate the risk of stand loss in the event of high intensity wildfire. While wildfire behavior is dependent on weather conditions and start location, fuel continuity contributes to a higher risk of stand loss should a wildfire occur under adverse conditions such as high wind speeds and low moisture conditions and in areas of high fuel loadings. Resulting wildfires would have the greatest potential to cause substantial changes to forest vegetation, including loss of LOS stands.

The Sunflower Natural Fuels Project is an on-going project started in 2004 in which 4,500 acres are planned for prescribed underburning over the next few years. The objective of the project is to reduce the fire severity regime to non-lethal on the acreage to be burned. The burning would have little effect on stand density as measured in terms of basal area, SDI, or canopy cover. Only seedlings, some saplings, and an occasional larger tree that torches are likely to be directly killed by the prescribed burning. Grand fir, Douglas-fir, and western juniper would be most vulnerable to fire. The trees likely to be killed make up only a small percentage of the overall stocking of a stand. Larger trees may be damaged, especially if growing in deep duff or adjacent to logs or stumps that might have a long burning duration. These damaged trees may attract bark beetles that might kill the tree and/or attack and kill groups of otherwise healthy trees adjacent to the damaged tree. Snag numbers would likely increase. Species composition of seedling and sapling sized trees would likely shift from western juniper, grand fir, and Douglas-fir towards ponderosa pine, but the overall stand composition would not change enough to change the overall seral/structural class.

The Bird PCT project was completed in 2004. Five-hundred and thirty-one acres were non-commercially thinned; almost 400 of these acres were then grapple piled and prescribed burned. Increased bark beetle activity in several areas adjacent to trees damaged by the burning was evident

in the spring following the burn. While the areas were not large (1/4 ac.), they do indicate the potential for larger bark beetle events. Overall, seral/structural stages were not changed by the project because an upper diameter cutting limit prevented further density reduction. The stands remain overly dense and serve as an example of the potential for upper cutting diameter limits to prevent the achievement of desired density objectives.

Continued grazing by cattle in the Project Area would have little effect on forested vegetation. Cattle do occasionally damage and kill seedling and sapling sized trees by browsing or trampling them, but this level of impact would be small and not detrimentally effect overall stand structure, species composition, stand density, or stand health.

There are no other reasonably foreseeable future activities that would result in changes to vegetation seral structure conditions within the project area. All effects of previous activities have been incorporated into the current condition and description for vegetation and forest health.

Summary

Under the no action alternative, the forest vegetation within the Project Area would remain overly dense and dominated by mid and late seral stages of sapling, pole and small sized trees instead of the open, park-like stands of ponderosa pine that once dominated. LOS, especially single-strata, would continue to be nearly absent. The Project Area would remain well outside of HRV for most structural stages and would not meet the desired condition. Insects and diseases would remain at uncharacteristically high levels and would slow the development of the large tree structure that is so deficient. Vegetation needs identified in the Purpose and Need for this project would not be met.

Direct and Indirect Effects – Alternative 2

Species Composition

Proposed commercial harvest (HTH and HIM) and non-commercial thinning (NCT) treatments are designed to reduce tree density and improve growth of the residual trees, enhance forest health, or recover potential mortality resulting from inter-tree competition. (See Appendix I for treatment descriptions). Numerous studies have shown increased growth and vigor of remaining trees following density management treatments (Oliver 1979, Barrett 1981 and 1982, Cochran and Barrett 1999). Other studies have shown reduced susceptibility to many insects and diseases that are density related (Barrett and Roth 1985, Filip and Schmitt 1990). Further studies show moderated fire hazard and lower crown fire potential as a result of thinning and fuel treatment (Graham 1999, Pollet 2002).

All HTH, HIM and NCT treatments would favor the retention of ponderosa pine over all other species and would favor Douglas-fir over grand fir. Table 64 displays the acreage of proposed mechanical treatments for Alternative 2 by PAG and seral stage. The total acreage of mid and late seral stands dominated by grand fir and Douglas-fir (dry grand fir and Douglas-fir PAGs) that would be mechanically treated to move the stands towards earlier seral stages is 1,181 acres (derived from Table 64). The resulting change in species composition on this acreage toward ponderosa pine and away from Douglas-fir and grand fir for both the short term and in 30 years would move the Project Area towards the HRV and the desired condition. This assumes continued prescribed burning is done to prevent in-growth of Douglas-fir and grand fir over the next 30 years.

Table 64. Acreage of Mechanical Treatments (HTH, HIM, NCT) for each Alternative by PAG and Seral Stage

PAG	Seral	Alt. 1	Alt. 2	Alt. 3
<i>Dry Grand Fir</i>				
	Early	0 ac.	43 ac.	43 ac.
	Mid	0 ac.	284 ac.	211 ac.
	Late	0 ac.	120 ac.	57 ac.
<i>Douglas-fir</i>				
	Early	0 ac.	131 ac.	118 ac.
	Mid	0 ac.	648 ac.	601 ac.
	Late	0 ac.	129 ac.	92 ac.
<i>Mesic Ponderosa</i>				
	Early	0 ac.	114 ac.	112 ac.
	Mid	0 ac.	1,107 ac.	942 ac.
	Late	0 ac.	1,108 ac.	957 ac.
<i>Dry Ponderosa</i>				
	Early	0 ac.	52 ac.	34 ac.
	Mid	0 ac.	248 ac.	177 ac.
	Late	0 ac.	467 ac.	398 ac.
Total				
	Early	0 ac.	340 ac.	307 ac.
	Mid	0 ac.	2,287 ac.	1,931 ac.
	Late	0 ac.	1,824 ac.	1,504 ac.

Source: Willow Pine Viable Ecosystem HRV spreadsheet, Silviculture Report, Appendix G.

Note: Acreage is not counted twice where both commercial harvest and non-commercial thinning are to be done.

The net result would be that mid and late seral conditions dominated by grand fir and Douglas-fir would decrease and be over HRV by a total of 1,228 acres (289 +939) following treatment, or an improvement of 570 acres when compared to the existing condition (Table 65). Acreage is similar for the 30 year projection. The portion of the Purpose and Need related to modifying tree species composition for the purpose of improving forest health would be achieved on this acreage.

Mesic ponderosa pine PAG stands above HRV in the mid and late seral stages which have Douglas-fir as a component would drop by 375 ac. (463-88) from the existing condition (Table 65). The reduction of Douglas-fir in these treated stands would move the Project Area towards HRV and the desired condition and would contribute to meeting the Purpose and Need by modifying tree species composition for the purpose of improving forest health.

Dry ponderosa pine PAG stands above HRV would drop by 233 ac. (1,275 – 1,042) from the existing condition to 1,042 ac. for early and mid stages by discriminating against western juniper during thinning treatments (Table 65). The reduction of western juniper on this acreage would move the Project Area towards HRV and the desired condition and would contribute to meeting the

Purpose and Need by modifying tree species composition for the purpose of improving forest health.

Table 65. Seral Stage Departure by PAG for Each Alternative

PAG	Seral Stage Departure (acres) from HRV					
	Following Treatment			After 30 years		
Seral Stage	Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3
Dry GF						
Early	404 below 417 above	401 below 289 above	401 below 285 above	404 below 417 above	395 below 293 above	283 below 291 above
Mid/Late Douglas-fir						
Early	722 below 1,381 above	723 below 939 above	721 below 992 above	722 below 1,381 above	724 below 941 above	724 below 922 above
Mid/Late Mesic Pine						
Early	206 above 463 above	207 above 88 above	206 above 138 above	206 above 463 above	214 above 67 above	213 above 122 above
Mid/Late Dry Pine						
Early/Mid	1,275 above	1,042 above	1,098 above	1,275 above	1,035 above	1,098 above
Late	564 below	430 below	450 below	564 below	288 below	361 below

Note: Seral stages combined where less desirable species (GF, DF, WJ) are present.

Stand Structure and Density

In Alternative 2, stands proposed for treatment contain a mosaic of seral structural stages and include a large proportion of pole and small sized trees and dense “a” stocking conditions. Most stands also contain varying amounts of large tree structure, ranging from scattered individuals to small groups of trees larger than 21” dbh.

All units in which mechanical thinning treatments are proposed (HTH, HIM, or NCT) are currently classified as overly dense. This alternative reduces the proportion of dense stands and increases the open condition, allowing increased growth rates and faster development of large tree structure in stands proposed for treatment. Table 66 displays by alternatives the total acreage and departure from HRV by PAG of stands classified as overly dense that would result following implementation of each alternative.

The total acreage of overly dense stands would be reduced by 3,621 acres (11,391-7,770) compared to current conditions (Table 66). Most of the reduction in dense stand acreage occurs within ponderosa pine PAG stands classified as pole and small sized (9-20.9” dbh). The total (all four PAGs) overly dense, pole-sized acreage moves closer to HRV by 1,022 acres (3,548-2,526), while that of the small-sized acreage narrows the gap by 2,320 acres (6,056-3,736). This movement towards HRV meets the Purpose and Need for this project and contributes towards achievement of the desired condition.

Commercial (HTH, HIM) and non-commercial (NCT) mechanical treatments would aim to reduce stand densities to recommended levels (Powell 1999) in all units except for the three goshawk nest

stands (Units 12, 55, and 94, totaling 93 ac.) where treatments would leave stand densities above UMZs in order to continue providing suitable nesting habitat. (See Appendix H for UMZs and LMZs by alternative and unit). Density adjustments would also be made to areas of units within wildlife connectivity corridors in order to retain densities within the upper 2/3 of UMZs in compliance with the Eastside Screens and in high elk use units (5, 6, 7, 33, 34, 35, 36, 37, 38 and 118) where areas of higher density clumps (approximately 10% of a unit's area) would be retained to enhance big game cover. Residual densities in these latter two scenarios would still fall between the UMZ and LMZ, but closer to the UMZ than other units.

Table 66. Acreage and HRV Departure of Stands Classified as Overly Dense for Each Alternative Following Proposed Treatments

PAG (total acres) Tree Size Class	Overly dense acres of PAG			Departure from HRV (ac.)		
	Alt. 1	Alt 2	Alt. 3	Alt. 1	Alt 2	Alt. 3
Dry Grand Fir (970 ac.)	910	505	641			
Seedling , sapling (<4.9" dbh)	0	0	0	N/A	N/A	N/A
Pole (5-8.9"dbh)	54	9	54	+ 44	within	+ 44
Small (9-20.9" dbh)	618	309	376	+ 520	+ 211	+ 278
Medium/large (21"+ dbh)	238	187	211	+ 140	+ 89	+ 113
Douglas-fir (2,708 ac.)	2,225	1,596	1,667			
Seedling , sapling (<4.9" dbh)	0	0	0	N/A	N/A	N/A
Pole (5-8.9"dbh)	738	589	589	+ 711	+562	+ 562
Small (9-20.9" dbh)	1,139	781	837	+ 841	+483	+ 539
Medium/large (21"+ dbh)	348	226	241	within	within	within
Mesic Ponderosa (7,373 ac.)	5,973	4,043	4,348			
Seedling , sapling (<4.9" dbh)	142	65	65	N/A	N/A	N/A
Pole (5-8.9"dbh)	1,878	1,231	1,275	+ 1,804	+ 1,157	+ 1,201
Small (9-20.9" dbh)	3,787	2,585	2,846	+ 3,565	+ 2,363	+ 2,624
Medium/large (21"+ dbh)	166	162	162	within	within	within
Dry Ponderosa (3,113 ac.)	2,283	1,626	1,817			
Seedling , sapling (<4.9" dbh)	40	15	15	N/A	N/A	N/A
Pole (5-8.9"dbh)	1,020	839	883	+ 989	+ 808	+ 852
Small (9-20.9" dbh)	1,223	772	919	+ 1,130	+ 679	+ 826
Medium/large (21"+ dbh)	0	0	0	- 31	- 31	- 31
Total (14,164 ac.)	11,391	7,770	8,473			
Seedling , sapling (<4.9" dbh)	182	80	80	N/A	N/A	N/A
Pole (5-8.9"dbh)	3,690	2,668	2,801	+ 3,548	+ 2,526	+ 2,659
Small (9-20.9" dbh)	6,767	4,447	4,978	+ 6,056	+3,736	+ 4,267
Medium/large (21"+ dbh)	752	575	614	within	within	within

Density reduction targets would not be achieved on a portion of some commercial harvest units where stocking of greater than 21" dbh trees exceeds recommended levels and in non-commercial thin units where stocking of greater than 9" dbh trees exceed recommended levels. Still, these portions of these units would be reduced to a moderate hazard from a very high or high hazard. Density reduction in all mechanical treatment units would result in higher growth rates, lower incidence of insect and disease mortality, faster development of large trees, and reduced risk of high-intensity fire – all components of the Purpose and Need. These effects of density reduction are expected to last 30-50 years.

Treatments in stands with large trees would improve health and vigor of the large tree component increasing the potential longevity of such trees. Treatments would also reduce the risk of loss of LOS to severe fire events. Both of these would contribute towards meeting the Purpose and Need.

Following proposed treatments, all units are expected to meet the Ochoco National Forest minimum stocking standards (Table 62). Areas below desired stocking levels but above minimum levels would be allowed to regenerate naturally. This is most applicable to the HIM units where gaps created by the removal of grand fir would allow ponderosa pine regeneration to become established and move the stands closer to the desired condition.

Prescribed burning in units not planned for commercial or non-commercial thinning (2,519 acres) would have little effect on reducing overall stand density and would not result in changes to structural stages. Burning may result in short-term (10 years) growth reductions (10-30%) of trees (Busse et al. 2000, Swezy and Agee 1990, Landsberg 1992, Grier 1989) in units planned for mechanical treatments following by burning (3,810 ac.) and in units planned for burning alone (2,764 ac.). Busse and Riegel (2005), however, found an actual increase in tree growth following a low intensity prescribed burn in central Oregon.

In 30 years, an estimated 28 seral/structural stages would be within HRV, 26 would be above HRV, and 18 would be below HRV. For all PAGs under this alternative, the proportion of open small-sized stands in 30 years would remain higher than under existing conditions, allowing continued growth and development of large structure at a higher and faster rate than would occur under Alternative 1.

Late Or Old Structure (LOS)

A total of 308 acres of multi-strata LOS would be thinned (Table 67), 179 ac. by commercial harvest and 129 ac. by non-commercial thinning. Commercial harvest within the LOS is allowed under the Eastside Screens because the HRV for these LOS stages are within HRV (Tables 59 and 67), these stages would remain within HRV following treatment, and the harvests would change this acreage to single-strata LOS which is currently below HRV (Table 59).

Table 67. Treatment Acreage of Late or Old Structure (LOS) Stands by Alternative and Acreage of LOS Immediately Following Treatment and After 30 Years

PAG Structure	Treatment ac.		Acres Qualifying as LOS					
	Alt. 2	Alt. 3	Post Treatment			After 30 years		
			Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3
Dry Grand Fir								
Multi Strata	52	28	238	187	211	238	187	211
Single Strata	0	0	0	50	27	0	357	265
Douglas-fir								
Multi Strata	191	174	348	224	241	348	224	241
Single Strata	0	0	0	125	107	0	485	409
Mesic Pine								
Multi Strata	65	65	166	162	162	166	162	162
Single Strata	0	0	0	4	4	0	1,208	957
Dry Pine								
Multi Strata	0	0	0	0	0	0	0	0
Single Strata	0	0	5	5	5	5	557	484
Total								
Multi Strata	308	267	752	573	614	752	573	614
Single Strata	0	0	5	184	143	5	2,607	2,115

Source: Willow Pine Viable Ecosystem HRV spreadsheet, Silviculture Report, Appendix G.

Harvest treatments would result in single-strata LOS moving 179 acres closer to HRV than current conditions (derived from Table 68). A corresponding 179 ac. decrease in multi-strata LOS would occur as the result of this harvest, but the amount of multi-strata LOS would stay within HRV. Almost all of the acreage in LOS that would change from multi to single-strata is within the dry grand fir and Douglas-fir PAGs (Table 67).

Table 68. Late or Old Structure (LOS) HRV Departure Acres by Alternative

PAG Structure	Departure from HRV (ac.)					
	Post Treatment			After 30 years		
	Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3
Dry Grand Fir						
Multi	within	within	within	within	within	within
Strata						
Single	-446	-396	-419	-446	-89	-181
Strata						
Douglas-fir						
Multi	within	within	within	within	within	within
Strata						
Single	-1,300	-1,175	-1,193	-1,300	-817	-891
Strata						
Mesic Pine						
Multi	within	within	within	within	within	within
Strata						
Single	-4,351	-4,347	-4,347	-4,351	-3,143	-3,393
Strata						
Dry Pine						
Multi	-31	-31	-31	-31	-31	-31
Strata						
Single	-774	-774	-774	-774	-222	-294
Strata						
Total						
Multi	within	within	within	within	within	within
Strata						
Single	-6,871	-6,692	-6,731	-6,871	-4,271	-4,759
Strata						

Source: Willow Pine Viable Ecosystem HRV spreadsheet, Silviculture Report, Appendix G.

Non-commercial thinning would not result in a change from multi to single-strata LOS because the upper cutting limit of 9” dbh would prevent the cutting of the middle strata trees that would be necessary for a change in strata to occur. The non-commercial thinning would result in raising the crown base height of stands which would decrease the fire hazard as long as the resulting fuels are lopped and prescribed burned as planned. In addition, the residual trees would gain access to additional site resources as the result of the density reduction and would be expected to increase in vigor, though the stands would remain well above UMZs.

Projections out 30 years indicate a 2,602 ac. (2,607 – 5) increase in single-strata LOS from current conditions (Table 67). Most of this increase is within the two ponderosa pine PAGs. Overall, the total acreage of single-strata LOS would move 2,600 acres closer to HRV while multi-strata LOS acreage is projected to be the same as immediately following treatment and remain within HRV (Table 68).

Prescribed burning without mechanical thinning treatments on 2,519 ac. is not expected to result in substantial changes to LOS. Burning may result in mortality of individual medium/large trees, especially if growing in deep duff or adjacent to a log or stump that might have a long burning

duration. These damaged trees may attract bark beetles that might kill the tree and/or attack and kill groups of otherwise healthy trees adjacent to the damaged tree. Resulting mortality would result in an increase in snag numbers, but would likely not result in an overall change to the acreage qualifying as LOS.

In summary, changes to LOS as the result of the activities under this alternative would move the Project Area both in the short term and in 30 years closer to the desired condition and HRV. The need for maintaining and increasing large and old structured stands would be met.

Bark Beetles

Under Alternative 2, commercial and non-commercial treatments totaling 4,551 ac. (Table 3) would cause a reduction in stand densities resulting in increased growth rates and vigor of the remaining trees and reduced susceptibility of this acreage to bark beetle attack. Forty-one percent of the acreage currently considered imminently susceptible to bark beetle attack would have tree densities reduced.

Table 69. Mechanical Thinning Treatment (HTH, HIM, NCT) Acreages and Percentages of the Total Hazardous Stand Conditions*

PAG (total hazardous acres)	Imminently Susceptible Area Treated					
	Acres				Proportion of Hazardous ac.	
Proposed Treatment	Alt. 1	Alt. 2	Alt. 3	Alt. 1	Alt. 2	Alt. 3
Dry Grand Fir (864 ac.)						
Commercial harvest (HTH, HIM)	0	437	301	0%	51%	35%
Non-commercial thin (NCT)	0	11	11	0%	1%	1%
Subtotal	0	448	312	0%	52%	36%
Douglas-fir (1,969 ac.)						
Commercial harvest (HTH, HIM)	0	597	498	0%	30%	25%
Non-commercial thin (NCT)	0	314	314	0%	16%	16%
Subtotal	0	911	812	0%	46%	41%
Mesic Ponderosa (5,987 ac.)						
Commercial harvest (HTH, HIM)	0	1,556	1,238	0%	26%	21%
Non-commercial thin (NCT)	0	774	775	0%	13%	13%
Subtotal	0	2,330	2,013	0%	39%	34%
Dry Ponderosa (2,354 ac.)						
Commercial harvest (HTH, HIM)		621	514	0%	26%	22%
Non-commercial thin (NCT)	0	241	159	0%	10%	7%
Subtotal	0	862	673	0%	37%	29%
Totals (11,174 ac.)						
Commercial harvest (HTH, HIM)	0	3,211	2,551	0%	29%	23%
Non-commercial thin (NCT)	0	1,340	1,259	0%	12%	11%
Total	0	4,551	3,810	0%	41%	34%

* Using the categories very high, high, and moderate from Table 60, by alternative for stands considered imminently susceptible to insects and diseases because of high stand densities.

Thinning would lower the probability of serious tree mortality from bark beetles by: (1) changing aspects of the physical environment such as light, temperature, and air movement, thus reducing the effectiveness of pheromone communication between host seeking beetles and beetles already at

trees suitable for attack; (2) increasing the amounts of water, nutrients, and light available for remaining trees, allowing trees to increase in vigor and produce protective oleoresins, which, upon attack, exude from the beetle holes and pitch out the attacking beetles; (3) reducing the host resource base (fewer trees) that supports beetle populations; and (4) raising stand temperatures to levels that can reduce beetle survival (Goyer et al. 1998).

The stands would change as the result of the treatments from very high and high hazard stands to low hazard stands. The threat to this treated acreage from bark beetles is expected to be low for 30-50 years since stand densities (based on FVS projections) are expected to stay below UMZs for this period where units are thinned to near the LMZ. Following proposed mechanical treatments, the area considered imminently susceptible to bark beetles would be reduced from 79% (11,174 ac.) of the suitable lands (14,164) in the Project Area to 47% (6,623 ac.) (derived from Tables 54 and 66).

Proposed prescribed burning (2,519) in units not planned for commercial (HTH, HIM) or non-commercial thinning (NCT) would have little effect on reducing overall stand density and improving stand health. Stand health, in fact, may actually be compromised in the short term as some trees are killed or weakened and serve to draw in bark beetles that in turn might attack adjacent trees. Prescribed burning in units where mechanical treatments would be completed prior to burning (4,551 ac.) are expected to have fewer trees damaged by the prescribed burn because less tree torching is anticipated with a reduction of ladder fuels. As a result, beetle attack of damaged trees would be of less concern on this acreage.

Western Spruce Budworm

Seral and structural conditions that make stands susceptible to western spruce budworm would be reduced from 2,833 ac. of overly dense stands dominated by grand fir and/or Douglas-fir to 1,474 ac. through commercial and non-commercial treatments (derived from Table 69). The 1,359 acres of treatment in these susceptible stands represent 48% of all acreage considered at risk to this defoliator. Ponderosa pine, a non-host species, would be favored for retention in all treatment units. Cutting most of the grand fir host and converting the units to ones dominated by ponderosa pine would meet the following needs identified in the Purpose and Need: (a) increasing resistance of forest stands to insects and disease, and (b) modifying tree species composition for the purpose of improving forest health. Forest Plan Standards and Guidelines related to western spruce budworm (Table 62) would be met in implementing the proposed treatments.

Dwarf mistletoe

Commercial and non-commercial mechanical treatments would discriminate against retaining trees with high levels of dwarf mistletoe infection. Presence and levels of dwarf mistletoe would be reduced as a result of these mechanical treatments on the 1,596 ac. of ponderosa pine stands where the disease is present and treatments are proposed and on the 911 ac. of Douglas-fir where the parasitic plant is found and treatments proposed. This represents 38% of infected ponderosa pine acreage and 46% of infected Douglas-fir acreage. Reduction of dwarf mistletoe on this acreage would result in increased growth for remaining trees, lowered susceptibility of the stands to bark beetle attack, and less likelihood of trees torching during prescribed burns and wildfires. Where infected trees are retained, the rate of spread to other trees would be lowered because of increased distances between residual trees as the result of thinning.

By discriminating against retaining dwarf mistletoe infected trees on 2,507 ac., the identified needs of removing diseased trees and increasing the resistance of forest stands to insects and diseases would be met. Forest Plan Standards and Guidelines for dwarf mistletoe would partially be met

(Table 62). Regeneration harvest would not be done as stated in the Standards and Guidelines because the levels and extent of the dwarf mistletoe present in stands proposed for mechanical treatment do not warrant regeneration at this time.

Root Diseases and Stem Decays

Non-commercial and commercial treatments that favor ponderosa pine and Douglas-fir for retention would occur on 448 ac. of the 864 ac. (52%) of overly dense, grand fir PAG stands where annosus root disease and Indian paint fungus are threatening grand fir (Table 69). Most grand fir trees less than 21" dbh would be cut in the commercial harvest units and most grand firs less than 9" dbh would be cut in the non-commercial thinning units, substantially reducing the susceptibility of these stands to these fungal diseases by removing their host species. Cutting most of the grand fir host and converting the units to ones dominated by ponderosa pine and Douglas-fir would meet the following needs identified in the Purpose and Need: (a) removing diseased trees, (b) increasing resistance of forest stands to insects and disease, and (c) modifying tree species composition for the purpose of improving forest health. Forest Plan Standards and Guidelines related to these two pathogens (Table 62) would be met in implementing the proposed treatments.

Any grand fir retained, especially if they are damaged during operations, would conceivably have a higher risk of being infected by these pathogens and eventually dying. Dormant Indian paint fungus infections in trees are activated by injury, either mechanical or natural. Spores of annosus root disease can infect injured trees and freshly cut stumps larger than 14" dbh; but the pathogen needs root to root contact by other grand fir to spread further, something that is unlikely if ponderosa pine and Douglas-fir are favored for retention as is planned and any grand fir retained are spaced far apart as is intended. Mortality of any retained grand fir would result in greater numbers of snags (though they would not stand long in the case of annosus), increased growing space for ponderosa pine and Douglas-fir to become established, and increased fuel loadings as the dead trees fall to the ground.

Cumulative Effects – Alternative 2

See the Cumulative Effects section under Alternative 1 for past and future activities that may affect forest vegetation and forest health. Activities proposed under Alternative 2 would improve adverse forest vegetative and health conditions that resulted from some of the past activities described – namely fire suppression that resulted in greater stand densities and changes in species composition and harvests that removed most of the large trees.

Summary – Alternative 2

Proposed mechanical treatments on 4,551 acres would immediately reduce stand densities and move species compositions towards earlier seral stages, increasing the resistance of these stands to insects and diseases and stand replacement fires. Single-strata LOS, practically absent, would increase by 179 acres upon completion of treatments and by 2,600 acres in thirty years as trees benefit from the reduced density and accelerate in growth. The Project Area would move towards the desired condition and HRV for all structural stages present. All of the vegetation needs from the Purpose and Need would be met. Forest Plan Standards and Guidelines for vegetation management and forest health would be met on the acreage proposed for treatment.

Direct and Indirect Effects – Alternative 3

Species Composition

Treatments and effects to tree species composition within treatment units are the same as described for Alternative 2. Table 64 displays the acreage of proposed mechanical treatments for Alternative 3 by PAG and seral stage. The total acreage of mid and late seral stands dominated by grand fir and Douglas-fir (dry grand fir and Douglas-fir PAGs) that would be mechanically treated to move the stands towards earlier seral stages is 961 acres (derived from Table 64). The resulting change in species composition on this acreage for both the short term and in 30 years would move the Project Area towards the HRV and the desired condition. This assumes continued prescribed burning is done to prevent in-growth of Douglas-fir and grand fir over the next 30 years.

The net result would be that mid and late seral conditions dominated by grand fir and Douglas-fir would be above HRV by a total of 1,277 acres (285 +992) following treatment, or an improvement of 521 acres when compared to the existing condition (Table 65). Acreage is similar for the 30 year projection. The portion of the Purpose and Need related to modifying tree species composition for the purpose of improving forest health would be achieved on this acreage.

Mesic ponderosa pine PAG stands above HRV in the mid and late seral stages which have Douglas-fir as a component would drop by 325 ac. (463-138) from the existing condition. The reduction of Douglas-fir in these treated stands would move the Project Area towards HRV and the desired condition and would contribute to meeting the Purpose and Need by modifying tree species composition for the purpose of improving forest health.

Dry ponderosa pine PAG stands above HRV would drop by 177 ac. (1,275 – 1,098) from the existing condition to 1,098 ac. for early and mid stages by discriminating against western juniper during thinning treatments. The reduction of western juniper on this acreage would move the Area towards HRV and the desired condition and would contribute to meeting the Purpose and Need by modifying tree species composition for the purpose of improving forest health.

Stand Structure and Density

Treatments and effects to stand structure and tree density within treatment units are the same as described for Alternative 2. The total acreage of overly dense stands would be reduced by 2,918 acres (11,391-8,473) compared to current conditions (Table 66). Most of the reduction in dense stand acreage occurs within ponderosa pine PAG stands classified as pole and small sized. The total overly dense, pole-sized acreage moves closer to HRV by 889 acres (3,548-2,659), while that of the small-sized acreage moves closer by 1,789 acres (6,056-4,267) (Table 66). This movement towards HRV meets the Purpose and Need and contributes towards achievement of the desired condition.

Commercial and non-commercial mechanical treatments would aim to reduce stand densities to recommended levels (Powell 1999) in all units (since the goshawk nest stands would not be treated under Alternative 3). Density reduction targets and achievement of minimum stocking standards would be the same as described for Alternative 2. Density reduction in all mechanical treatment units would result in higher growth rates, lower incidence of insect and disease mortality, faster development of large trees, and reduced risk of high-intensity fire – all components of the Purpose and Need. These effects of density reduction are expected to last 30-50 years.

Treatments in stands with large trees would improve health and vigor of the large tree component increasing the potential longevity of such trees. Treatments would also reduce the risk of loss of LOS to severe fire events. Both of these would contribute towards meeting the Purpose and Need.

Prescribed burning in units not planned for commercial or non-commercial thinning (2,765 acres) would have little effect on reducing overall stand density and would not result in changes to structural stages. Effects of burning on tree growth would be the same as described for Alternative 2.

In 30 years, an estimated 28 seral/structural stages would be within HRV, 25 would be above HRV, and 19 would be below HRV. For all PAGs under Alternative 3, the proportion of open small-sized stands in 30 years would remain higher than under existing conditions, allowing continued growth and development of large structure at a higher and faster rate than would otherwise occur.

Late Or Old Structure (LOS)

A total of 267 acres of multi-strata LOS would be thinned (Table 67), 138 ac. by commercial harvest and 129 ac. by non-commercial thinning. Commercial harvest within the LOS is allowed for the same reasons detailed under Alternative 2. Harvest treatments would result in single-strata LOS moving 140 acres closer to HRV than current conditions (derived from Table 68). A corresponding decrease in multi-strata LOS would occur as the result of this harvest, but the amount of multi-strata LOS would stay within HRV. Almost all of the acreage in LOS that would change from multi to single-strata is within the dry grand fir and Douglas-fir PAGs (Table 67).

As described under Alternative 2, non-commercial thinning would not result in a change from multi to single-strata LOS. The effects to non-commercially thinned stands would be the same as described for Alternative 2.

Projections out 30 years indicate a 2,110 ac. (2,115 – 5) increase in single-strata LOS from current conditions (Table 67). Most of this increase is within the two ponderosa pine PAGs. Overall, the total acreage of single-strata LOS moves 2,112 acres (6,871 – 4,759) closer to HRV while multi-strata LOS acreage is projected to be the same as immediately after treatment and remain within HRV (Table 68).

Prescribed burning without mechanical thinning treatments on 2,765 ac. is not expected to result in substantial changes to LOS. Burning would have the same effects on LOS structure and tree mortality as described for Alternative 2.

In summary, changes to LOS as the result of the activities under this alternative would move the Project Area both in the short term and in 30 years closer to the desired condition and HRV. The need for maintaining and increasing large and old structured stands would be met.

Bark Beetles

Under Alternative 3, commercial and non-commercial treatments totaling 3,810 ac. (Table 69) would cause a reduction in stand densities resulting in increased growth rates and vigor of the remaining trees and reduced susceptibility of this acreage to bark beetle attack. Thirty-four percent of the acreage currently considered imminently susceptible to bark beetle attack would have tree densities reduced. Effects from thinning on the interaction between remaining trees and beetles would be the same as described for Alternative 2.

The stands would change as the result of the treatments from very high and high hazard stands to low hazard stands. The threat to this treated acreage from bark beetles is expected to be low for 30-50 years since stand densities (based on FVS projections) are expected to stay below UMZs for this period where units are thinned to near the LMZ. Following proposed mechanical treatments, the area considered imminently susceptible to bark beetles would be reduced from 79% (11,174 ac.) of the suitable lands (14,164) in the Project Area to 52% (7,364 ac.).

Proposed prescribed burning (2,765) in units not planned for commercial (HTH, HIM) or non-commercial thinning (NCT) would have little effect on reducing overall stand density and improving stand health. Stand health, in fact, may actually be reduced in the short term as some trees are killed or weakened and serve to draw in bark beetles that in turn might attack adjacent trees. Prescribed burning in units where mechanical treatments would be completed prior to burning (3,810 ac.) are expected to have fewer trees damaged by the prescribed burn because less tree torching is anticipated with a reduction of ladder fuels. As a result, beetle attack of damaged trees would be of less concern on this acreage.

Western Spruce Budworm

Seral and structural conditions that make stands susceptible to western spruce budworm would be reduced through commercial and non-commercial treatments from 2,833 ac. of overly dense stands dominated by grand fir and/or Douglas-fir to 1,709 ac. The 1,124 acres of treatment in these susceptible stands represent 40% of all acreage considered at risk to this defoliator (derived from Table 69). Ponderosa pine, a non-host species, would be favored for retention in all treatment units. Cutting most of the grand fir host and converting the units to ones dominated by ponderosa pine would meet the following needs identified in the Purpose and Need: (a) increasing resistance of forest stands to insects and disease, and (b) modifying tree species composition for the purpose of improving forest health. Forest Plan Standards and Guidelines related to western spruce budworm (Table 62) would be met in implementing the proposed treatments.

Dwarf mistletoe

Commercial and non-commercial mechanical treatments would discriminate against retaining trees with high levels of dwarf mistletoe infection. Presence and levels of dwarf mistletoe would be reduced as a result of these mechanical treatments on the 1,343 ac. of ponderosa pine stands where the disease is present and treatments are proposed and on the 812 ac. of Douglas-fir where the parasitic plant is found and treatments proposed. This represents 32% of infected ponderosa pine acreage and 41% of infected Douglas-fir acreage. Effects on treated acreage would be the same as described for Alternative 2.

By discriminating against retaining dwarf mistletoe infected trees on 2,155 ac., the identified needs of removing diseased trees and increasing the resistance of forest stands to insects and diseases would be met. Forest Plan Standards and Guidelines for dwarf mistletoe would partially be met (Table 62). Regeneration harvest would not be done as stated in the Standards and Guidelines because the levels and extent of the dwarf mistletoe present in stands proposed for mechanical treatment do not warrant regeneration at this time.

Root Diseases and Stem Decays

Non-commercial and commercial treatments that favor ponderosa pine and Douglas-fir for retention would occur on 312 ac. of the 864 ac. (36%) of overly dense, grand fir PAG stands where annosus root disease and Indian paint fungus are threatening grand fir. Most grand fir trees less than 21" dbh would be cut in the commercial harvest units and most grand firs less than 9" dbh would be cut in the non-commercial thinning units, substantially reducing the susceptibility of these stands to these fungal diseases by removing their host species.

Cutting most of the grand fir host and converting the units to ones dominated by ponderosa pine and Douglas-fir would meet the following needs identified in the Purpose and Need: (a) removing diseased trees, (b) increasing resistance of forest stands to insects and disease, and (c) modifying tree species composition for the purpose of improving forest health. Forest Plan Standards and Guidelines related to these two pathogens (Table 62) would be met in implementing the proposed treatments. Effects of harvest operations on the spread of these two diseases are the same as discussed under Alternative 2.

Cumulative Effects – Alternative 3

See the Cumulative Effects section under Alternative 1 for past and future activities that may affect forest vegetation and forest health. Activities proposed under Alternative 3 would improve adverse forest vegetative and health conditions that resulted from some of the past activities described – namely fire suppression that resulted in greater stand densities and changes in species composition and harvests that removed most of the large trees.

Summary – Alternative 3

Like Alternative 2, proposed mechanical treatments would immediately reduce stand densities and move species compositions towards earlier seral stages, increasing the resistance of these stands to insects and diseases and stand replacement fires. However, this would be done on only 3,810 acres, 741 acres fewer than Alternative 2.

Single-strata LOS would increase by 140 ac. upon completion of treatments and by 2,110 ac. in 30 years (Table 70, 39 ac. and 490 ac. fewer acres, respectively, than Alternative 2. The Project Area would move towards the desired condition and HRV for all structural stages present but at a slower rate than Alternative 2. All of the vegetation needs from the Purpose and Need would be met. Forest Plan Standards and Guidelines for vegetation management and forest health would be met on the acreage proposed for treatment. See Table 70 for a summary comparison of selected attributes by alternative.

Table 70. Summary of Selected Attributes by Alternative

Attribute	Alt. 1	Alt. 2	Alt. 3
Total Acreage Above HRV for Mid/Late Seral GF, DF, and PP Following Treatment (from Table 65)	2,661	1,316	1,415
Seral/Structural Stages Within HRV After 30 Years (from Appendix G)	26	28	28
Overly Dense Acreage Following Proposed Treatments (from Table 66)	11,391	7,770	8,473
Total Single Strata LOS Acreage 30 Years After Proposed Treatments (from Table 67)	5	2,607	2,115
Proportion of Hazardous Area (insects/disease) Treated (from Table 69)	0%	41%	34%

Note: GF = grand fir, DF = Douglas-fir, PP = ponderosa pine.

Consistency with the Requirements of 16 U.S.C. 1604(g)(3)

There is assurance that harvested lands can be adequately restocked within five year after the harvest proposed with Alternative 2 and 3 (requirement of 1604(g)(3)(E)(ii)). Lands would be at least minimally stocked in all units following harvest.

The harvesting systems proposed for Alternatives 2 and 3 have not been selected primarily because they would give the greatest dollar return or the greatest unit output of timber (requirement of 1604(g)(3)(E)(iv)). Harvesting systems have been selected that would contribute towards meeting Forest Plan management area objectives, addressing identified needs for action, and responding to various resource concerns.

Analysis of 12”dbh Cutting Limit

Projections with FVS that model commercial thinning treatments using a 12” dbh upper cutting limit constraint indicate that residual density objectives that would leave stands below the UMZ and near the LMZ would almost never be achieved (Appendix J). Even where objectives are seemingly achievable, it must be taken into account that the SDI’s following thinning treatments projected by FVS are averages and do not reflect the clumpy nature of stands. Within these stands it is very likely that on about 30% of a stands’ acreages, residual density objectives would not be achieved with a 12” dbh upper diameter limit, even if FVS projections show an overall achievement based on averages.

In addition, a 12” dbh upper diameter cutting limit would render units with that restriction non-saleable from a commercial standpoint because of the small average cut tree size and the small volume per acre to be removed. To accomplish the thinning as a non-commercial project would require the same equipment and result in the same environmental effects as a commercial sale but would require payment to a contractor of \$200-\$300/ac. instead of a return to the Government of \$100-\$200/ac. that would result from a timber sale.

FVS projections with a 21” dbh upper cutting limit, a constraint required by the Eastside Screens, indicate that density reduction objectives to the LMZ can be achieved in almost all cases and densities below the UMZ can be achieved in most cases. Average cut tree sizes and volumes per acre would allow the work to be accomplished through a timber sale.

Range and Grazing

Forest-wide Standards and Guidelines

The Forest Plan, as amended, allows and encourages grazing. Stated goals are to provide forage for wildlife and domestic livestock in a manner consistent with other resource objectives and environmental constraints, while maintaining or improving ecological condition and plant community stability (Forest Plan, p. 4-11).

Desired Future Conditions

The desired future condition summarizes the anticipated physical changes that are likely to occur as a result of carrying out planned management practices over time. The following are excerpts from the desired future condition statements in the Forest Plan, as related to livestock grazing:

- “Management, including vegetation manipulation, structures, and prescribed fire to maintain or improve winter range, may be apparent. Livestock use of forage is planned, but will be conducted in harmony with big game winter range habitat needs,” in Winter Range MA-F20 (Forest Plan, p. 4-84).
- “A variety of native grasses, sedges, and forbs will be available for grazing animals. Competition from non-forage species such as sagebrush and juniper will not be a major problem. Most of the forested range lands will be in a fair and good forage condition class. Forage use will be apparent, and improvements installed to facilitate stock distribution and effective use of available forage will be evident,” in General Forest MA-F22 (Forest Plan, p. 4-87).
- “Grazing by livestock . . . may or may not be apparent . . .,” in Old Growth MA-F6 (Forest Plan, p. 4-58).
- “Grazing by livestock may or may not be visible immediately adjacent to these roads, but will be an acceptable resource in the area,” in Visual Management Corridors MA-F26 (Forest Plan, p. 4-95).

Affected Environment

The Sunflower Cattle Allotment is an active allotment of approximately 28,562 acres. The principal forage species used by livestock in timbered areas are pinegrass (*Calamagrostis rubescens*), elk sedge (*Carex geyeri*), Idaho fescue (*Festuca idahoensis*), and Wheeler bluegrass (*Poa nervosa*). In grassland areas and western juniper (*Juniperus occidentalis*) woodland or savannah, the primary forage species are bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue, and Sandberg bluegrass (*Poa secunda*). In mesic and dry meadows, livestock use Kentucky bluegrass (*Poa pratensis*), sedges (*Carex* spp.), and rushes (*Juncus* spp.).

Seven hundred and thirty-eight cow/calf pairs are permitted to graze on the allotment from June 1 through September 15. Livestock use and distribution is primarily dependent on forage quality, location, availability, fences, herding practices, water developments, salting, and pasture rotation. Two permittees use the allotment in common. The allotment is managed under a six-pasture, rest-rotation grazing system designated in the Sunflower Allotment Management Plan (1995) and a full-time rider is employed to disperse livestock.

The allotment has numerous water developments, pasture fences and gates, enclosure fences, and cattle guards. The allotment does not have any natural barriers that are used in place of fences.

Environmental Consequences

Alternative 1 - No Action

Direct and Indirect Effects

The No Action Alternative would not implement commercial and noncommercial thinning and prescribed burning activities.

Grazing permittees would be able to continue to graze livestock in accordance with annual operating instructions. High-density tree canopies would continue to suppress the growth and density of understory vegetation. Over time, forage quality and quantity would continue to diminish as the percentage of tree canopy cover increases. Forage plant diversity and distribution would continue to decrease. As forage in the uplands decreases, livestock would be expected to occupy and utilize areas with more available and palatable forage, such as meadows and riparian areas to a greater degree.

Cumulative Effects

Livestock grazing has occurred in the Willow Pine Project Area since the early 1900s. Records show 19,835 sheep and 1,370 cattle permitted in 1907 in this area. By the 1930s, springs within the Sunflower country had been developed for livestock watering. By 1946, the type of livestock use on the allotment had shifted entirely from sheep to cattle. Feral horse use occurred between the early 1920s until the mid-1940s. Anecdotal accounts put numbers of feral horses between 500-800 head on the range, year-long, in the general area of the Sunflower Allotment. Until grazing restrictions began to be implemented in earnest in the mid-1900s, the health of upland and riparian vegetation was probably declining in the Willow Pine Project Area. Notes in the 1995 Sunflower Environmental Analysis state that, from 1960 to 1989, range condition improved on 58%, stayed the same on 13%, and decreased on 4% of the allotment.

Timber management activities in the past have affected stand conditions in the Project Area. Past harvest concentrated on removal of large mature trees. Thinning of small-diameter understory trees was limited. As these stands matured and canopies became denser, many understory forage species would have been negatively affected by an increase in shading, competition for moisture, and a build-up of needle litter on the forest floor.

Past fire suppression activities have also affected all vegetation in the Project Area. Under a historic fire regime approximately 34,000 acres would have been expected to burn in the time period between 1970 through 2001. However, fire suppression was so effective that only 25 acres actually burned during this period. A reduction in fire occurrence has, along with harvest practices, resulted in a degree of vegetation growth and fuels buildup that would substantially increase the severity of wildfire should it occur. Past timber management activities have attempted to address this resource concern through associated fuels management activities, such as jackpot burning. The majority of these activities occurred prior to 1994.

See Appendix A for a complete listing of past activities in the Willow Pine Project Area.

The Sunflower Fuels Project is a current project within the Willow Pine Project Area that includes fall underburning of 4,492 acres. The project began in 2004 and will end in 2008. As of 2006, approximately 1,500 acres in the northern third of the Willow Pine Project Area have been underburned. Currently, a temporary pasture rotation schedule, which is different from that in the

Allotment Management Plan, would continue to be implemented until 2008. The temporary pasture rotation schedule was created to ensure that pastures underburned in the fall receive two full growing seasons of forage recovery after treatment through rest and deferred grazing. Fuels consumption objectives for four units in Sunflower Fuels Project were not able to be met during the fall of 2004 due to burning conditions. The Paulina District Ranger subsequently approved spring underburning operations for these units in 2005. Other District projects under development in the Willow Pine Project Area include the protection and regeneration aspen stands in drainages near the 5870-300 road, and the installation of guzzlers to improve wildlife habitat.

In regards to livestock grazing and forest health issues, an article by Belsky and Blumenthal, entitled *Effects of Livestock Grazing on Upland Forests, Stand Dynamics, and Soils of the Interior West: Livestock and the "Forest Health" Crisis*, was published by the Oregon Natural Resources Council in 1995. The authors argue that current levels of livestock grazing are a primary causative factor of the current forest health dilemma. The primary basis of this argument is two-fold. First, livestock grazing reduces tree seedling competition resulting in increased seedling survival. Second, livestock grazing reduces fine fuels which in turn results in a decreased fire frequency and "dense," "fire prone" forested stands, and then immediately counters that grazing reduces the frequency of fires." Although heavy grazing, which occurred in the Willow Pine Project Area early in the 20th century, has been generally accepted within the literature as reducing fire frequencies due to the removal of fine fuels, the relatively minute current levels of grazing within the Willow Pine Project Area are expected to result in negligible local reductions in fine fuels. Therefore, under the alternatives being considered in the Willow Pine Project Analysis, livestock grazing is expected to have negligible impacts on numbers of fire starts and rates of fire spread.

The article continues with a discussion of soil effects relative to livestock grazing, using studies from the 1930s through the 1960s (a period of time when grazing intensity was generally higher than today) to indicate livestock grazing as having a profound influence on runoff and erosion across the Interior West. The utilization levels which corresponded to these effects are not included in the discussion. One modern citation used, Gifford 1981 does not include a listing under Literature Cited and is therefore impossible to corroborate. Another modern citation, Bohn and Buckhouse 1985, is misrepresented as that study found positive infiltration response to a rest-rotation system, and to short-duration, high-intensity deferred rotation grazing in September (the same system in October yielded negative results). The Belsky and Blumenthal article merely indicated that, according to Bohn and Buckhouse 1985, "Grazing yielded significant increases in sediment production." While many studies have documented increased sedimentation and decreased infiltration with heavy levels of grazing, the Belsky and Blumenthal article fails to generate application to the Willow Pine Project Area, as well as integrity of rhetoric.

Alternative 2 – Proposed Action

Direct and Indirect Effects

This alternative proposes to improve tree stands on approximately 3,211 acres by commercial thinning, on approximately 3,943 acres by noncommercial thinning, and would use underburning on approximately 7,070 acres to reduce the potential effects of wildfire.

This alternative would have an increasingly positive effect on forage production, livestock accessibility, diversity of forage species, and quality of forage in upland and riparian areas. As a result, forage production would improve. Forage species would be expected to increase in vigor the first growing season following removal of overstory competition and underburning and

increase spatially in following years, until the time that overstory vegetation dominates moisture and light resources again in an estimated ten to twenty years. Accumulations of slash from thinning activities would hinder livestock movement through the treated areas unless the slash was treated by underburning or piling.

Cumulative Effects

In addition to the cumulative effects discussed in Alternative 1, noncommercial thinning would take place within Riparian Habitat Conservation Areas (RHCAs). Opening up the canopy in these areas may result in beneficial effects to woody species such as willows and alder, for an estimated ten to twenty years, which can help protect streambanks and shade the streams. Forage production in these areas would also increase. An increase in vegetation in the RHCAs has the potential to increase livestock use in the RHCA, and may result in a higher probability of exceeding forage and browse utilization standards as well as streambank alteration limits imposed in the Forest Plan (as amended), for an estimated ten to twenty years. However, livestock numbers and season of use are expected to remain the same, and an improvement in forage production in the uplands as a result of burning and thinning activities would draw the livestock out of the riparian areas, for an estimated ten to twenty years.

Alternative 3

Direct and Indirect Effects

This alternative proposes to improve tree stands on approximately 2,551 acres by commercial thinning, on approximately 3,313 acres by noncommercial thinning, and would use underburning on approximately 6,575 acres to reduce the potential effects of wildfire.

This alternative would have fewer acres of thinning and underburning than proposed in Alternative 2. However, this alternative would also have an increasingly positive effect on forage production, livestock accessibility, diversity of forage species, and quality of forage in upland and riparian areas. As a result, forage production would improve. Forage species would be expected to increase in vigor the first growing season following removal of overstory competition and underburning and increase spatially in following years, until the time that overstory vegetation dominates moisture and light resources again in an estimated ten to twenty years. Accumulations of slash from thinning activities would hinder livestock movement through the treated areas unless the slash was treated by underburning or piling.

Cumulative Effects

Cumulative effects for this alternative would be the same as portrayed in Alternative 2, but would affect fewer acres.

Heritage

Affected Environment

The Areas of Potential Effects (hereafter referred to as the Project Area) to Heritage Resources for the Willow Pine Vegetation and Fuels Environmental Analysis are the places where timber harvesting, road building, and fuels reduction activities would take place.

The geography of the Paulina Ranger District contributed to its use over thousands of years by tribal bands and also historically by Euro-Americans. The southern half of the District, including

this Project Area, borders an interface between the lower grasslands below and, above, the forested foothills of the Ochoco Mountains. This interface was visited and used often by tribal bands for seasonal habitation and both ecological areas were used for resource gathering. Subsequently, today these areas also reflect a high probability for finding the remains of this use in the archaeological record. Interspersed in the forested foothills are rock flats supporting a varied population of traditional plants, and also springs that afforded water and hunting opportunities. This part of the Paulina RD reflects a south/southeast aspect and warms early in the spring. Many areas still contain traditional plants. The lands within the project area would have offered an early spring hunting and gathering area just off of the South Fork John Day River travel corridor. Historically, these lower foothills were an entrance way into the Forest for grazing, hunting, and early-day homesteading and logging.

The existing condition of archaeological sites within the Project Area varies. Euro-American sites (wooden structures, log troughs) are better protected against logging, livestock grazing, and road building due to their location and structural qualities, however, weathering from age and fires affect their integrity. The majority of prehistoric sites within the Project Area have undergone decades of disturbance to their surface and subsurface from livestock grazing, logging, road building, both natural and prescribed burning across the landscape, and surface collecting of artifacts by Forest visitors.

The areas within the Project Area were analyzed for past Heritage survey coverage, and all archaeological sites within this area were identified and analyzed for their eligibility to the National Register of Historic Places, and for specific damage listed in their site records from past management activities. The following data was compiled:

Land within the Project Area:

- Proposed for timber harvesting: 3,211 acres
- Proposed for non-commercial thinning: 3,943 acres
- Proposed for fuels reduction: 7,069 acres

Total number of past Heritage inventories within the Project Area: 26

Number of those past Heritage surveys adequate for present SHPO standards: 6

Project Area land with SHPO-adequate past inventories: 7,069 acres

Land within the Project Area still needing Heritage inventories: 0 acres

High probability acres needing inventories: 0 acres

Low probability acres needing inventories: 0 acres

Total number of archaeological sites within the Project Area: 112

Sites types within the proposed activity units:

Euro-American (historic) sites: 36

Prehistoric sites: 76

Of those 112 sites, those that have been evaluated as Eligible to the National Register or are deemed potentially Eligible: 76

The types of specific damage mentioned in site records from past management activities include the following:

- The disassembly/removal of historic structures by the Forest Service (Hardscrabble lookout tower, Cougar Creek Ranger Station, structures associated with the Ellingson airstrip).

- The removal of carved aspen bark by past logging operations and fuel reductions.
- The trampling and displacement of surface artifacts by livestock congregating at watering places (streams, springs, developed ponds, watering troughs).
- The displacement and destruction of surface and subsurface artifacts from timber harvesting operations and road construction.

The damage component that is of most concern, and that offers the most opportunity for improvement would be the protection of archaeological sites and their surface and subsurface materials adjacent to streams, springs, developed ponds, and within meadows and rock flats.

The measure used to characterize this damage component would be the assessment of those qualities of an archaeological site that contribute to its eligibility to the National Register of Historic Places, specific to disturbance from livestock grazing, timber harvesting, and road building activities. The objective to be attained is the prevention of disturbance to ground surface cultural artifacts, and to preserve the integrity of the site's subsurface materials (by definition, those cultural materials lying at least 10 centimeters below the surface of the ground) against the damage from proposed Willow Pine activities.

Forest Service Standards and Guidelines, and federal laws and regulations that apply for Heritage Resources are found in the Ochoco National Forest Resource Management Plan, in the Forest Service manual, section 2360, in federal regulations 36 CFR64 and 36 CFR800, and in various federal laws including the National Historic Preservation Act of 1966 (as amended), the National Environmental Policy Act, and the National Forest Management Act. In general, the existing management direction asks the Forest to consider the effects on Heritage Resources when considering projects that fall within the Forest's jurisdiction. Further direction indicates that the Forest would determine what cultural resources are present on the Forest, evaluate each resource for eligibility to the National Register of Historic Places, and protect or mitigate effects to those resources that are eligible.

Under Forest Service Manual Chapter 1560: External Relations: State, Tribal, County, and Local Agencies: 1563.01.d – Treaty Rights: The United States entered into over 3000 treaties with Tribes prior to 1871. Each of these treaties is unique but, in general, Tribes retained certain rights to hunt, fish, graze, and gather on the lands ceded to the United States. The Forest Service must administer lands in a manner that protects Tribes' rights and interests in the resources reserved under treaty. Treaty rights are subject to limited State and Federal regulation, where such regulation is nondiscriminatory and reasonably necessary to the conservation of a species or resource.

Current day tribal use of this Project Area include the harvesting of roots, bulbs, and other vegetation for food, medicinal, and ceremonial purposes, and also hunting. These uses are protected for the Tribes who signed the 1855 Treaty with the Tribes of Middle Oregon. This treaty, signed by Wasco and Sahaptin-speaking Indians living along the mid-Columbia River and its tributaries, ceded title to ten million acres of land to the United States but reserved the right to continue using the land for traditional purposes.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

This alternative would have the least potential to disturb historic and surface and subsurface prehistoric sites. No harvesting of timber, thinning, machine piling, or burning of slash would take place from this proposed project. Archaeological sites within the project area would continue to degrade from livestock grazing, weathering, and erosion.

Cumulative Effects

Surface and subsurface cultural materials on the Paulina Ranger District, both historic and prehistoric, have felt the effects of both natural and man-caused activities for thousands of years, sometimes since the day the materials were deposited into the archaeological record. Wildfires, flooding, erosion, and weathering are just some of the natural damage agents that deteriorate archaeological sites. The cumulative effects of logging, road building, grazing, surface collecting and/or illegal digging, and natural fuels reductions accelerate the effects from natural causes. All of these activities would still be reflected in the integrity of these sites. Early site records, dating to the 1970s, often document the disturbance of surface archaeological sites from logging activities, both past and present. Beginning in the mid-1980s, surface sites were given more protection in order to obtain a clearance for that project with SHPO, however, these sites still reflect this damage today. With this Alternative, archaeological sites would continue to be damaged from natural causes, and also from man-caused agents unless protective measures were implemented. See Appendix A for a more detailed description of past activities within this planning area that have affected prehistoric and historic sites.

Alternative 2 – Proposed Action and Alternative 3

Direct and Indirect Effects

Both Alternatives would have the potential to disturb the same number of archaeological sites; however, design criteria built into this proposed project would protect those qualities of a site that make it eligible to the National Register of Historic Places. For those sites within proposed harvest units, buffers would be placed around them. All skid trails and landings near sites would need approval before harvesting. Sites would also be protected from fuel reduction activities proposed for both Alternatives. With the design criteria included for both Alternative 2 and 3, these Alternatives conform to those federal laws and guidelines for the protection of NRHP-eligible sites. These Alternatives would have no impact on the treaty rights of Warm Springs tribal members because no roads would be closed that may affect access to traditional use areas.

Cumulative Effects

The Heritage design criteria for this project would prevent damage that could affect archaeological sites within the proposed units for these Alternatives, however, the cumulative effects of natural elements, logging, road building, grazing, surface collecting and/or illegal digging, and natural fuels reductions would still be reflected in these sites.

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, western most part of Grant, and the northern most sections of Harney and Lake Counties (Zone of Influence or Zone). The major population centers within the Zone and their population figures based on the 2000 census are: Prineville (7,356), Bend (52,029), Redmond (13,481), Madras (5,078), John Day (1,821) Prairie City (1,080) and Burns/Hines (3,490) (U.S Department of Commerce, Bureau of Census, Decennial Census of Population and Housing, 2001). 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 71.

Table 71. Central Oregon Population Growth

County	Population		Change	Percent
	1990 Census Data	2000 Census Data		
Jefferson	13,676	19,009	5,333	39%
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%
Grant	7,855	7,950	95	1.2%
Harney	7,060	7,609	549	7.8%
Lake	7,176	7,422	245	3.3%
Totals	126,265	178,089	51,824	40%

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

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

Employment

According to the 2000 Census, estimated civilian labor force, by county, 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.

During this time the labor force in Oregon as a whole increased 18 percent.

In Crook County, the three largest sectors were trade (1,640), lumber and wood products (1,510), and government (1,180). Since then, with the closure of the remaining sawmills, employment in the lumber and wood products has decreased. In February 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).

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.

During this time the unemployment rate in Oregon as a whole was 5.7 percent (U.S Department of Commerce, Bureau of Census, Decennial Census of Population and Housing, 2001).

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

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

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 as a whole. Future projections also call for continued slow growth in these three economies (U.S Department of Commerce, Bureau of Census, County Business Patterns, 2001; Oregon Employment Department, 1992; personal communications with Jason Yohannan, Regional Economist, April 2006). In fact Grant and Harney Counties had the highest and second highest, respectively, unemployment rates in the state in 2005.

Although the past decade (1990-2000) has seen a significant reduction in employment within the lumber and wood products industry, the lumber and wood products industry is still an important contributor to the local economies. In Crook County (2000), 1,510 people were employed in the lumber and wood products industry. This accounted for 25 percent of all wage and salary employment in the county, and represented the third highest paying job in the county. Since then, with the closure of additional sawmills, employment in the lumber and wood products has decreased. In February 2006 there were 1,110 people employed in this sector. Moreover, almost all these jobs are located in the logging and secondary wood products sectors.

In Deschutes County, 4,770 people were employed in the lumber and wood products industry. This accounted for 10 percent of all wage and salary employment, and represented the seventh highest paying job in the county. In Jefferson County, 1,150 people were employed in the lumber and wood products industry. This accounted for 19 percent of all wage and salary employment, and represented the third highest paying job in the county. As of February 2006, 1080 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 February 2006 250 individuals were still employed.

Of all the counties in the Zone, Grant is the only local economy remaining with a significant dependency on logging and primary manufacturing (sawmills). In Lake County, 290 people were employed in the lumber and wood products industry, and other manufacturing. This accounted for 13 percent of all wage and salary employment, and represented the third highest paying job in the county. Today 260 people are employed. Wheeler County has no manufacturing sector industries (U.S Department of Commerce, Bureau of Economic Analysis, 2001, Labor Trends, April 2006).

Job and Personal Income Effects

Assumptions for Direct and Indirect Effects

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 (2002) and Philips (2004). The jobs associated with prescribed fire and noncommercial thinning are based on local experience and do not include indirect and induced jobs.

Table 72 shows the annual estimated job and income impacts by alternative. These estimates are for commercial forest products, noncommercial thinning and piling of small woody debris (slash), road construction, road reconstruction, and 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.

Timber harvest jobs and income shown in Table 72 are based on statewide relationships and not necessarily the expected impact in any one county. Because of this the estimated jobs and income figures in Table 72 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.

Over half of the timber jobs displayed in Table 72 are associated with primary manufacturing (sawmills), and since there is no certainty on where manufacturing would occur (may not even be processed within the Zone); it is not possible to predict where many of these jobs would reside.

Table 72. Total Employment and Income

	Alternative 1	Alternative 2	Alternative 3
Estimated Timber Volume to be Harvested (MMbf)	0	6.5	5.1
Jobs, timber harvest	0	103.1	81.1
Income, timber harvest (\$1000)	0	\$3.5	2.8
Jobs, road work	0	1.1	.9
Income, road work	0	\$34,600	29,200
Jobs, noncommercial thinning /slash piling/prescribed fire	0	13.7	11.7
Total Jobs	0	118	93.7

Direct and Indirect Effects – 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 local or regional economies. In all actuality, the No Action Alternative would have negative impacts to local economies because forest product jobs would not be maintained. The ability to substitute this material from other source is questionable given the current availability of timber, especially from Federal lands. Although it is not possible to predict with any certainty where these jobs would have been located because of the project location and access, the most likely economies are in Grant and to a lesser extent, in Crook and Harney Counties. As a result, the No Action Alternative would result in some downward pressures on these three economies, especially in Grant County because it is the logical place for the logs to be processed (primary manufacturing- sawmills).

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 noncommercial thinning and slash piling, are accomplished through the use of contracting and many of the resources needed, including workers, are from outside the Zone.

Direct and Indirect Effects of Alternatives 2 and 3

Alternatives 2 and 3 do propose commercial harvest activities and therefore would contribute to the local and regional economies. Table 72 displays the expected level of harvest in million board feet and the number of timber and related jobs that would be created or maintained by each alternative. The estimated jobs would occur over several (1-5) years as timber is harvested and processed. Given the major restructuring of the woods product industries over the past 10 to 15 years and lack of supply, it's likely that these would not be new jobs but jobs needed to support 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; as a result, it cannot capture the jobs associated with this activity. Grant County on the other hand, not only has the manufacturing capacity; but, because of the proximity and access to the project area, is the logical place for the timber to be milled. In addition, over half of the jobs supported by the harvesting, transporting and processing of timber are associated with the primary manufacturing.

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 ten years.

As noted earlier, it is reasonable to expect a good proportion of the noncommercial 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 developed for this project have the potential to bring in workers from the outside to perform logging, precommercial thinning, and related activities. While the outside workforce is more likely to be more racially diverse than the local resident population, the residents have worked effectively with and supported anticipated fluctuations in the workforce expected with the implementation of an action-based alternative.

Cumulative Effects of All Alternatives

Overall the economic influence from implementation of any of the alternatives is likely to be minimal 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 adverse economic impacts under Alternative 1. However, with the location of the project in close proximity to Crook, Grant, and Harney, the loss of economic opportunities associated with the No Action Alternative, along with the high unemployment rates, and poorly diversified, yet more timber dependent economies, would result in downward pressure on these economies (mainly in Grant and Harney). Crook County's, with its' more robust economy, should see little economic impact overall. Depending on the labor source and milling location, alternatives 2 and 3, which do provide commercial wood products in addition to economic activities associated with the other management activities, should help stabilize the benefiting local economies, especially Grant's, if the milling were to occur within the county. In the context of a larger economy (regional or State-

wide), the economic activity lost under Alternatives 1, or the amount provided in Alternatives 2 and 3, would not register at these scales.

CHAPTER 4 – LIST OF PREPARERS, CONSULTATION AND COORDINATION, INDEX, GLOSSARY OF ACRONYMS, ABBREVIATIONS, AND TERMS, BIBLIOGRAPHY

LIST OF PREPARERS

Anita Andazola, District Fish Biologist
Lila Black, District Range Specialist
Lori Blackburn, Natural Resources Team Leader
Janis Bouma, District NEPA Coordinator, Project Team Leader
Bob Crisler, District NEPA Coordinator, Project Team Leader
Matt Deppmeier, Silviculturist, Bend/Fort Rock Ranger District
Andy Eglitis – Forest Entomologist
Mike Feiger, District Wildlife Biologist
Janet Hollister, Writer/Editor
Deb Mafera, District Botanist
Carl Magill, District Roads Specialist
Kathleen Martin, District Archaeologist
Tom Mountz, COFMS Fuels Planner
Dave Palmer, District Range Specialist
Jim Seymour, West Zone Hydrologist
Peter Sussman, Deschutes NF, Soils Scientist

CONSULTATION AND COORDINATION

The Forest Service consulted the following individuals, Federal, State and local agencies, Tribes and non-Forest Service persons during the development of this environmental assessment:

Interdisciplinary Team Members

Anita Andazola, District Fish Biologist
Lila Black, District Range Specialist
Lori Blackburn, Natural Resources Team Leader
Janis Bouma, District NEPA Coordinator, Project Team Leader
Bob Crisler, District NEPA Coordinator, Project Team Leader
Matt Deppmeier, Silviculturist, Bend/Fort Rock Ranger District
Andy Eglitis – Forest Entomologist
Mike Feiger, District Wildlife Biologist
Deb Mafera, District Botanist
Carl Magill, District Roads Specialist
Kathleen Martin, District Archaeologist
Tom Mountz, COFMS Fuels Planner
Dave Palmer, District Range Specialist
Jim Seymour, West Zone Hydrologist
Peter Sussman, Deschutes NF, Soils Scientist

Federal, State and Local Agencies

Jerry Cordova – US Fish and Wildlife Service
Gordon Foster, Oregon Department of Forestry
Grant County Commissioners, Judge Dennis Reynolds, Canyon City, Oregon
BLM, Prineville Field Office, Tina Welch, Prineville, Oregon
Oregon Dept. of Fish and Wildlife, Brian Ferry, Prineville, Oregon
Grant County Soil and Water Conservation District, Kenneth Delano, John Day, Oregon
US Fish and Wildlife, Nancy Gilbert, Portland, Oregon

Tribes

Sally Bird, Dept. of Natural Resources, Conf. Tribes of the Warm Springs Res.
Robert Brunoe, General Manager, Dept. of Natural Resources, Conf. Tribes of the Warm Springs Res.
Gary Burke, Chairman, Board, of Trustees, Conf. Tribes of the Umatilla
Amos First Raised III, Natural Resources, Burns Paiute Tribe
Allan Foreman, Chairman, Tribal Council, The Klamath Tribes
Rick George, EPRP Program Manager, Conf. Tribes of the Umatilla
Lonny Macy, Dept. of Natural Resources, Conf. Tribes of the Warm Springs Res.
Clay Penhollow, Dept. of Natural Resources, Conf. Tribes of the Warm Springs Res.
Barbara Sam, Chairman, Tribal Council, Burns Paiute Tribe
Gerald Skelton, Cultural and Heritage Dept., The Klamath Tribes
Charisse Snapp, Acting Chairperson, Tribal Council, Burns Paiute Tribe
Ron Suppah, Sr. Tribal Council Chairman, Conf. Tribes of the Warm Springs Res.
Scott Turo – Off Reservation Wildlife Biologist, Conf. Tribes of the Warm Springs Res.
Jeff VanPelt, Cultural Resource Protection Mgr., Conf. Tribes of the Umatilla

CONSULTATION AND COORDINATION, CONT.

Others

Don Lantz – National Wild Turkey Federation
Gerry Gardiner – Land owner representative
Rod Martino – Land owner, upper Sunflower Creek
Asante Riverwind, Eastern Oregon Forest Organizer, Sierra Club
Greg Bedortha, Paulina, Oregon
Bedortha Ranches, Paulina, Oregon
Gary Bedortha, Paulina, Oregon
Richard and Vicki Nelson, Burns, Oregon
Chris Paulson, Bozeman, Montana
John and Peter Pagter
Thomas and Christi Jett, Bend, Oregon
Emily M. Hite, Prineville, Oregon
Gene Bernard, Paulina, Oregon
Ron and Rosalee Palmer, Paulina, Oregon
Helen Schnabele and Carl Schnabele, Canyon City, Oregon
Ray and Bonnie Sessler, Prineville, Oregon
Martin and Penny Kennedy, LaPine, Oregon
Mike and Joanne Keerins, Canyon City, Oregon
National Wild Turkey Federation, Bend, Oregon
Rocky Mountain Elk Foundation, Missoula, Montana

INDEX

A

Affected Environment and Environmental Consequences	37
Alternative 1 – No Action.....	17, 27, 28
Alternative 2 – Proposed Action.....	18, 20, 21, 27, 28
Alternative 3.....	23, 24, 25, 27, 28
Alternatives Considered but Eliminated From Detailed Analysis.....	17
Alternatives Considered in Detail.....	17
Alternatives, Including the Proposed Action.....	17

B

Background Information of the Proposal.....	8
Bibliography	281
Botany.....	32, 186

C

Comparison of Alternatives.....	27
Consultation and Coordination.....	265
Cultural Resources.....	see Heritage Resources

D

Description of Management Areas and Management Direction.....	10
Design Criteria and Monitoring Requirements.....	29
Decision Framework for the Proposal.....	14
Document Structure.....	7

E

Equivalent Harvest Area (EHA).....	70, 71, 74, 272
------------------------------------	-----------------

F

Fisheries and Aquatic Resources (see also Water Quality and Fisheries).....	111
Forest Wood Products and Jobs.....	258

G

Glossary of Acronyms, Abbreviations, and Terms.....	269
---	-----

H

Heritage Resources.....	36, 254
Hydrology	69

I

Issues.....	14
-------------	----

L

List of Figures.....	6
List of Tables.....	4

M	
Management Indicator Species.....	114, 140, 165, 178, 275
N	
Noxious Weeds.....	32, 201
P	
Post Fledging Areas (PFA).....	37, 47, 50, 53, 57, 60, 62, 63, 65
Primary Cavity Excavators.....	140, 145, 147, 149-151, 154, 156, 158, 161, 164, 165, 325
Proposed Action.....	13
Public Involvement.....	14
Purpose of and Need for Action... ..	10
R	
Range and Grazing	36, 251
Riparian Management Objectives (RMO).....	31, 85, 116
Riparian Habitat Conservation Areas (RHCA)... ..	10, 31-32, 35, 77-80, 84, 87, 95, 103, 104 109, 110, 123, 211, 254
S	
Sensitive Plants.....	32, 186
Stream Shade... ..	306
W	
Water Quality and Fisheries	31
Wildlife Species and Habitat	
See Management Indicator Species	
Northern Goshawk.....	13, 14, 19, 23, 28, 29, 37-42, 45-69, 176, 226, 238, 246
Pileated Woodpecker.....	140, 142-144, 147, 149, 151, 153, 157, 158, 161, 165, 325
Primary Cavity Excavators.....	140, 145, 147, 149-151, 153, 154, 156-158, 161, 164 165, 325

GLOSSARY OF ACRONYMS, ABBREVIATIONS, AND TERMS

Allochthonous: The word refers to energy source or nutrient coming from the outside the stream system which may be in the form of leaves, sticks, cones, bark, branches, and logs that fall or get washed into the stream, which begins a breakdown process by fungi and bacteria. Allochthonous material feeds macroinvertebrates, which feed fish.

Airshed - A geographical area that because of topography, meteorology, and climate shares the same air.

Alternative - In an EA/EIS, one of a number of possible options for responding to the purpose of and need for action.

AMP - Allotment Management Plan (livestock grazing).

Areas To Protect (ATP) – locations designated on the timber sale contract map as areas to protect from project implementation activities.

Arterial Road - Roads comprising the basic access network for National Forest System administrative and management activities. These roads serve all resource to a substantial extent, and maintenance is not normally determined by the activities of any one element. They provide service to large lands areas and usually connect with public highways or other Forest arterial roads to form an integrated network of primary travel routes. Usually they are developed and operated for long-term land and resource management purposes and constant service.

AUM - Animal unit month; based on the amount of forage required by an animal unit for one month (26 pounds dry matter per day, Forest Plan).

BA - Biological Assessment

BE - Biological Evaluation

Best Management Practices (BMPs) - Practices designed to prevent or reduce water pollution, including sedimentation.

BLM - Bureau of Land Management

BMP – see Best Management Practices

Canopy - In a forest, the branches from the uppermost layer of trees; in a shrub or grassland, the uppermost layer of shrubs; in a riparian area, the layers of vegetation that project over the stream.

Canopy Cover – The areas of the ground covered by a vertical projection of the canopy. Used to describe how open or dense a stand of trees is, often expressed in 10 percent increments.

CFR – Code of Federal Regulations.

cfs (cubic feet per second) – a method of measuring volume or capacity; a cubic foot is 1,728 cubic inches or 0.028 cubic meters.

Closed Road – Generally, local roads that are physically closed (signs, gates, and earthen berms) to public use.

Collector Road - Roads that serve smaller lands areas than a Forest arterial road, and usually connected to an arterial road or public highway. These roads collect traffic from local Forest roads and/or terminal facilities. The location and standard are influenced by both long-term multi-resource service needs, as well as travel efficiency. These roads may be operated for either constant or intermittent service, depending on land use and resource management objectives for the area.

Compaction - Packing together soil particles by exerting force at the soil surface and increasing soil density. Making soil hard and dense, decreasing its ability to support vegetation because the soil can hold less water and air and because roots have trouble penetrating the soil.

Connectivity - The arrangement of habitats that allows organisms and ecological processes to move across the landscape; patches of similar habitats are either close together or linked by corridors of appropriate vegetation (the opposite of fragmentation).

Cover - (1) Trees, shrubs, rocks, or other landscape features that allow an animal to partly or fully conceal itself. (2) The area of ground covered by plants, litter, and coarse fragments, including tree crowns and shrubs that are in direct contact with the ground.

Cultivator - an implement to loosen soil while crops are growing.

Cumulative Effects - Impacts on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor but collectively major actions taking place over a period of time.

CWE – Cumulative Watershed Effects; substantial, adverse influences on water quality and biological resources that arise from the way watersheds function, and particularly from the ways that disturbances within a watershed can be transmitted and magnified within channels and riparian habitats downstream of disturbed areas.

dbh – diameter at breast height; a standard way of measuring the diameter of a tree with a measuring tape.

Decommissioned (Road) - A road that is no longer needed and not planned to be used again. It has been closed and, generally, has been returned to production (example: a road that has been ripped/(tilled and planted with vegetation).

Design Elements – measures taken to reduce the potential for negative impacts on a resource from a project activity.

Detrimental Soil Conditions – There are four categories describing detrimental soil conditions: compaction, displacement, puddling and severely burned soil or charring. Compaction is defined as an increase in soil bulk density of 20% or more from the undisturbed level for volcanic ash soils

and 15% or more for residual soils. Displacement is often described as the removal or mixture of topsoil or humus from the A horizon. Puddling is the breakdown of soil structure under wet conditions. Severely burned soil or charring can be described as having the top layer of mineral soil greatly changed in color, usually to red, and the next one-half inch blackened from organic matter charring by heat conducted through the top layer.

Developed Recreation - Recreation that requires facilities that in turn result in concentrated use of an area; for example, a campground.

Dimension - A term that refers to the cross-sectional profile of a stream.

Direct Effects - Impact on the environment that is caused by an action and occur at the same time and place.

Discing - to cultivate with a disc harrow or similar implement

Dispersed Recreation - Recreation that does not occur in a developed recreation sites; for example, hunting or backpacking.

Diversity - The distribution and abundance of different plant and animal communities and species within an area.

EA – Environmental Assessment

Ecosystem - A complete, interacting system of living organisms and the land and water that make up their environment; the home places of all living things, including humans.

EHA - see Equivalent Harvest Area

EIS - see Environmental Impact Statement

Embeddedness The degree to which fine sediments surround and cement coarse substrates on a streambed. This comparison is used to assess habitat capability for spawning and feeding, incubating and over-wintering fish, as well as for their prey base. Embeddedness provides an indication of how easily substrate moves at various flows, linking it to water quality measures including stream turbidity

Endangered Species - A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a major portion of its range.

Endangered Species Act (ESA) - An act, passed by Congress in 1973 that directed all Federal departments and agencies to seek to conserve endangered and threatened species. Actions authorized, funded, or carried out by Federal departments and agencies should not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitat. The act also mandates conferencing with the appropriate agencies.

Environment - The combination of external physical, biological, social, and cultural conditions affecting the growth and development of organisms and the nature of an individual or community.

Environmental Consequences – Effects as a result of an action. Included are direct effects, which are caused by the action and occur at the same time and place; indirect effects, which are caused by the action and are later in time or further removed in distance but which are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and the related effects on air, water, and other natural systems, including ecosystems. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if, on balance, the agency believes the effects will be beneficial.

Equivalent Harvest Area (EHA) - That area which when harvested under any of the various silvicultural regimes produces hydrological effects similar to one acre of clear-cut.

Erosion – The detachment and removal of soil material from its original location.

Essential Fish Habitat (EFH) – The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996, established procedures to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. The Act requires Federal agencies to consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH.

Evolutionarily Significant Unit (ESU) – An ESU is a Pacific salmon population or group of populations that is substantially reproductively isolated from other populations of the same species that represents an important component of the evolutionary legacy of the species.

Exclosure - A structure, generally a fence, that prohibits cattle and/or wildlife from a designated area.

Fire Prescription - the application of fire in pre-determined patterns under pre-determined conditions in order to produce a desired average flame length and rate of spread. This combination of environmental conditions is called a “fire prescription”.

Fire Regime - The characteristics of fire in a given ecosystem, such as the frequency, predictability, intensity, and seasonality of fire. Fire regimes can be grouped into three severity regimes: Non-lethal, Mixed, and Stand Replacement. Non-lethal fires are of low to moderate intensity, creeping, surface fires that consume primarily understory grasses, forbs, and shrubs, and leave the overstory trees intact. Stand replacement fires are of high intensity and consume most of an existing stand. Mixed fires are of moderate intensity and consume the understory and some of the overstory.

Forest Cultivator - large V bar curved tooth harrow usually pulled as a separate unit. Used to rip to 12-14 inches.

Forest Plan (Land and Resource Management Plan) - A document that guides natural resource management and establishes standards and guidelines for a National Forest; required by the National Forest Management Act.

Forest Plan Amendment #2 (aka Regional Forester's Interim Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales or Eastside Screens) - Originally signed in 1994 and amended in 1995. The objective of this direction was to provide an approach for maintaining future planning options concerning wildlife habitat associated with late

and old structural stages, fish habitat, and old forest abundance. The direction was intentionally restrictive, reflecting a conservative interpretation of riparian, wildlife, and ecosystem needs for the short term. The direction applies to timber sales. The Interior Columbia Basin Ecosystem Management Project will supersede the Eastside Screens.

FSM – Forest Service Manual

Fragmentation (habitat) - The breakup of a large land area (such as a forest) into smaller patches isolated by areas converted to a different land type (the opposite of connectivity).

FS - Forest Service

Fuels – Includes living plants; dead, woody vegetative materials; and other vegetative materials capable of burning.

General Forest Management Area – see Management Area.

Ground Cover - Perennial vegetation plus litter and coarse fragments (greater than 2 mm in size), including tree crowns and shrubs, that are in direct contact with the ground. Based on the erosion hazard class, effective ground cover is between 20% and 75% of ground covered the first year after management activities.

Gully - An erosional term used to describe concentrated erosion in the vertical direction. Gullies are generally deeper than they are wide.

Habitat - A place that provides seasonal or year-round food, water, shelter, and other environmental conditions for an organism, community, or population of plants or animals.

Habitat Effectiveness Index (HEI) - The Forest Plan identifies standards for overall habitat effectiveness measured by the Habitat Effectiveness Index (HEI).

Heritage Resources - The remains of sites, structures, or objects used by humans in the past. They may be historic, prehistoric, archaeological, or architectural in nature.

Historic Range of Variability – changes in forest vegetation, specifically, the comparison of its current condition with what it was like historically.

Hydrolic Subsoiler - toothed ripper or harrow that allows teeth to rise over rocks, etc. by means of an affixed nitrogen cylinder that compresses under a maximum mechanical loading to prevent tooth from breaking off.

IDT - Interdisciplinary Team

Inactivated (Road) - A road that is managed in a stored or closed category for long-term intermittent use. Generally, a traffic service level D single purpose type road that remains open to motorized off-highway vehicles. An inactivated road can be hydrologically stabilized or hydrologically closed.

Indirect Effects - Impacts on the environment that are caused by an action and are later in time or farther removed in distance.

INFISH - Interim Inland Native Fish Strategy for the Intermountain, Northern, and Pacific Northwest Regions (Forest Service). A strategy intended to provide interim direction to protect habitat and populations of resident fish outside of anadromous fish habitat in eastern Oregon, eastern Washington, Idaho, western Montana, and portions of Nevada. The Decision Notice/Finding of No Significant Impact for this strategy was signed July 28, 1995.

Instream Structures – Boulders, logs, or other artificially placed materials that are used to enhance or improve existing fish habitat by altering stream velocity and depth or to provide physical cover.

Interdisciplinary Team (IDT) - A team of people that collectively represent several disciplines and whose duty it is to coordinate and integrate the planning process.

Intermittent Stream - A stream that flows only at certain times of the year when it receives water from other streams or from surface sources such as melting snow.

Irretrievable - A category of impacts that applies to losses of production or commitment of renewable resources. For example, while a linear piece of land is being used as a road, some or all of the timber production there is "irretrievably lost." If the road was rehabilitated after use and soil compaction was reduced, timber production could resume; therefore, the loss of timber production during the time the road was in use is irretrievable but not irreversible, because it is possible for timber production to resume if the piece of land is no longer used as a road.

Irreversible - A category of impacts that applies to non-renewable resources, such as minerals and archaeological sites. Losses of these resources cannot be reversed. Irreversible effects can also refer to effects of actions on resources that can be renewed only after a very long period of time, such as the loss of soil productivity.

Issue - A matter of controversy, dispute, or general concern over resource management activities or land uses. To be considered a "major " or "key" issue, it must be well defined, relevant to the proposed action, and within the ability of the agency to address through alternative management strategies.

Jump - A vertical transition within a stream that may prevent fish passage.

LRMP – Land Resource Management Plan (Forest Plan).

Landtype – An inventory map unit with relatively uniform potential for a defined set of land uses. Properties of soils, landform, natural vegetation, and bedrock are commonly components of landtype delineation used to evaluate potentials and limitations for land use.

Late and Old Structure (LOS) - Late and old structure forested stands.

Listed Species - A wildlife or plant species listed under the authorization of the Endangered Species Act as threatened or endangered.

Listed (Streams) – Streams listed on the 303(d) List by Oregon Department of Environmental Quality (ODEQ) as water quality limited.

LMZ – limit management zones. See Appendix H for LMZs by alternative and unit.

Local Road - Local roads are usually one-lane roads constructed to serve a dominant use or resource. Local roads do not access large land areas since they are more site-specific than arterial and collector roads.

LOS - see Late/Old Structure

LRMP - Land & Resource Management Plan (see Forest Plan)

LTPA - Large trees per acre.

Management Area - a unit of land allocated to emphasize a particular resource, based on the capability of the area. Expressed as MA F20, MA F22, etc.

Management Direction - A statement of goals and objectives, management prescriptions, and associated standards and guidelines for attaining them.

Management Indicator Species (MIS) - Vertebrate species whose population changes are believed to best serve as an index of a biological community's response to the effects of land management activities or are important for fishing, hunting and trapping.

MIS – see Management Indicator Species

Mitigation - Measures designed to counteract environmental impacts or to make impacts less severe.

National Environmental Policy Act (NEPA) - An act, passed by Congress in 1969 that declared a national policy to encourage productive harmony between humans and their environment. This act requires the preparation of environmental impact statements for Federal actions that are determined to be of major significance (see 40 CFR [Code of Federal Regulations] 1500-1508 for implementing regulations. See also FSH [Forest Service Handbook] 1909.15, the FS Environmental Policy and Procedures Handbook.)

NEPA - see National Environmental Policy Act

NCT – Non-commercial thinning.

NLAA - Not Likely to Adversely Affect

NMFS - National Marine Fisheries Service

Non-forest Land – Lands that have never had or that are incapable of having 10% or more of the area occupied by forest trees, or lands previously having such cover and currently developed for non-forested use.

NRHP – National Register of Historic Places

No Action Alternative - The most likely condition expected to exist in the future if current management direction were to continue unchanged.

NTU – Nephrometric Turbidity Unit: How turbidity is expressed. Turbidity is the degree to which suspended material in the water impedes light penetration.

ODEQ – Oregon Department of Environment Quality

ODFW - Oregon Department of Fish & Wildlife

Old Structure - A forest stand with moderate to high canopy closure; a multi-layered, multi-species canopy dominated by large overstory trees, high incidence of large trees, some with broken tops and other indications of old decaying wood (decadence), numerous large snags; and heavy accumulations of downed wood. For ponderosa pine stands, large diameter trees with incidences of snags and old decaying wood may indicate old structure. Canopy densities may actually be low with fewer trees per acre present than other plant associations.

OSHA - Oregon Occupational Safety & Health Association

Overstory - The upper canopy layer of trees.

PACFISH – Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (commonly referred to as PACFISH).

Plant Association Groups (PAG) -

Pattern - A term that refers to the plan-view of a stream.

PBA - Programmatic Biological Assessment

PDC - Project Design Criteria

Periphyton: Microscopic underwater plants and animals that are firmly attached to instream surfaces like rocks and large woody debris. Fish and macroinvertebrates may use periphyton as a food source.

Perennial - A plant that lives for three or more years.

Perennial Stream - A stream that flows water year round.

PFA - Post Fledgling Area

Plant Associations - Climax plant community types

Plant Association Group (PAG) - A group of plant associations that share similar productivities, disturbance regimes, and responses to disturbance. Eight major plant association groups have been described on the Ochoco National Forest.

Plant Communities - A homogeneous unit in respect to the number and relationship of plants in tree, shrub, and ground cover strata.

Prescribed Fire – A wildland fire burning under specified conditions that will accomplish certain planned objectives. The fire may result from either planned or natural ignitions. The Regional Forester must approve proposals for use of natural ignitions for this purpose.

Post-holing - A term used to describe soil disturbance from wildlife and livestock that results in “post-hole like” depressions.

Profile - A term that refers to the longitudinal profile of stream.

Proposed Action - A proposal made by the Forest Service to authorize, recommend, or implement an action on National Forest System lands to meet a specific purpose and need.

Puddling – A term used to describe standing water on the soil surface resulting from platiness or lack of structure.

Rager Green Dot Road Closure – a wildlife management tool, used on the Paulina Ranger District (Rager Ranger Station), where certain forest roads and the adjacent area within 300 feet of those roads are closed to public vehicular traffic during periods of restrictions. Closure begins three days prior to General Deer Season.

Relative Erosion Rate (RER) – portrays average sediment load changes attributable to forest management practices and natural disturbance factors.

Riparian Management Objectives (RMO) – INFISH key habitat elements.

Ripping -generic term for using toothed implements to loosen earth or rock. May be used singly as in large long rippers behind tractors or in straight bar gangs or V bar gangs either on a tractor or on a trailer. Depths commonly range from 1 to 3 feet.

RHCA - see Riparian Habitat Conservation Area

Riparian Area - An area with distinctive soil and vegetation between a stream or other body of water and the adjacent upland; includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation.

Riparian Habitat Conservation Area (RHCA) - A portion of a watershed where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines. RHCA include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems by (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams, (2) providing root strength for channel stability, (3) shading the stream, and (4) protecting water quality.

RMO – see Riparian Management Objectives

Scarification - term used to describe usually shallow (<12 inches discing), harrowing or cultivating.

Scoping - The early stages of preparation of an environmental assessment or environmental impact statement used to solicit public opinion, receive comments and suggestions, and determine the

issues to be considered in the development and analysis of a range of alternatives. Scoping may involve public meetings, telephone conversations, mailings, letters, and other contacts.

Sediment - Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity or ice and has come to rest on the earth's surface either above or below sea level.

Sedimentation – The action or process of forming or depositing sediments.

Sediment Yield – Sediment that is eroded from adjacent land into a body of water.

Sensitive Species - Species identified by a Regional Forester for which population viability is a concern because (a) of substantial current or predicted downward trends in population numbers or density, or, (b) of substantial current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Seral Stage – A plant or animal community that is transitional in stage of succession, being either short- or long-term. If left alone, the seral stage will pass and another plant or animal community will replace it.

Short-Term Effects – For timber management planning, those effects which will not be substantial beyond the RPA planning horizon of 50 years. For DEQ water quality, short-term effects are defined as two days or less. Generally, short-term effects are within the planning period.

Silviculture - The practice of manipulating the establishment, composition, structure, growth, and rate of succession of forests to accomplish specific objectives.

Species - A population or series of populations of organisms that can interbreed and reproduce freely with each other but not with members of other species.

Stand - A group of trees in a specific area that is sufficiently alike in composition, age, arrangement, and condition to be distinguishable from the forest in adjoining areas.

Stand Density Index (SDI): the general term stand density is a measure of the amount of tree vegetation on a unit of land area and can be the number of trees per acre, the basal area per acre, or other parameters such as average stand density index (SDI) per area. SDI is based on the relationship between tree size and the number of trees per acre and is indexed to a stand having a 10 inch diameter at breast height (dbh) average tree size.

Stream Class - A classification system for streams. **Class I** are perennial or intermittent streams containing one or more of the following characteristics: (1) are the direct source of water for domestic use; (2) are used by large numbers of fish for spawning, rearing, or migration; and/or (3) contain enough flow to have a major influence on water quality of a Class I stream. **Class II** are perennial or intermittent streams containing one or more of the following characteristics: (1) are used by moderate numbers of fish for spawning, rearing, or migration; and/or (2) flow enough water to have a moderate influence on downstream quality of a class I or II stream. **Class III** are all other perennial streams not meeting Class I or II definitions. **Class IV** are all other intermittent streams not meeting Class I, II, or III definitions.

Subwatershed - An area mostly bounded by ridges or other similar topographic features contributing water, organic matter, dissolved nutrients, and sediments to a lake or stream. One or more subwatersheds make up one watershed.

Succession - A series of dynamic changes by which one group of organisms succeeds another through stages leading to potential natural community or climax. An example is the development or series of plant communities (called seral stages) following a major disturbance.

Threatened Species - Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a major portion of their range.

Tillable - capable of being tilled, fractured, disced, ripped - varies with equipment capabilities.

Tillage - the operation of tilling land, to plow, sow seed and raise crops.

TMDL - Total Maximum Daily Load – The state establishes a Total Maximum Daily Load (TMDL) allocation plan. A TMDL allocation plan establishes limits on the quantity of a pollutant that enters a stream from a specific land user or group of users.

TPA (tpa) – trees per acres.

Understory – May include grass, forbs, shrubs, small trees (such as seedlings and saplings), and other plants found beneath the overstory tree canopy.

UMZ – upper management zone. See Appendix H for UMZs by alternative and unit.

USDA - United States Department of Agriculture.

USDI - United States Department of Interior.

USFWS - United States Fish & Wildlife Service

VEM - Viable Ecosystems model (VEM) is the method used on the Ochoco N.F to apply ecosystem concepts to project-level planning. This system compares existing vegetation with site potential (or biophysical environment) and historic conditions. The VEM is designed to be applied at both the forest and the sub-watershed scale.

Watershed – An area mostly bounded by ridges or other similar topographic features contributing water, organic matter, dissolved nutrients, and sediments to a lake or stream. A watershed is made up of two or more subwatersheds.

WEPP – Water Erosion Prediction Project; a model to estimate potential soil erosion and sediment yield.

W/D - Width to Depth Ratio

Winged Subsoiler - toothed ripper or harrow that has teeth that are T shaped in cross section which lifts the soil and loosens it more than standard teeth.

WQRP - Water Quality Restoration Plan

Xeric – Of, characterized by, or adapted to an extremely dry habitat.

BIBLIOGRAPHY

- Agee, James K. 1993. *Fire Ecology of Pacific Northwest Forests*. Island Press.
- Agee, James K. and C.N. Skinner. 2005. *Basic Principles of Forest Fuel Treatments*. *Forest Ecology and Management* 211 (2005) p. 83-96
- Anderson, B. 1989. Background Information on the EHA Model. Unpublished, on file at the SO, Ochoco National Forest.
- 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
- Barrett, J.W. 1979. *Silviculture of Ponderosa Pine in the Pacific Northwest: The State of Our Knowledge*. USDA For. Serv. Gen. Tech. Rep. PNW-97. 106 p.
- Barrett, J.W. 1981. *Twenty-Year Growth of Thinned Ponderosa Pine in the Methow Valley of Northern Washington*. USDA Forest Service, Pacific NW Research Station, PNW-RP-286. 13 p.
- Barrett, J. 1982. *Growth of Ponderosa Pine Saplings Thinned to Five Spacings in Central Oregon*. USDA Forest Service, Pacific NW Research Station, PNW-RP-301. 18 p.
- Barrett, J.W., and L.F. Roth. 1985. *Response of Dwarf Mistletoe-Infested Ponderosa Pine to Thinning*. USDA Forest Service, Pacific NW Research Station, PNW-RP-331. 19 p.
- Bêche, L.A. 2004. Unpublished dissertation. *The Effects of Riparian Prescribed Fire on Aquatic and Riparian Communities in a Mixed-Conifer Forest Watershed*. Sierra Nevada, California, USA. University of California at Berkeley. 78 p.
- Bêche, L.A., S.L. Stephens and V.H. Resh. 2005. *Effects of Prescribed Fire on a Sierra Nevada (California, USA) Stream and its Riparian Zone*. *Forest Ecology and Management*. 218 (2005) p. 37-59
- Beschta, R.L.; Bilby, R.E.; Brown, G.W.; [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 Forestry.
- Black, S.H. 2005. *Logging to Control Insects: The Science and Myths Behind Managing Forest Insect 'Pests'*. The Xerces Society for Invertebrate Conservation, Portland, OR. 82 p.
- Block, Michael L. Morrison, and M. Hildegard Reiser, Eds. 1994. *The Northern Goshawk: Ecology and Management*. *Proceedings of a Symposium of the Cooper Ornithological Society*, Sacramento, CA. *Studies of Avian Biology* No. 16. 136 Pp.

- 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.
- Brookes, M. H., R.W. Campbell, J.J. Colbert, R.G. Mitchell, and R.W. Stark. 1987. *Western Spruce Budworm*. USDA Forest Service, Cooperative State Research Service, Technical Bulletin No. 1694. 198 p.
- Bull, Evelyn L. 2005 *Ecology of the Columbia Spotted Frog in Northeastern Oregon*. Gen Tech. Rep. PNW-GTR-640. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 6 p.
- Bull, Evelyn L. and Janet E. Hohmann. 1992. *Final Report: Northern Goshawks in Northeastern Oregon*. USDA Forest Service. PNW Research Station. La Grande, OR. pp. 34.
- Bull, Evelyn L. and Janet E. Hohmann. 1994. *Breeding Biology of Northern Goshawks in Northeastern Oregon*. *Studies in Avian Biology* No. 16:103-105.
- Busse, M.D., S.A. Simon, and G.M. Riegel. 2000. *Tree-Growth and Understory Responses to Low-severity Prescribed Burning in Thinned Pinus ponderosa Forest of Central Oregon*. *Science* 46: 258-268.
- Busse, M.D., and G.M. Riegel. 2005. *Long-Term Trends in Soil Quality: Who Will Speak for the Soils of Central Oregon?* Unpublished. 15 p.
- Chitwood, L. 2005. Deschutes National Forest Geologist. Personal Communication.
- Cilimburg, A. C., and K. C. Short. 2005. *Forest Fire in the U. S. Northern Rockies: a Primer*. Accessed March 15, 2004 from <http://www.northernrockiesfire.org>.
- 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. 1992. *Stocking Levels and Underlying Assumptions for Uneven-aged Ponderosa Pine Stands*. USDA Forest Service, Pacific Northwest Research Station, Research Note PNW-RN-509. 10 p.
- 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* 8(4): 126-132.
- Cochran, P. H., J.M. Geist, D.L. Clemens, R.R. Clausnitzer, and D.C. Powell. 1994. *Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington*. USDA Forest Service Pacific Northwest Research Station Research Note PNW-RN-513. 21 p.
- Cochran, P. H. and J.W. Barrett. 1999. *Growth of Ponderosa Pine Thinned to Different Stocking Levels in Central Oregon: 30-Year Results*. USDA Forest Service Pacific Northwest Research Station Research Paper PNW-RP-508. 27 p.

- Cochran, P.H. and J.W. Barrett. 1999. *Thirty-five Year Growth of Thinned and Unthinned Ponderosa Pine in the Methow Valley of Northern Washington*. USDA For. Serv. PNW-RP-502. 24 p.
- Cook, John G.; Bruce K. Johnson; Rachel C. Cook; Robert A. Riggs; T. Decurtio; Larry D. Bryant; and L. L. Irwin. 2004. *Effects of Summer-Autumn Nutrition and Partrition Date on the Reproduction and Survival of Elk*. *Wildlife Monographs*. 155:1-61.
- Croft, L., W.R. Owen, J.S. Shelly. 1997. *Interior Columbia Basin Ecosystem Management Project Analysis of Vascular Plants*. USDA Forest Service publication.
- Currens, K.P and S.L. Stone. 1988. *A Genetic Comparison of Rainbow Trout (Salmo gairdneri) Above and Below Izee Falls in the John Day River, Oregon*. Oregon Cooperative Fishery Research Unit; Oregon State University, Corvallis, Oregon
- David, J., 2000. Harvest Review - *Soils Monitoring: Black Bear Timber Sale*. Letter to Black Bear IDT, File Code 2550.
- David, J., 2002. *Deep EIS Soils Report - Existing Condition and Alternative Analysis*.
- David, James. 2006. Ochoco National Forest Soil Scientist. Personal communication.
- Daw, Sonya K. and Stephen DeStafeno. 2001. *Forest Characteristics of Northern Goshawk Nest Stands and Post-Fledging Areas in Oregon*. *Journal of Wildlife Management* 65(1):59-65.
- DeByle, N.V. and Packer, P.E., 1972. Plant nutrient and soil losses in overland flow from burned forest clearcuts. *Watersheds in Transition, Proc. Symposium AWRA & Colorado Stae Univ.*, p.296-307.
- Deppmeier, Matthew. 2006. Deschutes National Forest Silviculturist. Personal communication and Silviculture report for the Willow Pine Vegetation Management EA.
- DeStafeno, Stephen and E. Charles Meslow. 1992. *Annual Report: Status, Distribution, and Habitat of Northern Goshawks in Eastern Oregon*. Oregon Cooperative Wildlife Research Unit, Oregon State University. Corvallis, OR. pp. 12.
- Dickson, James G, Ed. 1992. *The Wild Turkey: Biology and Management*. Stackpole Books. Mechanicsburg, PA. 463 Pp.
- Dolph, R. E. 1982. *Growth and Vigor Information in Thinned Second-growth Ponderosa Pine Stands on the Deschutes and Ochoco National Forests*. USDA Forest Service, Pacific Northwest Region, Forest Pest Management, Portland, OR. Unpublished report. 11 p.
- Eglitis, A. 2004. Healthy forest restoration act as applied to the Ochoco N.F. Letter to the Forest Supervisor, Ochoco N.F. 14 p.
- Fiddler, G. O., T.A. Fiddler, D.R. Hart, and P.M. McDonald. 1989. *Thinning Decreases Mortality and Increases Growth of Ponderosa Pine in Northern California*. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station. Research Paper PSW-194, 7 p.

- Fiedler P.L. 1987. Life History and Population Dynamics of Rare and Common Mariposa Lilies (*Calochortus* Pursh: Liliaceae). *Journal of Ecology* (1987) 75, 977-995.
- Filip, G. M. and C. L. Schmitt. 1990. *Rx for Abies: Silvicultural Options for Diseased Firs in Oregon and Washington*. USDA Forest Service, Pacific NW Research Station, General Technical Report PNW-252. 34 p.
- Fontaine, B., 1998. A letter Dated December 12, 1998 attachment to August 11, 1997 monitoring report. Trout Creek watershed monitoring, precommercial thinning within RHCA – results. File designation:1950 Environmental Analysis. USDA Forest Service, Lookout Mountain Ranger District, Prineville, OR.
- Furniss, M.J., S.A. Flanagan, B. McFadin. 2000. *Hydrologically-connected Roads: An Indicator of the Influence of Roads on Chronic Sedimentation, Surface Water Hydrology, An Exposure to Toxic Chemicals*. Stream Notes, July 2000. Stream Systems Technology Center. USDA Forest Service, Rocky Mountain Research Center, Fort Collins, CO. 8 p.
- Gordon, Caroline. 2003. Ochoco National Forest Geologist. Personal communication.
- Goyer, C.C., M.R. Wagner, and T.D. Schowalter. 1998. *Current and Proposed Technologies for Bark Beetle Management*. *Journal of Forestry* 96(12): 29-33.
- 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*. USDA Forest Service, Pacific NW Research Station, PNW-GTR-463. 27 p.
- Graham, R.T., S. McCaffrey, and Theresa B. Jain. Eds. 2004. *Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity*. RMRS-GTR-120. USDA Forest Service.
- Gresswell, R.E., 1999. *Fire and Aquatic Ecosystems in Forested Biomes of North America*. *Transactions of the American Fisheries Society* 128:193-221.
- Grier, C.C. 1989. *Effects of Prescribed Springtime Underburning on Production of Nutrient Status of a Young Ponderosa Pine Stand*. P. 71-76 in Symp. proc. Multiresource Management of Ponderosa Pine Forest.
- Hall F.C. 1987. *Growth Basal Area Handbook*. USDA Forest Service, R6-Ecol-181b-1984. 84 p.
- Hall, Fred. 1989. *Plant Association and Management Guide for the Ochoco and Southern Blue Mountain Areas*. USDA-FS R6 ECOL TP-000-90. Portland, Oregon.
- Hall, R. C.; Davis, G. R. 1968. *Mountain Pine Beetle Epidemic at Joseph Creek Basin, Modoc National Forest*. USDA Forest Service, Division of Timber Management, California Regional Office. San Francisco, Unpublished.
- Hann, W.J. et al. 1997. *An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins*. Volume II, Chapter 3: Landscape Dynamics of the Basin. PNW-GTR-405. USDA Forest Service.

- Hann, W., M. Beighley, P. Teensma, T. Sexton, M. Hilbruner. 2004. *A Cohesive Strategy for Protecting People and Sustaining Natural Resources: Predicting Outcomes for Program Options*. Presented at the "Fire, Fuel Treatments and Ecological Restoration Conference; April 16-18 2002; Fort Collins, CO 36 p. Accessed on March 24, 2006 at <http://www.frcc.gov>
- Harvey, A.E.; Geist, J.M.; McDonnald, G.I. [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.
- 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.
- Hubbard, R.K., G.L. Newton and G.M. Hill. 2004. *Water Quality and the Grazing Animal*. *Journal of Animal Sciences*, Vol. 82 (E. Suppl.) E255-E263
- Johnson, Bruce K.; Alan A. Ager; James H. Noyes; and Norman J. Cimon. 2005. *Elk and Mule Deer Response to Variation in Hunting Pressure*. Pages 127-138 in Wisdom, M.J., technical editor. *The Starkey Project: a synthesis of long-term studies of elk and mule deer*. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources Conference, Alliance Communications Group, Lawrence, Kansas, USA.
- Johnson, C. and R.R. Clausnitzer. 1992. *Plant Associations of the Blue and Ochoco Mountains*. USDA For. Serv. R6-ERW-TP-036-92. 164 p.
- Kilgore, Bruce.M., Curtis, George A. 1987. *Guide to Understory Burning in Ponderosa Pine in the Intermountain West*. US Forest Service Technical Report INT-233.
- Kolb, T. E., P.Z. Fule, M.R. Wagner, W.W. Covington. 2001. *Six-Year Changes in Mortality and Crown Condition of Old-Growth Ponderosa Pines in Ecological Restoration Treatments at the G. A. Pearson Natural Area*. P. 61-66 In: R.K. Vance, C.B. Edminster, W.W. Covington, J.A. Blake, comps. *Ponderosa pine ecosystems restoration and conservation: Steps toward stewardship*, April 25-27, 2000; Flagstaff, AZ. Proceedings RMRS-P-22. Ogden, UT: U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Landsberg, J.D. 1992. *Response of Ponderosa Pine Forest in Central Oregon to Prescribed Underburning*. PH.D. diss. Oregon St. U., Corvallis, OR. 282 p.
- Lilieholm, Robert J.; James N. Long; and Susan Patla. 1992. *Assessment of Goshawk Nest Area Habitat Using Stand Density Index*. *Studies in Avian Biology* No. 16:18-23.
- 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.

- Mafera, D. 2006. Ochoco National Forest, Paulina Ranger District Botanist. Personal Communication.
- Marshall, David B. 1992. *Status of the Northern Goshawk in Oregon and Washington*. Audubon Society of Portland. Portland, OR. pp. 34.
- Marshall, David B., Matthew G. Hunter, and Alan L. Contreras Eds. 2003. *Birds of Oregon: A General Reference*. Oregon State University Press. Corvallis, OR. 768 Pp.
- Martin, K. 2006. Historical Information Willow Pine Summary Report. White paper summary of historic records within the Willow Pine Analysis Area.
- McGrath, Michael. 1998. *Northern Goshawk Habitat Analysis in Managed Forest Landscapes*. Thesis submitted for Degree of Master of Science. Oregon State University. Corvallis, OR. 127 Pp.
- McNabb, D., and H. Froehlich, 1983. Conceptual Model for Predicting Forest Productivity Losses from Soil Compaction. Proceedings of the Society of American Foresters National Convention, pp. 261-265.
- Minshall, G., J. Brock, D. Andrews, and C. Robinson. 2001. *Water Quality, Substratum and Biotic Responses of Five Central Idaho (USA) Streams During the First Year Following the Mortar Creek Fire*. International Journal of Wildland Fire 10:185-199.
- National Marine Fisheries Service. 1996. *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale*. US Department of Commerce.
- National Oceanographic and Atmospheric Administration. NMFS. August 1996. 16 p.
- Oliver, W.W. 1979. *Growth of Planted Ponderosa Pine Thinned to Different Stocking Levels in Northern California*. USDA Forest Service, PSW Forest and Range Experiment Station, PSW-147. 11 p.
- Owens, Dave 2002. Fire planner. Ochoco National Forest. US Forest Service. Personal communication.
- Parks, C.G., M.J. Wisdom and John G. Kie. 2004. *The Influence of Ungulates on Non-native Plant Invasions in Forests and Rangelands: A Review*. USDA Forest Service, Pacific Northwest Research Station, La Grande, Oregon.
- Pilliod, D.S., R.B. Bury, E.J. Hyde, C.A. Pearl, P. S. Corn, 2003. *Fire and Amphibians in North American Forests*. Ecology and Management. 178 (2003) 163-181
- 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*. USDA For. Serv. Tech. Pub. F14-SO-TP-03-99. 300 p.

- Powell, David. 2000. *Potential Vegetation, Disturbance, Plant Succession, and Other Aspects of Forest Ecology*. US Forest Service Technical Report F14-SO-TP-09-00
- Reshin, E.B., C.J. Clishe, A.T. Loch, and J.M. Bell. 2006. Effectiveness of timber harvest practices for controlling sediment related water impacts. *Journal of the American Water Resources Association*, October 2006, p. 1307-1327.
- Reynolds, Richard T.; Russel T. Graham; M. Hildegard Reiser; Richard L. Bassett; Patricia L. Kennedy; Douglas A. Boyce, Jr.; Greg Goodwin; Randall Smith; and E. Leon Fisher. 1992. *Management Recommendations for the Northern Goshawk in the Southwestern United States*. Gen. Tech. Rep. RM-217. Ft. Collins, CO; USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station. 90 Pp.
- Rothermel, R.C., Wilson, Jr. R.A., Morris, G.A., Sackett., S.S. 1986. *Modeling Moisture Content of Fine Dead Wildland Fuels*. US Forest Service Research Paper INT-359
- Roundy, B.A., 1999. *Lessons from Historical Rangeland Revegetation for Today's Restoration*. Revegetation with native species: Proceedings, 1997 Society for Ecological Restoration Annual Meeting. Fort Lauderdale, Florida November 12-15, 1997. USDA Forest Service Rocky Mountain Research Station. Proceedings RMRS-P-8, April 1999 p. 33-38
- Rowland, Mary M.; Michael J. Wisdom; Bruce K. Johnson; and Mark A. Penninger. 2005. *Effect of Roads on Elk: Implications for Management in Forested Ecosystems*. Pages 42-52 in Wisdom, M.J., technical editor. *The Starkey Project: a synthesis of long-term studies of elk and mule deer*. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources Conference, Alliance Communications Group, Lawrence, Kansas, USA.
- Sartwell, C. and R.E. Stevens. 1975. *Mountain Pine Beetle in Ponderosa Pine: Prospects for Silvicultural Control in Second-Growth Stands*. *Journal of Forestry* 73: 136-140.
- Sartwell, C. and R.E. Dolph. 1976. *Silviculture and Direct Control of Mountain Pine Beetle in Second-Growth Ponderosa Pine*. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Research Note PNW-268. 8 p.
- Saveland, James M.; Neuenschwander, Leon F. 1989. *Predicting Ponderosa Pine Mortality from Understory Prescribed Burning*. Symposium proceedings, Prescribed Fire in the Intermountain Region. Washington State University.
- Schmid, J.M. and S.A. Mata. 1992. *Stand Density and Mountain Pine Beetle-Caused Tree Mortality in Ponderosa Pine Stands*. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Research Note RM-515. 4 p.
- Scott, D.W. 1996. *A Rationale and Procedure for Determining Imminent Susceptibility of Stand to Insects in the Blue and Wallowa Mountains of Southeastern Washington and Northeastern Oregon*. USDA-For. Serv. Pac. NW Reg., Blue Mtns. Pest Mgt. Serv. Center, BMZ-96-15. 17 p.

- Sheay, R.W. 1993. *Effects of Prescribed Fire and Silvicultural Activities on Fuel Mass and Nitrogen Redistribution in Pinus Ponderosa Ecosystems of Central Oregon*. Masters Thesis submitted to Oregon State University.
- Simpson, M., D. Zalunardo, A. Eglitis, D.C. Wood, D. Roy, and S. Johnson. 1994. (Draft) *Ochoco Viable Ecosystems Management Guide*. USDA Forest Service, Ochoco NF. 108 p. plus appendices.
- Soil Disturbance Assessment Form, Ochoco National Forest.
- Spence, B.C., G.A. Lomnický, R.M. Hughes, and R.P. Novitski. 1996. *An Ecosystem Approach to Salmonid Conservation*. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, OR. (Available from the National Marine Fisheries Service, Portland, Oregon.)
- Spencer, C. N., and F. R. Hauer. 1991. *Phosphorus and Nitrogen Dynamics in Streams During a Wildfire*. Journal of the North American Benthological Society 10:24-30.
- Spencer, C. N., K. O. Gabel, and F. R. Hauer. 2003. Wildfire Effects on Stream food webs and nutrient dynamics in Glacier National Park, USA. *Forest Ecology and Management* 178:141-153.
- Stone, J.E., T.E. Kolb and W.W. Covington. 1999. *Effects of Restoration Thinning on Pre-settlement Pinus ponderosa in Northern Arizona*. *Restoration Ecology* 7(2): 172-182.
- Sussmann, Peter. 2006. Deschutes National Forest Soil Scientist. Personal communication, and Soils Report for the Willow Pine Vegetation Management EA.
- Swezy, D.M., and J.K. Agee. 1990. *Prescribed Fire Effects on Fine-Root and Tree Mortality in Old-growth Ponderosa Pine*. *Can. J. For. Res.* 21: 626-634
- Tiedeman, A.R., Helvey, J.D., and Anderson, T.D., 1978. Stream chemistry and watershed economy following wildfire and fertilization. *Journal Environ. Qual.*, Vol. 7, no. 4. p 580-589.
- Thomas, Jack Ward, ed. 1979. *Wildlife Habitats in Managed Forests: the Blue Mountains of Oregon and Washington*. USDA Forest Service, Agriculture Handbook No. 553. US Government Printing Office, Washington, D.C. 512 Pp.
- Trombulak, S.C. and C.A. Frissell. 2000. *Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities*. *Conservation Biology* V.14, No. 1, February 2000.
- USDA, 1977. *Soil Resource Inventory*, Ochoco National Forest.
- USDA, R1/R4, 1981. "Guide for Predicting Sediment Yields from Forested Watersheds", USDA Forest Service, Region 1 and Region 4.
- USDA. 1988. Pacific Northwest Region, Forest Service. General Water Quality Best Management Practices, Introduction, Page 1.

- USDA. 1989. *Ochoco National Forest Land Resource Management Plan*.
- USDA, R1, 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. 1992. Forest Service Manual 2670 Threatened, Endangered, and Sensitive Plants and Animals.
- USDA. 1993. Forest Ecosystem Management Team. *An Ecological, Economic and Social Assessment*.
- USDA. 1998. Forest Service Manual 2500, R-6 supplement 2500-98-1. Portland, OR: USDA Forest Service, Pacific Northwest Regional Office.
- USDA, Malheur NF, 1998. Upper South Fork John Day River Limited Watershed Analysis.
- USDA. 1998. Ochoco National Forest and Crooked River National Grassland Integrated Noxious Weed Management Environmental Assessment.
- USDA. 2003. *Murray Salvage Environmental Assessment*. Ochoco National Forest. Paulina Ranger District.
- USDA. 2005. *Preventing and Managing Invasive Plants*. Final Environmental Impact Statement. Pacific Northwest Region Invasive Plant Program. R6-NR-FHP-PR-02-05.
- USDA (a). 2005. *Upper Beaver Creek Watershed Assessment*. Draft. Ochoco National Forest, Paulina Ranger District.
- USDA. 2005. Forest Service Summary of the “*Logging to Control Insects: The Science and Myths Behind Managing Forest Insect ‘Pests’*.” Unpublished. 3 p.
- USDA, Ochoco NF, 2006. Commercial Road Rules. Pages 26.
- USDA. 2006. Fire Effects Information System. Accessed on March 28, 2006 at <http://www.fs.fed.us/database/feis/index.html>
- USDA. Intermountain Forest and Range Experiment Station, Gen. Tech. Rep. INT-133. 112 p.
- USDA Natural Resource Conservation Service. 2006. Plants Database. <http://plants.usda.gov>.
- US Fish and Wildlife Service. 1999. *Endangered and Threatened Wildlife and Plants*. 50 CFR 17.11 and 17.12, reprint December 31, 1999.
- US Fish and Wildlife Service. Interagency Implementation Team (IIT), 2000. Grazing Implementation Monitoring Module, USFWS, NMFS, Forest Service, and BLM.
- US Fish and Wildlife Service. 2002. *Birds of Conservation Concern 2002*. Division of Migratory Bird Management. Arlington, VA. 99 Pp.

- Utah State University Extension. 2001. *Factors Influencing Grazing Tolerance. No. 3.1.2. Behavioral Education for Human, Animal, Vegetation and Ecosystem Management.*
- 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.
- Wisdom, M.J., technical editor. *The Starkey Project: a synthesis of long-term studies of elk and mule deer.* Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources Conference, Alliance Communications Group, Lawrence, Kansas, USA.
- Wisdom, Michael J.; Alan A. Ager; Haiganoush K. Preisler; Norman J. Cimon; and Bruce K. Johnson [2]. 2005. *Effects of Off-Road Recreation on Mule deer and Elk.* Pages 67-80 in Wisdom, M.J., technical editor. *The Starkey Project: a synthesis of long-term studies of elk and mule deer.* Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources Conference, Alliance Communications Group, Lawrence, Kansas, USA.
- Wisdom, Michael J.; Norman J. Cimon; Bruce K. Johnson; Edward O. Garton; and Jack Ward Thomas. 2005. *Spatial Partitioning by Mule Deer and Elk in Relation to Traffic.* Pages 53-66 in
- Woodbridge, Brian and Christina D. Hargis. 2005. *Northern Goshawk Inventory and Monitoring Technical Guide.* USDA Forest Service, Washington D.C. 63 Pp.
- Wykoff, W.R., N.L. Crookston, and A.R. Stage. 1982. User's guide to the Stand Prognosis Model. USDA-Forest Service. Intermountain Forest and Range Experiment Station, Gen. Tech. Rep. INT-133. 112 p.
- Zika, P.F. 1992. *Draft Management Guide for Rare Botrychium Species for the Mount Hood National Forest.* Unpublished report submitted to the Ochoco National Forest. Oregon Natural Heritage Program, Portland, OR.
- Zika, Peter F., R. Brainerd and B. Newhouse. 1995. *Grapeferns and Moonworts (Botrychium, Ophioglossaceae) in the Columbia Basin.* An unpublished report submitted to the Eastside Ecosystem Management Project, U.S. Forest Service, Walla Walla, WA.